Molycorp, Inc.
A Unocal Company
300 Caldwell Avenue
Washington, Pennsylvania 15301
Telephone (412) 222-5605

40-8778
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UNOCAL
MOLYCORP

April 24, 1997

Mr. LeRoy Person
US Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

License No: **SMB-1393**

Dear Mr. Person:

Enclosed are four copies of the Environmental Report prepared in support of the Decontamination and Decommissioning Plan for Molycorp's Washington, PA site. An additional copy is being forwarded under separate cover to the Document Room.

Sincerely,

Barbara K. Dankmyer
Resident Manager

xc: PA DEP - J. Yusko
PA DEP - J. Matviya

030003

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Washington Facility Environmental Report

VOLUME 1 OF 2

prepared for

UNOCAL 76
MOLYCORP

prepared by

ICF KAISER

Worldwide Excellence in Meeting Client Needs

April 1997

ECMSC JD/RS

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EXECUTIVE SUMMARY

In accordance with United States Nuclear Regulatory Commission (NRC) directives, Molycorp, a wholly owned UNOCAL subsidiary, has prepared this Environmental Report (ER) to evaluate the potential environmental consequences of various alternatives for decommissioning the Washington, Pennsylvania facility. Three decommissioning alternatives for the thoriated material at the Molycorp, Inc. facility in Washington, Pennsylvania are presented in the ER. The items considered in the environmental consequences evaluation include land use, community resources, groundwater and surface water, air quality, aesthetics, noise, human health, and ecological resources, extensive environmental field studies including geologic and hydrogeologic investigations; sound pressure level evaluations; soil, surface water and groundwater analytical testing; and ecological surveys were undertaken by Molycorp to provide the data needed to evaluate the environmental consequences.

The no-action alternative is a baseline alternative which provides information regarding the current state of the facility and potential consequences and risks associated with not performing any remedial activity on the thoriated material currently at the facility. The no-action alternative is not considered to be a viable alternative by Molycorp since this would not provide for long term controlled storage of the thoriated material. The no-action alternative is presented as required by the National Environmental Policy Act.

Another option for decommissioning of the facility involves off-site storage of the thoriated material in a Nuclear Regulatory Commission licensed disposal facility. Analyses presented indicate minimal environmental consequences due to the excavation, loading and transportation of the thoriated material to the NRC licensed disposal facility indicating that this would be a viable alternative. Although viable, implementation of this alternative would require Molycorp to release physical control of the thoriated material.

Three on-site engineered storage cell options are presented in the ER for storage of the thoriated material. Each of these cell options provide adequate storage volume. As shown by the analysis presented in this report, any of these three on-site options would be protective of human health and the environment and would also allow Molycorp to ensure proper control and monitoring of the thoriated material.

1.0 INTRODUCTION

Molycorp, Inc., a wholly owned subsidiary of UNOCAL, currently owns two facilities located in York and Washington, Pennsylvania that have source materials licenses issued by the United States Nuclear Regulatory Commission (NRC). Decommissioning Plans for both the Washington and York facilities have been submitted to the NRC (Foster-Wheeler, 1995a and Foster Wheeler, 1995b). Based upon these Decommissioning Plans, the NRC has determined that the decommissioning of these facilities may constitute a major action as defined by the National Environmental Policy Act (NEPA) (10 Code of Federal Regulations (CFR) Part 51). This Environmental Report (ER) has been prepared, as required, for submittal to the NRC to evaluate the environmental consequences of various alternatives being considered for decommissioning of the facilities.

This ER evaluates potential radiological and non-radiological impacts associated with the alternative plans which could be implemented for decommissioning the facilities. Environmental impacts evaluated within this ER include land use, community resources, groundwater and surface water, air quality, aesthetics, noise, human health, and ecological resources. Recommended monitoring and mitigation measures for each alternative are presented. An analysis comparing the costs and the benefits associated with each alternative has been performed and is included.

1.1 BACKGROUND

The NRC has a statutory responsibility for the protection of public health and the environment related to the use of source, byproduct, and special nuclear material under the Atomic Energy Act. One portion of this responsibility is to assure safe and timely decommissioning of the facilities it has licensed. The NRC provides guidance to licensees on how to plan for and prepare their sites for decommissioning and oversees the decommissioning of the facility. Decommissioning, as defined in 10 CFR 40.4, means to safely reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. Because soil radioactivity levels at the Molycorp facilities are known to exceed NRC's existing criteria for decommissioning, the NRC is requiring Molycorp to remediate the facilities to meet the NRC's decommissioning criteria, as described in the Site Decommissioning Management Plan Action Plan (57 Federal Regulations (FR) 13389).

The Decommissioning Plans proposed by Molycorp for the York and Washington facilities identified on-site internment of materials from both the York and Washington facilities at the Washington facility. If these plans are approved by the NRC and implemented, the York facility would meet NRC's existing unrestricted use criteria for decommissioning, however, the Washington facility would not. Consequently, if NRC approved on-site internment of the radioactive material, land use restrictions or other institutional controls would be necessary to ensure the long-term protection of public health and the environment. Molycorp would have to apply for and obtain a variance from the NRC's present requirements because NRC's current requirements for decommissioning do not allow for land use restrictions as would be required at the Washington facility.

The NRC is required by regulations (10 CFR Part 51) implementing NEPA to evaluate the variance request. As part of this process, the NRC has required submission of this ER by Molycorp. The ER is a factual presentation and evaluation of potential environmental impacts and measures proposed to mitigate potential environmental impacts of each decommissioning alternative, including the alternative proposed by Molycorp. The NRC evaluation of the information contained in the ER may influence the content of the Decommissioning Plan and the method of decommissioning proposed by Molycorp in the plan as part of the approval process.

Once an approval is obtained of the decommissioning plan, implementation will be scheduled and performed. As part of these actions, Molycorp will perform a Final Radiological Survey of the facility to document achievement of decommissioning criteria. These results will be independently verified by the NRC through performance of their own Confirmatory Radiological Survey. Once the Confirmatory Survey has verified removal of the regulated material, a License Termination and Site Release may be granted by the NRC.

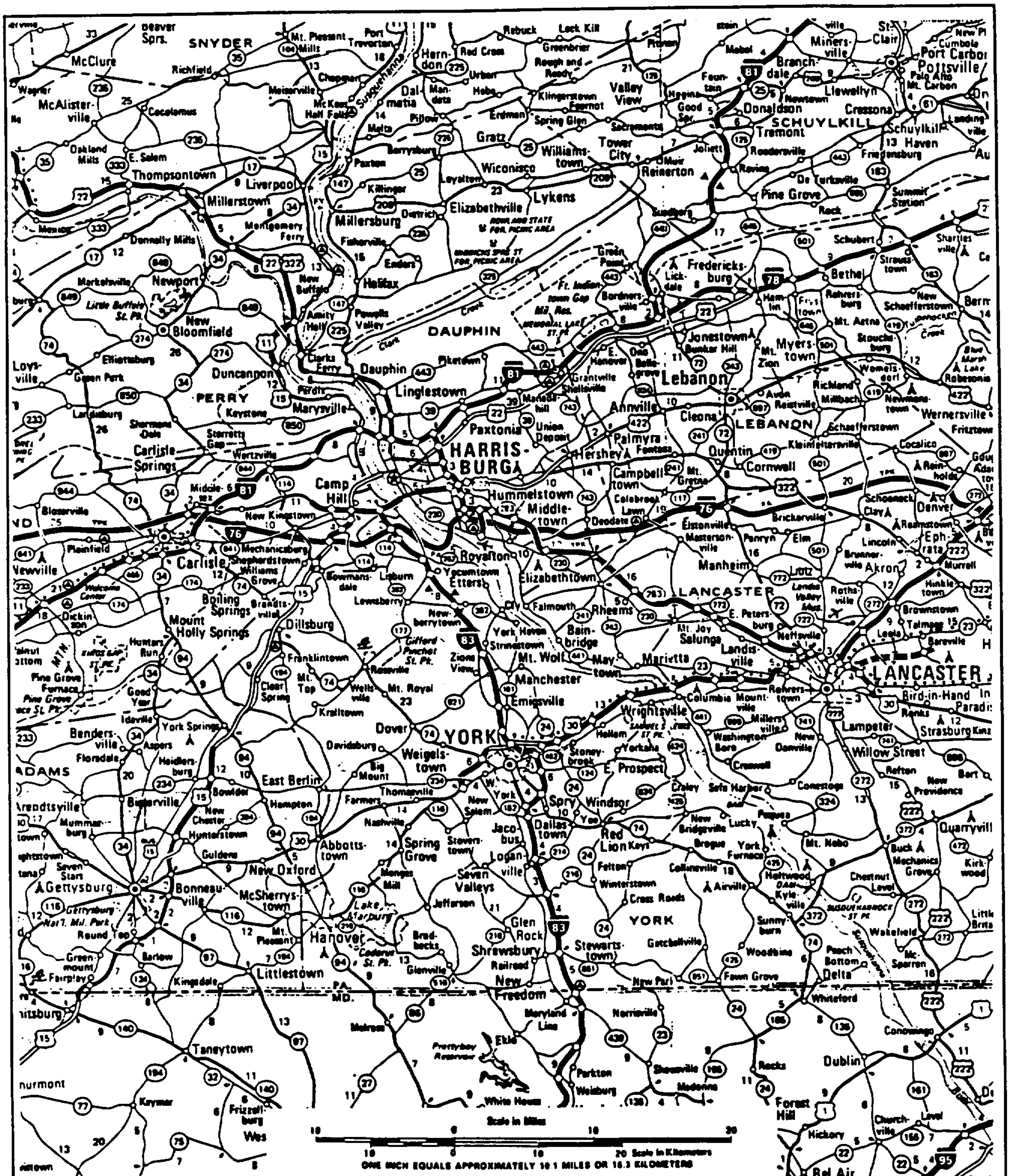
1.1.1 <u>York Facility Site History and Background</u>

Molycorp, known as the Molybdenum Corporation of America prior to 1974, owns and has operated a facility on the outskirts of the City of York, Pennsylvania in Spring Garden Township for over 60 years. This facility produced a broad line of rare earth chemicals for various industries. This facility is located entirely within Spring Garden Township, just north of the City of York and is approximately 20 miles southeast of Harrisburg, the capital of Pennsylvania (see Figure 1-1). The Molycorp York facility occupies approximately 6.1 acres just outside the city limits of York as shown in Figure 1-2. The site is bounded by paved roads to the east, north and west and to the south by a rail line. Surrounding properties include an abandoned quarry to the north of the site and commercial and residential properties to the south, east, and west. Production at the York facility terminated in March 1993. (Foster-Wheeler, 1995b).

Molycorp has occupied the York facility since 1930, when it was purchased from the York Metal & Alloys Company. It was purchased primarily to process metals. Molycorp produced primarily tungsten and molybdenum ferroalloys from 1930 to approximately 1943. From the time of World War II until the early 1970s, the facility primarily produced sodium and ammonium molybdates and tungstates. In 1963, refinement of inorganic rare earth chemicals such as compounds of cerium and yttrium was begun The raw materials used at this facility included bastnasite and cerium concentrates. Both of these materials contain low levels of naturally occurring radioactive materials (NORM), primarily thorium.

A slurry was produced during the rare earth processing at the York facility. The slurry process waste underwent treatment in settling basins to provide physical separation of solids. Slurry liquids underwent neutralization treatment, and equalization in basins prior to discharge. The solids which collected in the settling and equalization basins contained thoriated soils from the raw materials used in facility processes. Solids from the basin were originally stockpiled near the southeast corner of the site. In 1977, drum filters were implemented to dewater co-products in waste treatment. The solids pile and surrounding small areas of contamination were excavated, drummed and transported to Molycorp's Mountain Pass facility in California for lanthanide recovery in 1987 and 1988. During the 1980's, 13,000 drums of thoriated co-products were repackaged into large sling bags and transported to Molycorp's Mountain Pass, California for reprocessing.

In August of 1992, Molycorp informed the NRC that they intended to request an amendment for the termination of the Source Materials License for the York facility. The NRC received a letter from Molycorp in January 1993 announcing that all operations using the regulated material had ceased. In March 1993, all production ceased. Radiation Surveillance Associates, Inc. (RSA) conducted a preliminary radiological characterization of the site in 1993 and identified and quantified the approximate amount of contamination from the thorium residues and its decay products at the facility in soils and buildings (See Figure 1-3). Molycorp requested that the NRC amend their Source Material License #SMB



SOURCE: PENNSYLVANIA OFFICIAL TRANSPORTATION MAP, PENNSYLVANIA DEPARTMENT OF TRANSPORTATION, COPYRIGHT 1989.

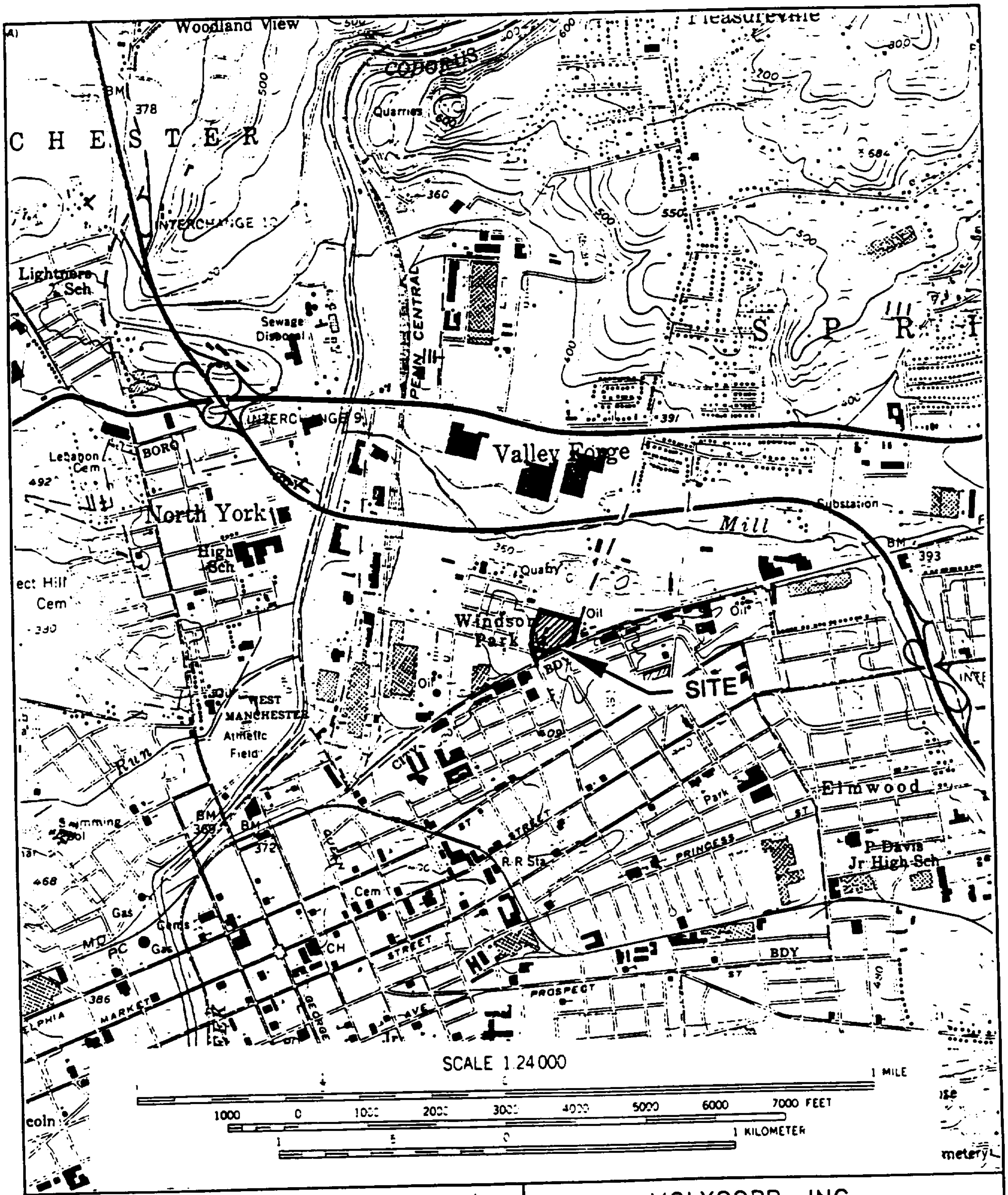
N

FILE NAME: NOCADA04
PLOT SCALE: 1=1

MOLYCORP. INC.
350 NORTH SHERMAN STREET
YORK, PA.

FIGURE 1-1
LOCATION OF MOLYCORP
YORK, PA. FACILITY
SOUTH CENTRAL, PA.

ICF KAISER



SOURCE: U.S.G.S. 7.5 MINUTE TOPOGRAPHIC MAP, YORK, PA. QUADRANGLE 1954, PHOTOREVISIED 1990.

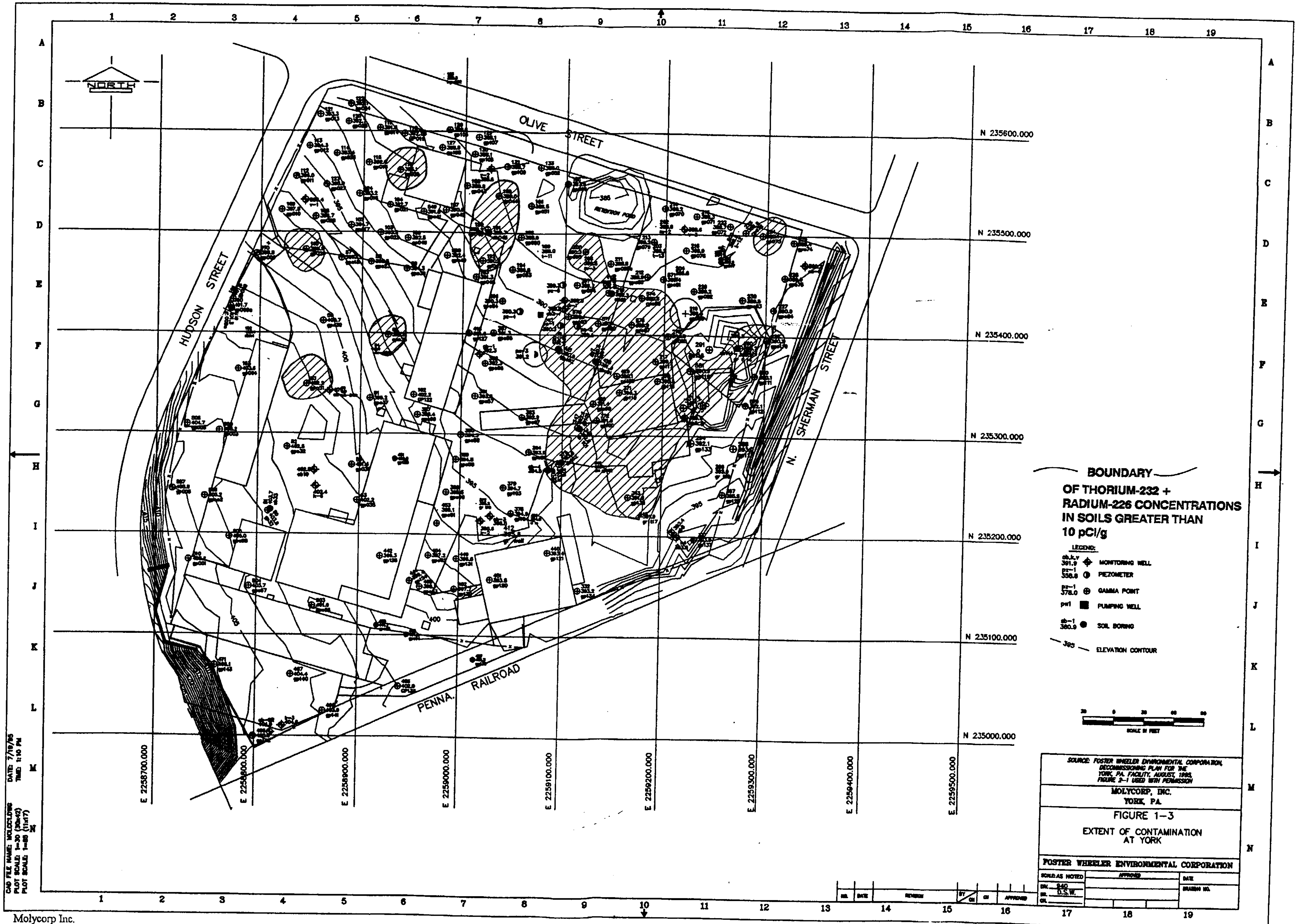
FILE NAME: NOCADA05
PLOT SCALE: 1=1

MOLYCORP. INC.
350 NORTH SHERMAN STREET
YORK, PA.

FIGURE 1-2

LOCATION OF MOLYCORP YORK, PA. FACILITY

ICF KAISER


NORTH
OLIVE STREET
HUDSON STREET
N. SHERMAN STREET
PENNA. RAILROAD
RETENTION POND
N 235600.000
N 235500.000
N 235400.000
N 235300.000
N 235200.000
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E 2259300.000
E 2259400.000
E 2259500.000
BOUNDARY OF THORIUM-232 + RADIUM-226 CONCENTRATIONS IN SOILS GREATER THAN 10 pCi/g
LEGEND:
MONITORING WELL
PIEZOMETER
GAMMA POINT
PUMPING WELL
SOIL BORING
ELEVATION CONTOUR
SCALE IN FEET
SOURCE: FOSTER WHEELER ENVIRONMENTAL CORPORATION, DECOMMISSIONING PLAN FOR THE YORK, PA. FACILITY, AUGUST, 1995, FIGURE 2-1 USED WITH PERMISSION
MOLYCORP, INC.
YORK, PA.
FIGURE 1-3
EXTENT OF CONTAMINATION AT YORK
FOSTER WHEELER ENVIRONMENTAL CORPORATION
SCALE: AS NOTED
APPROVED
DATE
DRAWING NO.

1408 from an operating status to the status of possession only for decommissioning (Foster-Wheeler, 1995b).

Under the decommissioning plan proposed by Molycorp, all material with a concentration of 10 picoCuries/gram (pCi/g) or greater will be removed from the facility for temporary disposal at the Washington facility in an engineered containment cell designed for temporary (less than 10 years) storage and subsequent permanent storage in an on-site engineered containment cell designed for permanent storage of the material. Removal of thoriated soil with a concentration greater than 10 pCi/g will allow the York site to be released for unrestricted use and access. Both the temporary and permanent containment cells will be designed in accordance with NRC regulations and approved by NRC prior to use.

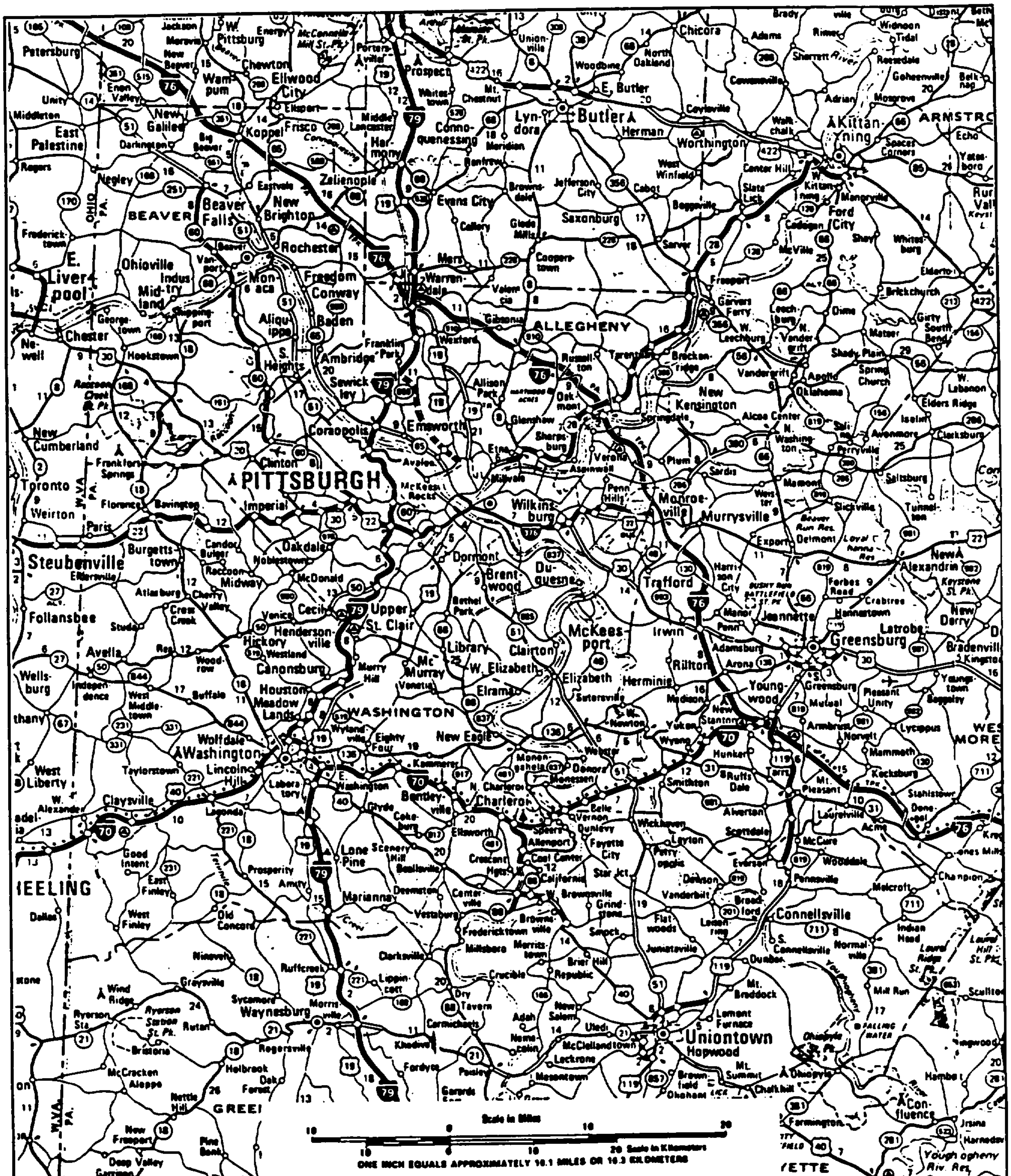
Molycorp has submitted the following reports to the NRC in support of the decommissioning process for the York facility:

Report Title	Date Submitted
Site Characterization Plan for License Termination of the Washington, PA Facility	Nov. 15, 1992
Preliminary Radiation Survey for the Molycorp Plant Site at York, PA*	
Investigation of the Shallow Groundwater Aquifer at the Unocal 76 Molycorp, Inc., York Pennsylvania Facility*	
Supplemental Site Characterization Report of the York, PA Facility	May, 1995
Decommissioning Plan for the York, PA Facility	August, 1995
Final Design Report Temporary Thorium Storage Structure	October 29, 1996
Hydrogeology in the Vicinity of the Proposed Interim Storage Area at the Washington, PA Facility	April, 1996

*By prior arrangement with the NRC, these two reports were considered to comprise the majority of the Site Characterization Report. Additional information required by the NRC was provided in the Supplemental Site Characterization Report.

1.1.2 Washington Facility Site History and Background

Molycorp has owned and operated a ferroalloy plant on the outskirts of Washington, Pennsylvania in Canton Township for over 70 years. This facility is entirely within Canton Township, less than one-half mile southwest of the City of Washington and approximately 35 miles southwest of Pittsburgh (see Figure 1-4). The region is generally comprised of towns located close to transportation corridors surrounded by agricultural lands and open areas. The Molycorp Washington facility consists of



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FILE NAME: NOCADA06
PLOT SCALE: 1=1

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 1-4
LOCATION OF MOLYCORP
WASHINGTON, PA. FACILITY
SOUTHWEST, PA.

ICF KAISER

approximately 55 acres; the site is divided by paved roads and creeks, and is bounded by paved roads and highways, industrial and commercial properties and private residences. (Foster-Wheeler, 1995c).

In 1916, the Electric Reduction Company bought a small parcel of land from the Railway Spring and Manufacturing Company (later called the Railway Spring Co. or the Car Springs Co.) who owned the land from January 20, 1902 to December 18, 1916. The Electric Reduction Company was a manufacturer of alloys. The Molybdenum Corporation of America was formed from the Electric Reduction Company on June 16, 1920 to continue the manufacture of ferroalloys.

Throughout its operational history, additional surrounding land parcels were purchased and operations expanded. The current 55 acres is divided into three main areas: the north process area; the southeast low-lying open storage area; and the southwest hill area.

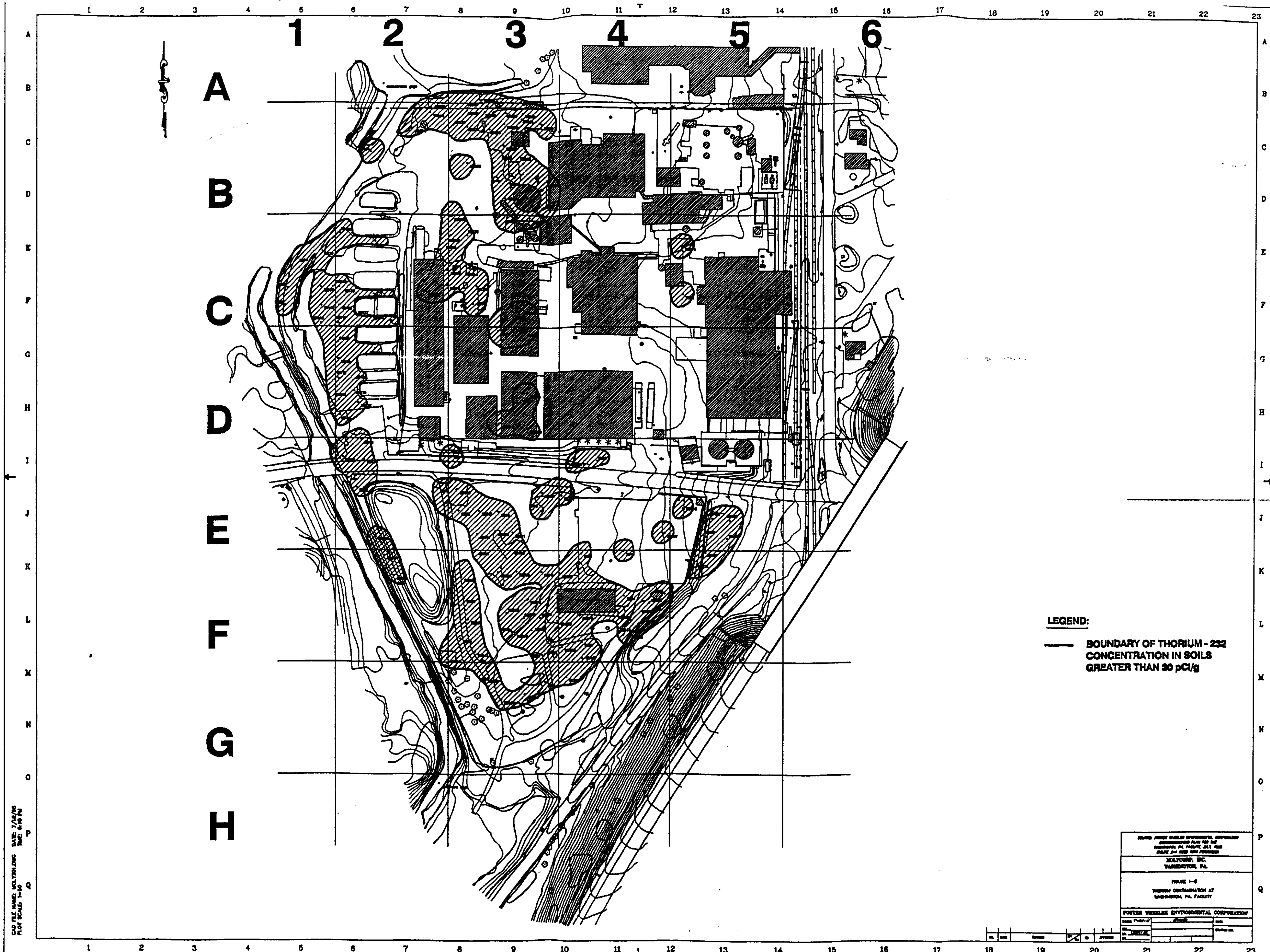
The hill area in the southwestern portion of the property is the former site of a coal gasification plant originally owned by the Hazel Atlas Glass Company (PHR, 1996). The coal gasification plant produced coal gas used as a fuel source for plant furnaces. A tar-like residue from the coal gasification facility was discovered after the property was purchased by Molycorp. The tar-like residue lies outside the area affected by radionuclides and contains no NRC-regulated material. The residue becomes less viscous under heat and pressure and therefore tends to rise to the surface during warm weather. The foundation from the coal gasification facility remains at the top of the southwest hill and the foundation remains contain the tar-like residue. Molycorp constructed a tar containment area in the southeast corner of the property in 1985. This containment area consists of a diked area into which the tar material was placed prior to being covered with clean soil and vegetated. The containment area was then fenced with an eight foot security fence (Foster-Wheeler, 1995c).

Although Molycorp began producing molybdenum in the 1920's, they continued to produce a variety of ferroalloys and produced ferrocolumbium (FeCb) from 1963 to 1969. The production of ferrocolumbium involved the processing of ore concentrates. These concentrates contained 0.05 percent (or greater) by weight of thorium, ore concentrates containing 0.05 percent (or greater) by weight of thorium, uranium or a combination of both necessitating a Source Materials License, SMB-744, which was issued on December 19, 1963 (after renewal in 1976, the license number was changed to SMB-1393). The ore material was a pyrochlore from Companhia Brasileira de Metalugia e Mineracao's Araxa mine in Brazil whose ore contained thorium as an accessory mineral above the 0.05 percent limit. The slag which resulted from the production of the FeCb was in a refractory glass/ceramic form containing an average of 1.2 percent thorium. The production of FeCb was transferred in the late 1960's from the Washington site to the Araxa mine where the ore was mined. (Foster-Wheeler, 1995c).

An Atomic Energy Commission (AEC) compliance inspection in June of 1971 revealed that thoriated slags had been buried on-site. It was speculated that a private contractor who was totally unaware of the placement restrictions had buried the FeCb slags during a large scale clean-out of settling basins and regrading of the plant site.

In 1972 Molycorp authorized Applied Health Physics, Inc. to excavate, sample and concentrate the thoriated slag as much as possible and ship it in bulk form to an AEC-licensed disposal facility. Concentration of the material consisted of removing material to achieve surface gamma readings of less than 250 microroentgens per hour (μR/hr). An estimated 887,500 pounds of soil and thoriated slag mixed were transported to the disposal facility. The average thorium concentration of the shipped material was 1.3% thorium. (Applied Health Physics, 1975). Disposal at the facility, Nuclear Fuel Services, Inc. in West Valley, New York was terminated when New York State officials determined the slag was "of insignificant contamination and too large a volume to bury and waste valuable burial area". (Foster-Wheeler, 1995c). In 1973, the additional thoriated slag material was consolidated and placed into a 10,000 yd^3 pile, at the south end of the site, covered with clean soil, and vegetated. An 8-foot steel security fence surrounds the area where the pile is located, south of Caldwell Avenue. Appropriate warning signs are posted on and around the pile and the steel fence is repaired as needed. This action was in compliance with Federal and state regulations as well as Molycorp's Source Material License SMB-744. In 1975, the average concentration of thorium-232 in the slag pile was 1,250 pCi/g, with exposures below the 0.25 mR/hr NRC maximum level allowed at that time. (Foster-Wheeler, 1995c).

A radiological survey of the site was conducted in 1985 by Oak Ridge Associated Universities, an NRC contractor. Levels of thorium in dikes separating eight surface impoundments located in the west of the plant area were found to be twice background or greater indicating the potential presence of subsurface thoriated slag in the northwestern portion of the site. In 1990, RSA, Inc. conducted a sub-surface survey to characterize thorium levels across the western portion of the site and the areas immediately to the north, west and northwest of the impoundment area. (Foster-Wheeler, 1995c). Figure 1-5 illustrates the extent of


1
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LEGEND:
BOUNDARY OF THORIUM - 232 CONCENTRATION IN SOILS GREATER THAN 30 pCi/g
FOSTER WHEELER ENVIRONMENTAL CORPORATION

thorium levels at the site. Table 1-1 indicates the volume of material calculated to be at the Washington Site based on information presented in the Site Characterization Report.

TABLE 1-1

QUANTITY OF THORIATED SLAG LOCATED AT THE WASHINGTON, PA FACILITY

Concentration (pCi/g)	Estimated Volume (cubic yards)
>1000	0
500 - 1000	12.2
100 - 500	8,641
50 - 100	12,632
15 - 50	48,005
10 - 15	22,873
5 - 10	41,138

In October 1992, Molycorp's Source Material License (SMB 1393) was renewed. This license renewal included an amendment incorporating a schedule for decommissioning the site. Molycorp has submitted the following reports to the NRC in support of the decommissioning process at the Washington facility: In 1995, a remediation action involving eight impoundments east of Chartiers Creek and west of the plant was performed. The impoundments were drained of all free liquids. Thoriated slag was found in two of the impoundments' sludge. This sludge was placed in eight 20 yd^3 lined and covered rolloff boxes. The impoundments were then backfilled and the rolloffs staged in this area. Access to this area is restricted by fencing and warning signs are posted on the fencing. In 1996 a second remediation action was performed involving the Findlay property adjacent to the north plant property line. Excavation of one hundred and eighty-four 20 yd^3 lined and covered rolloff boxes of thoriated slag was performed. The excavated area was backfilled and the rolloffs staged in the former impoundment area.

Report Title	Date Submitted
Site Characterization Plan for License Termination of the Washington, PA Facility	May 1994
Site Characterization Report for License Termination of the Washington, PA Facility	January 1995
Decommissioning Plan for the Washington, PA Facility	July 1995
Ecological Risk Assessment and Permitting Support for Unocal/Molycorp, Inc. Washington, Pennsylvania	Attached as Appendix A

Ferromolybdenum production, purchasing and reselling alloys, maintenance and decommissioning are the principal current site activities. (Foster-Wheeler, 1995c).

Molycorp has requested from the NRC that thoriated soil from York with a concentration greater than 10 pCi/g and the thoriated slag from Washington with a concentration greater than 30 pCi/g be consolidated and placed in a permanent storage cell to be located within the Washington property. The storage cell would be located in accordance with NRC regulations and constructed in accordance with plans and specifications approved by the NRC. Placement of thoriated slag and soil with a concentration of greater than 30 pCi/g in a storage cell will result in radiation levels at the fence line equivalent to background levels. The engineered storage cell will be monitored and maintained and access to the site and the storage cell will be restricted through the use of fences and posting of signs.

1.2 THE ENVIRONMENTAL REPORT PROCESS

This ER is a presentation and evaluation of potential environmental impacts and measures designed to mitigate potential environmental impacts for each of the evaluated alternatives for decommissioning both the York and Washington facilities. This ER evaluates viable alternatives and provides justification of the preferred alternative. This ER includes the following four sections:

- A description of the decommissioning alternatives included in Section 2.0.

- A description of the current state of the environmental factors which may be affected by the decommissioning of the facility is provided in Section 3.0. A description of the affected environment has been completed through the use of existing documentation supplemented by publicly available information and a field investigation. The investigation included site reconnaissance and geologic mapping, soil drilling, bedrock hydraulic tests, piezometer construction, data correlation, and detailed site mapping.

- Section 4.0 evaluates the potential environmental consequences of the implementation of each of the alternatives. This section evaluates the potential impacts of these alternatives on land use, community resources, environmental parameters, human health, and ecological resources. To the extent possible, the evaluations have been based on empirical data rather than subjective reasoning. Mitigating actions that could be implemented with each of the alternatives, during and after construction, have also been explored.

- Section 5.0 is a cost/benefit analysis for each of the alternatives. This section provides information related to short and long term benefits of each of the alternatives in relation to the anticipated cost of implementation.

This ER has been prepared for submittal to the NRC to aid in the selection of the appropriate decommissioning alternative to be implemented at the Washington facility for thoriated soil and slag from both the York and Washington facilities.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

As discussed in Section 1.0, decommissioning plans for both the York and the Washington facilities have been submitted to the NRC. The purpose of the decommissioning process is to remove source material from inactive facilities so that the facilities may be released for unrestricted use. The decommissioning plan for the York facility proposes the removal of thoriated slag with a thorium-232 concentration greater than 10 pCi/g and placing this material in a temporary thorium storage structure located at the Washington facility. The decommissioning plan has been submitted to the NRC and NRC approval of the design of the temporary storage structure is pending. This evaluation of alternatives is being performed based on conditions at the Washington facility as presented in the Site Characterization Report for License Termination for the Washington, PA Facility (Foster Wheeler, 1995c) and the placement of approximately 3,300 yd^3 of thoriated soil from the York facility in the temporary thorium storage structure to be constructed at the Washington facility (Foster Wheeler, 1995a and ICF Kaiser, 1996). Many of the figures presented in this section are oversized drawings. Reduced versions of these drawings are presented in the text following their notation. Full-size drawings are provided at the end of the section.

2.1 ON-SITE MANAGEMENT ALTERNATIVES

On-site storage would include containment of thoriated material in an engineered landfill-type cell which would be lined, capped, and monitored. The volume of thoriated slag to be contained is approximately 62,000 yd^3; 3,300 yd^3 is anticipated from the York facility with thorium-232 concentration greater than 10 pCi/g and 58,700 yd^3 with thorium-232 concentration greater than 30 pCi/g are anticipated from various locations throughout the Washington facility. The actual volumes excavated may vary based on conditions encountered during excavation to achieve the target soil level concentration. All on-site storage options have been preliminarily designed to have a minimum storage volume of approximately 70,000 yd^3, which provides a minimum excess capacity of approximately 8,000 yd^3. Final grading may be modified if the volume of thoriated material is less than the volume estimated by the site characterization studies. Due to the volume of thoriated material to be contained during the decommissioning process, the location of the storage cell within the Washington facility is limited. Limitation is due to the topography of the site, the 100-year floodplain of Chartiers Creek, jurisdictional wetlands, and the existing industrial buildings which are currently occupied or have the potential to be occupied. Three potential on-site storage structure locations are shown in Figure 2-1. The following activities are assumed to have been completed prior to the beginning of decommissioning activities at the Washington facility:

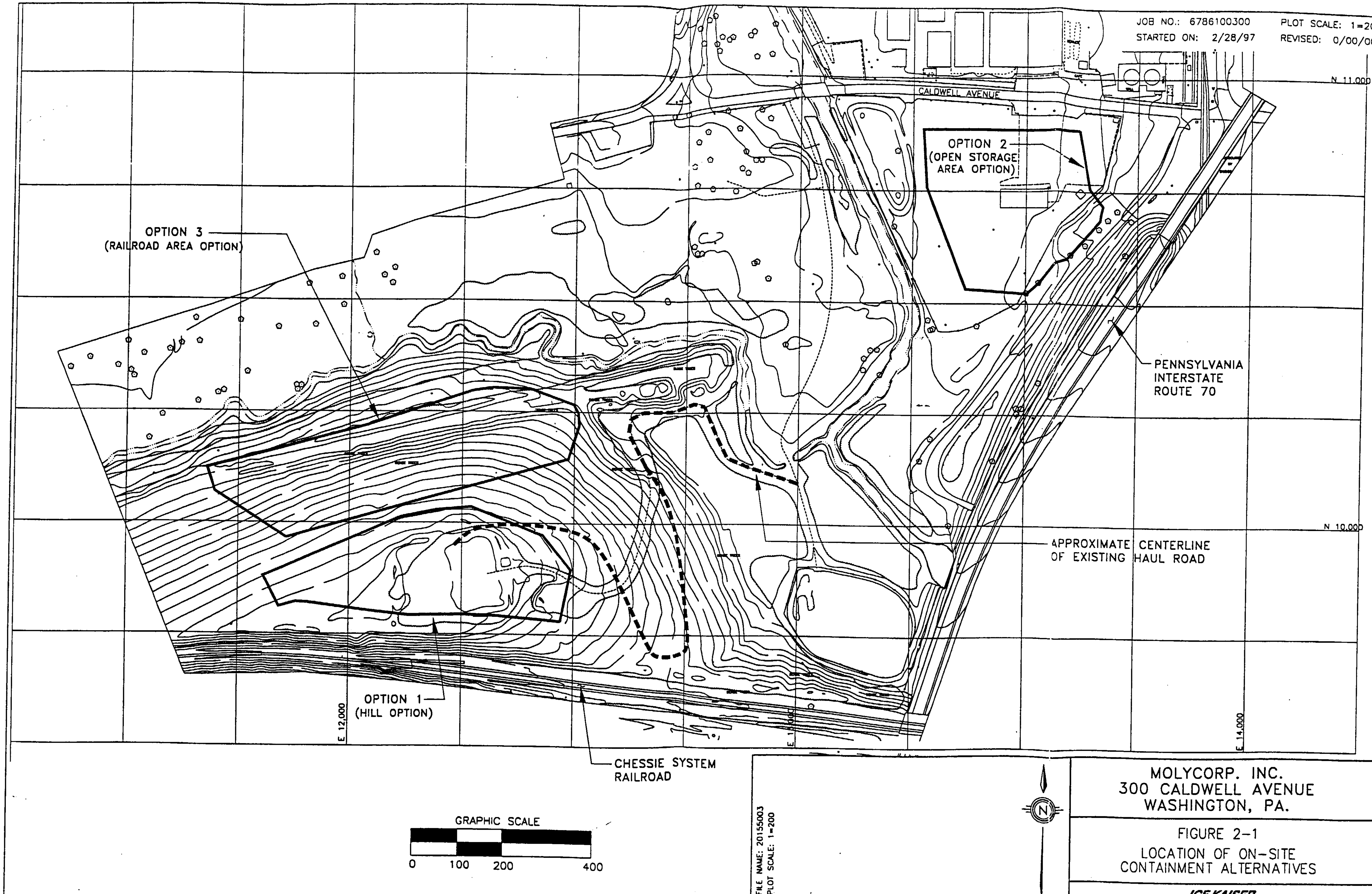
- The 3,300 yd^3 of thoriated soil from the York facility has been transferred and placed in the temporary storage structure at the Washington facility.

- The former coal gasification plant foundation on top of the hill has been demolished and removed for off-site disposal and the coal tar residue has been transferred to the coal tar disposal area located in the southeast corner of the Washington facility.

The design of the storage cell for each of the alternatives incorporates methods for providing human health and environmental protection. A berm would be constructed around the perimeter of the cell to increase slope stability and provide leachate containment. Preliminary stability analyses were performed for each option utilizing the STABL5M computer software developed by Purdue University. Results of these analyses are included in Appendix B. Each option was found to exhibit satisfactory factors of safety for slope stability under both static and seismic conditions. Factors of safety for static conditions were equal to or greater than 1.5 and factors of safety for seismic conditions were equal to or greater than 1.2. To obtain satisfactory factors of safety for Option 3, textured HDPE geomembrane and geonet with non-woven geotextile heat-bonded to both sides was modeled in the liner system for both geonet and geomembrane layers. Options 1 and 2 yielded adequate factors of safety for slope stability utilizing smooth HDPE geomembrane and geonet with no heat-bonded geotextile in the liner system.

A double liner system would be installed utilizing geosynthetic materials and would provide both leachate collection and leak detection. The thoriated material and subsequent cap system would be graded at a four horizontal to one vertical (4H:1V) slope to provide adequate cap stability. The perimeter of the containment cell would be fenced to restrict access and warning signs would be posted on the fence. A cross section of a typical storage cell is provided in Figure 2-2. The description of each layer of the cell system is provided below, from the bottom to the top:

- Subgrade would be graded to promote leachate collection and would be prepared to provide a relatively smooth surface for liner installation;



JOB NO.: 6786100300
STARTED ON: 2/28/97
PLOT SCALE: 1=200
REVISED: 0/00/00
N 11,000
CALDWELL AVENUE
OPTION 2
(OPEN STORAGE AREA OPTION)
OPTION 3
(RAILROAD AREA OPTION)
PENNSYLVANIA INTERSTATE ROUTE 70
N 10,000
APPROXIMATE CENTERLINE OF EXISTING HAUL ROAD
OPTION 1
(HILL OPTION)
E 12,000
E 14,000
CHESSIE SYSTEM RAILROAD
GRAPHIC SCALE
0 100 200 400
FILE NAME: 20155003
PLOT SCALE: 1=200
N
MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.
FIGURE 2-1
LOCATION OF ON-SITE CONTAINMENT ALTERNATIVES
ICF KAISER

2.1.1 On-Site Management Option 1

A preliminary design of on-site management Option 1 (Hill Option) is presented in Figures 2-3 and 2-4. A version of this option was presented in the Washington, PA Decommissioning Plan dated July 1995. The Hill Option involves the construction of the cell near the southwest corner of the Molycorp property on the top of the southwest hill area (the location of the former coal gasification facility). The Hill Option provides approximately 71,400 yd^3 of storage volume, which provides adequate storage volume for the estimated 62,000 yd^3 of thoriated material, and an excess storage volume of approximately 9,400 yd^3.

A description of cell construction activities for the Hill Option is provided below. This description is not intended to detail the construction sequence, but to provide an overview of cell construction for comparison to other options.

1. Temporary erosion and sediment control devices would be installed to provide protection of Surface Waters of the Commonwealth from sediment transport in stormwater runoff during construction activities. Clearing and grubbing (removal of grasses, brush, shrubs, and trees) would be performed in areas of cell construction and areas where thoriated slag is to be excavated.

2. Approximately 33,000 yd^3 of material would be removed from the top of the hill to create the cell. Material removed would consist of soil and rock. Borings drilled in this area indicate that approximately the top 14 feet consists of silts and clays which should be easily excavated using conventional earth-moving equipment; no blasting would be performed. Approximately 13,800 yd^3 of the cut material would be used to create the perimeter berms of the cell. The remaining 19,200 yd^3 of cut material would be stockpiled in the southeast corner of the open storage area outside the floodplain limits and outside the thoriated slag removal limits. This material would be used to fill areas excavated to remove thoriated slag. Temporary erosion and sediment control devices would be installed around the stockpile as appropriate to minimize sediment transport in stormwater runoff.

3. The cell base would be graded and the liner installed. All three of the on-site storage options have the same basic cell design to contain the thoriated material (as indicated in Figure 2-2). The component layers of the cell were discussed previously in Section 2.1.

- An HDPE geomembrane (textured surface) would be installed and anchored;

- A geosynthetic drainage net with non-woven geotextile heat-bonded to both sides would be installed as the cap drainage layer to direct stormwater infiltration from the cap;

- A 12-inch thick "biotic" layer of rock or cobbles would be constructed to prevent intrusion of burrowing animals, which may damage the synthetic cap materials;

- A non-woven geotextile would be installed as a separation layer between the cover soil and "biotic" layer;

- Cover soil would be placed and compacted to a depth of 18 inches;

- Six inches of topsoil would be placed over the cover soil to provide for vegetative growth;

- The topsoil would be seeded to promote vegetative growth;

- The cap would be graded and drainage ditches would be constructed to convey stormwater runoff from the site and minimize erosion of the cap.

The proposed system would minimize stormwater infiltration from entering the storage cell, thus reducing leachate generation. The leachate collection system allows for removal of leachate which may be generated, preventing a "bathtub" condition and reducing the risk of leakage. The leak detection system would allow for monitoring any leachate which may emanate from punctures in the primary lining system. Due to the durability of the HDPE geomembrane and the construction methods and systems to be used, leakage from the primary lining system should be greatly minimized. Additionally, the secondary lining system beneath the leak detection system even further reduces the risk of leachate leaking from the cell.

The three storage options are discussed below.

- A geosynthetic clay liner (GCL) (i.e., Claymax®) would be installed as a secondary liner beneath the leak detection system. The GCL is approximately one-half inch thick and is equivalent to approximately 3 ft. of compacted clay with a permeability of 1×10^{-7} cm/sec, thus allowing for additional storage capacity;

- A 60-mil high density polyethylene (HDPE) geomembrane would be installed as a primary liner beneath the leak detection system. This layer will be textured in Option 3. A sump (or sumps, if required by final design) would be constructed and lined with the GCL and HDPE geomembrane to provide monitoring for the leak detection system;

- A geosynthetic drainage net would be installed for leak detection. This layer will have non-woven geotextile heat-bonded to the top and bottom of the net in Option 3. The geosynthetic material is approximately 1/4-inch thick as compared to a 1-foot thick conventional sand layer, thus providing more storage capacity for the thoriated slag;

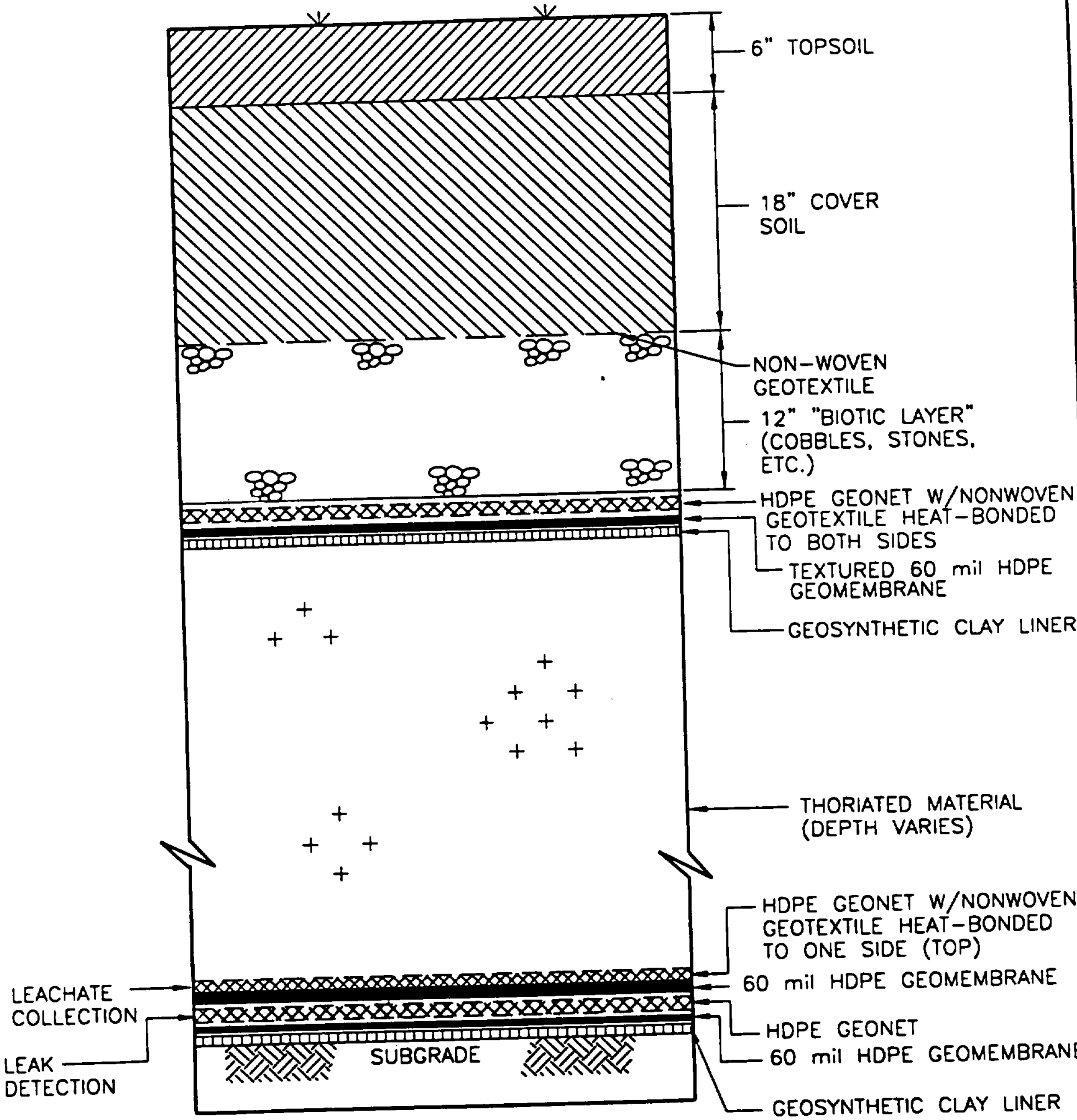
- A 60-mil HDPE geomembrane would be installed as the primary liner for thoriated material containment. This layer will be textured in Option 3;

- A geosynthetic drainage net with non-woven geotextile heat-bonded to the top of the net would be installed as the leachate collection system. This layer will have non-woven geotextile heat-bonded to both the top and bottom of the net in Option 3. The geotextile would act as a filtration layer to minimize soil from entering and possibly clogging the drainage net. Piping would be installed within the leachate collection system to convey the leachate to a sump area where it would be collected;

- Six inches of clean fill material would be placed to provide a bedding for the thoriated material which may damage the liner system if placed in direct contact;

- Thoriated material would be placed in the cell in controlled lifts and compacted;

- A GCL (i.e., Claymax®) would be installed and anchored;



NOTE: TYPICAL SECTION FOR OPTIONS 1 AND 2. SEE TEXT FOR OPTION 3 MODIFICATIONS.

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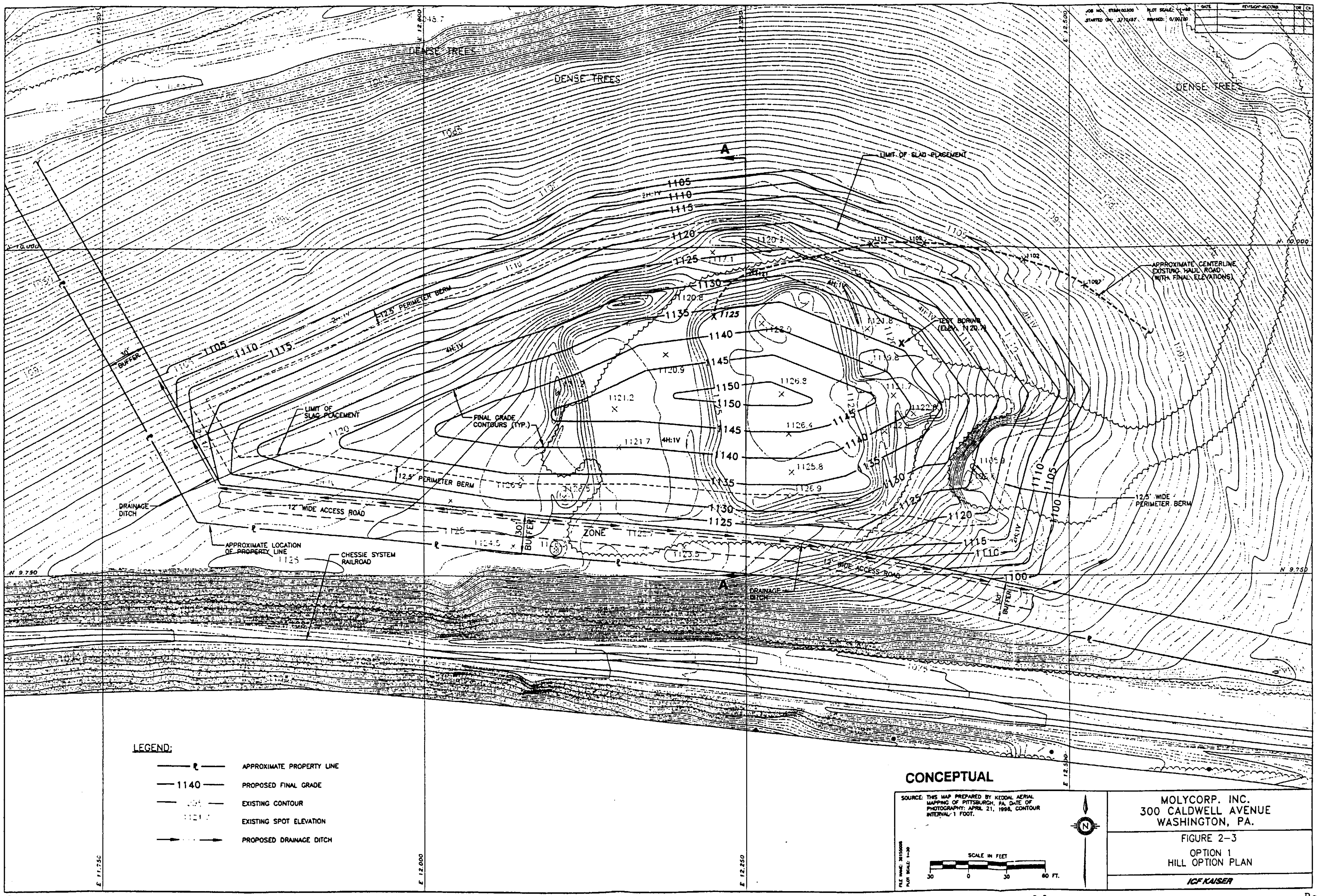
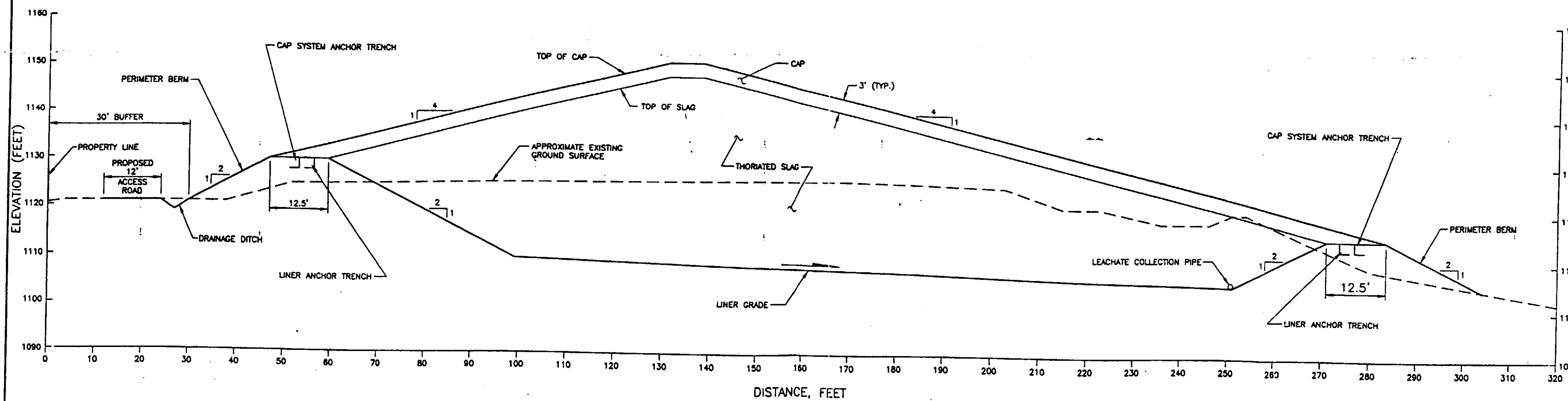
WASHINGTON, PA.

FIGURE 2-2
TYPICAL CELL SECTION

ICF KAISER

FILE NAME: 30157004
PLOT SCALE: 1=1


DENSE TREES
DENSE TREES
DENSE TREES
LIMIT OF SLAG PLACEMENT
APPROXIMATE CENTERLINE EXISTING HAUL ROAD (WITH FINAL ELEVATIONS)
TEST BORING (ELEV. 1120.7)
12.5' PERIMETER BERM
30' BUFFER
LIMIT OF SLAG PLACEMENT
FINAL GRADE CONTOURS (TYP.)
12.5' PERIMETER BERM
12.5' WIDE PERIMETER BERM
DRAINAGE DITCH
12' WIDE ACCESS ROAD
30' BUFFER
ZONE
APPROXIMATE LOCATION OF PROPERTY LINE
CHESSIE SYSTEM RAILROAD
12' WIDE ACCESS ROAD
DRAINAGE DITCH
30' BUFFER
LEGEND:
APPROXIMATE PROPERTY LINE
1140 PROPOSED FINAL GRADE
EXISTING CONTOUR
EXISTING SPOT ELEVATION
PROPOSED DRAINAGE DITCH
CONCEPTUAL
SOURCE: THIS MAP PREPARED BY KEDDAL AERIAL MAPPING OF PITTSBURGH, PA. DATE OF PHOTOGRAPHY: APRIL 21, 1996, CONTOUR INTERVAL 1 FOOT.
SCALE IN FEET
30 0 30 60 FT.
MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.
FIGURE 2-3
OPTION 1
HILL OPTION PLAN
ICF KAISER



SECTION A–A

CONCEPTUAL

HORIZONTAL AND VERTICAL SCALE
0 5 10 20 FEET

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WASHINGTON, PA.

FIGURE 2–4

OPTION 1 – HILL OPTION
SECTION A–A

ICF KAISER

4. Thoriated slag with more elevated concentrations of thorium would be placed along the bottom of the cell. This includes the material located in the 10,000 yd^3 pile located south of Caldwell Avenue in the open storage area. The method for removal and transportation of the thoriated slag would consist of removing overburden (material with thorium concentration less than 30 pCi/g) and stockpiling this material adjacent to the removal area and outside the limits of the 100-year floodplain. The thoriated slag would be excavated and loaded directly on transport trucks and taken to the cell. Additionally, the temporary storage structure would be dismantled and the thoriated soil would be placed in the cell. Dust suppression methods such as water or other sprays would be used to minimize fugitive dust emissions from both overburden and thoriated material. The thoriated material would be placed into the cell in 12-inch thick loose layers and compacted. The previously removed overburden material and the excess cut material from the cell construction would then be placed into the excavated area in 12-inch thick loose layers and compacted. Additional fill to return the area to original grade, if needed, would be obtained from an off-site source. Approximately 17,500 yd^3 of overburden is anticipated to be removed to allow removal of thoriated slag. In order to restore the overburden and thoriated slag removal areas to grade, the 17,500 yd^3 of stockpiled overburden plus approximately 26,100 yd^3 of off-site borrow material and 19,200 yd^3 excess cut material from cell construction would be used for backfilling. Confirmation surveys would be performed to ensure that all thoriated slag with a concentration greater than 30 pCi/g has been removed prior to backfilling the removal areas. Once backfilled, removal areas would be vegetated in compliance with erosion and sediment control regulations.

5. Once all thoriated material has been placed in the cell, the cap would be constructed. The synthetic materials as indicated in Figure 2-2 would be installed over the slag. A layer of rock and shale would be placed as a "biotic" layer over the synthetic materials to prevent the intrusion of burrowing animals which may damage the synthetic cap materials. Cover soil and topsoil would be placed and vegetation established. Vegetation on the cap would be short-rooted grasses. Maintenance would include reseeding bare areas and removal of any new growth trees which may take root naturally. Surface water which sheet flows from the cap would be collected in a perimeter drainage ditch and directed off the hill. A total of approximately 4,500 yd^3 of "biotic" layer material, 6,800 yd^3 of cover soil, and 2,300 yd^3 of topsoil material would be needed from off-site sources.

A material summary of Option 1 is provided in Table 2-1.

TABLE 2-1

MATERIAL SUMMARY

Material Description	Option 1 (Hill Area)	Option 2 (Storage Area)	Option 3 (Railroad Area
Cell space available for thoriated slag	71,400 yd^3	78,500 yd^3	71,600 yd^3
Total thoriated material to be placed in cell On-Site[(1)] From York	62,000 yd^3 58,700 yd^3 3,300 yd^3	62,000 yd^3 58,700 yd^3 3,300 yd^3	62,000 yd^3 58,700 yd^3 3,300 yd^3
Total overburden[(2)]	17,500 yd^3	17,500 yd^3	17,500 yd^3
Total fill needed to construct berms	13,800 yd^3	[(3)]24,900 yd^3	5,400 yd^3
Total cut (to create cell)	33,000 yd^3	6,900 yd^3	68,300 yd^3
Off-site borrow required[(4)]	26,100 yd^3	63,300 yd^3	[(5)]0
Cap System			
Topsoil (6")	[(6)]2,300 yd^3	[(6)]2,100 yd^3	[(6)]2,900 yd^3
Cover soil (18")	[(6)]6,800 yd^3	[(6)]6,400 yd^3	[(7)]8,700 yd^3
Rock/aggregate "biotic" layer (12")	[(6)]4,500 yd^3	[(6)]4,300 yd^3	[(6)]5,800 yd^3

(1) On-site thoriated material will be excavated and managed on-site or off-site. Excavations will be backfilled to original grade. On-site thoriated material quantity includes existing stockpile quantity of approximately 10,000 yd^3 located between the proposed Option 2 cell and Chartiers Creek, south of Caldwell Avenue and approximately 4,000 yd^3 of thoriated material currently located in roll off boxes on-site. No backfilling will be required to replace these volumes of material.

(2) Overburden above thoriated material will be excavated, stockpiled, and backfilled in thoriated material excavation area.

(3) Quantity includes interior berm construction and 10' wide berm for 100-year floodplain clearance.

(4) Off-site borrow required is the amount of borrow material required to return the thoriated material removal areas to existing grade and for berm construction. This quantity does not include materials needed for cap construction.

(5) Because of the large quantity of cut required for Option 3, there will be no need for off-site borrow for backfilling excavation areas or for berm construction.

(6) To be obtained solely from off-site sources. Not included in the off-site borrow quantity.

(7) Excess cut material from Option 3 cell construction may be used as cover soil. No off-site borrow will be needed.

2.1.2 On-Site Management Option 2

A preliminary design of on-site management Option 2 (Open Storage Area Option) is presented in Figures 2-5 and 2-6. The Open Storage Area Option involves construction of the cell near the southeast area of the property in the open storage area located south of Caldwell Avenue. The Open Storage Area Option provides approximately 78,500 yd^3 of storage volume, which provides adequate storage volume for the estimated 62,000 yd^3 of thoriated material and an excess storage volume of approximately 16,500 yd^3.

The cell section would be similar to that of Option 1 as presented in Figure 2-2. Option 2 is located in the thorium removal area, thus stockpiling of thoriated slag and phased construction of the cell would be required. The thoriated slag would be excavated from the northern portion of the existing storage area and stockpiled in the southern portion of the area. The initial phase of the containment cell (North Cell) would be constructed in the area where the thoriated slag was excavated. Thoriated slag present in the southern portion of the existing storage area, and stockpiled materials excavated from the northern portion, along with the thoriated soil from the temporary storage structure, would be placed in the cell. After all the thoriated material has been removed, the containment cell would be completed (South Cell).

Option 2 would require the relocation of approximately 500 feet of force main sanitary sewer around the southwest corner of the proposed disposal cell.

Option 2 is located within the 100-year floodplain (elevation 1024 feet above mean sea level (ft-msl)). In accordance with Title 10, Part 61, 61.50 Subpart D, "Waste disposal shall not take place in a 100-year floodplain," a 10-foot wide berm would be constructed to elevation 1025.0 ft-msl around the perimeter of the containment cell where existing grades are lower than elevation 1025.0 ft-msl. The volume of the 100-year floodplain displaced due to the construction of the containment cell is approximately 111,000 cubic feet. The anticipated increase in the 100-year floodplain elevation due to the decrease in storage volume is judged to be minimal.

A description of cell construction activities for the Open Storage Area Option is provided below. Due to the construction of the cell in an area where a large quantity of the on-site thoriated slag is located, construction would be more complex than Option 1 and would result in double handling of overburden and


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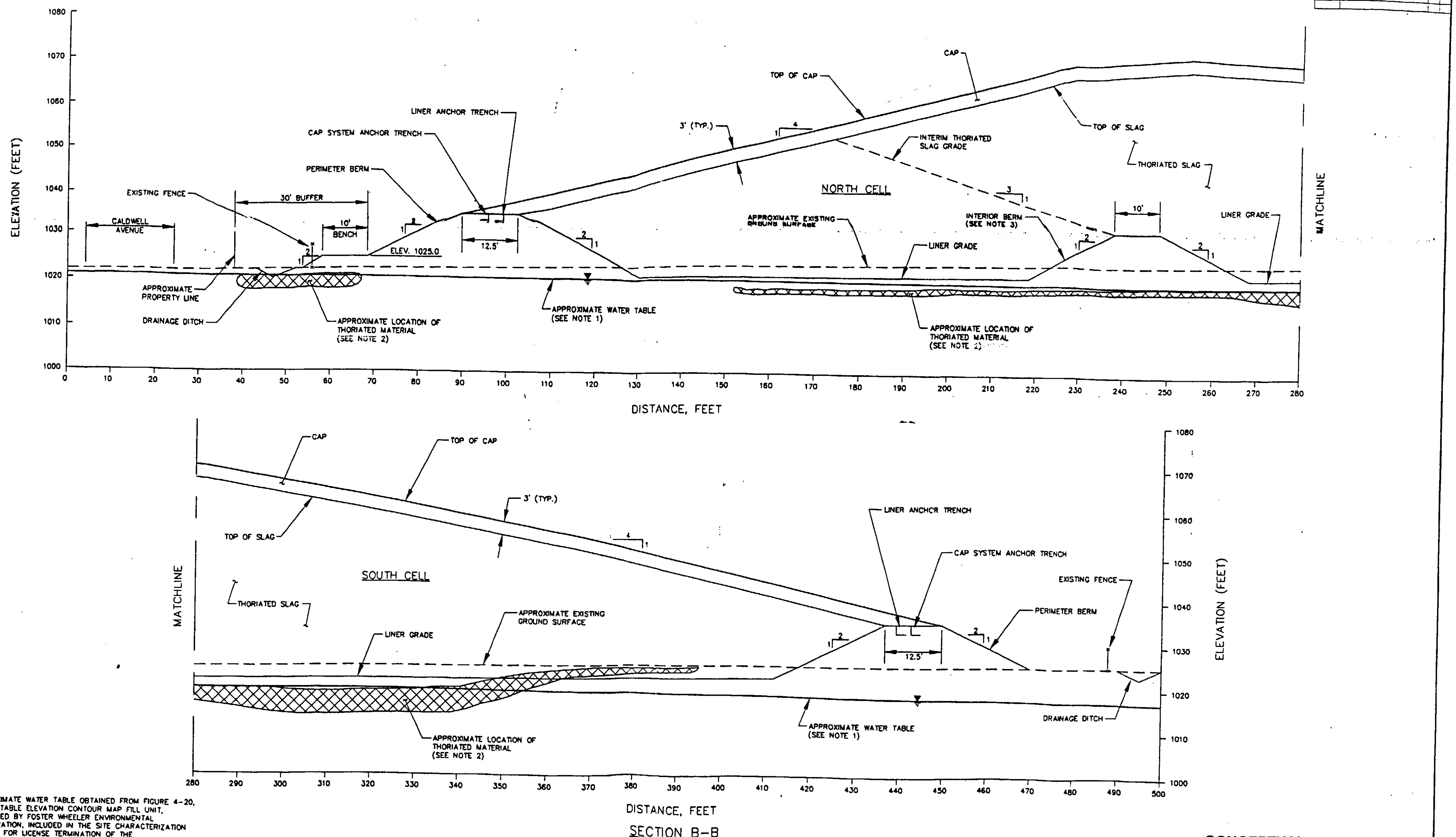
FIGURE 2-5
OPTION 2 -
OPEN STORAGE AREA OPTION PLAN
ICF KAISER
SOURCE: THIS MAP PREPARED BY KEDDAL AERIAL MAPPING OF PITTSBURGH, PA. DATE OF PHOTOGRAPHY: APRIL 21, 1996. CONTOUR INTERVAL 1 FOOT.
SCALE IN FEET
30 0 30 60 FT.
LEGEND:
RELOCATED STORM SEWER
EXISTING FORCE MAIN STORM SEWER
WATER MAIN
SANITARY SEWER
APPROXIMATE PROPERTY LINE
EXISTING FENCE
PROPOSED FINAL GRADE
EXISTING CONTOUR
EXISTING SPOT ELEVATION
PROPOSED DRAINAGE DITCH
CALDWELL AVENUE
CHARTIERS CREEK
PENNSYLVANIA INTERSTATE ROUTE 70
EXISTING FENCE
30' BUFFER FROM ℓ
10' BENCH
DRAINAGE DITCH
APPROXIMATE LOCATION OF PROPERTY LINE
APPROXIMATE LOCATION OF EXISTING SANITARY SEWER
APPROXIMATE LOCATION OF EXISTING FORCE MAIN STORM SEWER
APPROXIMATE LOCATION OF EXISTING WATER MAIN
12.5' PERIMETER BERM
LIMIT OF SLAG PLACEMENT
FINAL GRADE CONTOURS (TYP.)
EXISTING SHED (TO BE REMOVED)
BRIDGE
EXISTING WAREHOUSE (TO BE REMOVED)
10' INTERIOR BERM
APPROXIMATE EXISTING 100 YEAR FLOODPLAIN ELEVATION 1024 FT.±
100' BUFFER FROM CREEK
30' BUFFER FROM ROAD
PAVED ACCESS ROAD
APPROXIMATE LOCATION OF TEMPORARY STORAGE STRUCTURE (TO BE DISMANTLED)
APPROXIMATE RELOCATION OF FORCE MAIN STORM SEWER LINE
GATE
WALL
2H:1V
4H:1V
B



CONCEPTUAL

NOTES:

1. APPROXIMATE WATER TABLE OBTAINED FROM FIGURE 4-20, WATER TABLE ELEVATION CONTOUR MAP FILL UNIT, PREPARED BY FOSTER WHEELER ENVIRONMENTAL CORPORATION, INCLUDED IN THE SITE CHARACTERIZATION REPORT FOR LICENSE TERMINATION OF THE WASHINGTON, PA FACILITY, DATED JANUARY 1995.
2. APPROXIMATE LOCATION OF THORIATED MATERIAL OBTAINED FROM FIGURE 2-1A, SOIL AREAS AND BORING LOCATIONS WITH GREATER THAN 30 pCi/g THORIUM-232, PREPARED BY FOSTER WHEELER ENVIRONMENTAL CORPORATION, INCLUDED IN THE DECOMMISSIONING PLAN FOR THE WASHINGTON, PA FACILITY, DATED JULY 1995.
3. THE INTERIOR BERM WILL BE CONSTRUCTED SUCH THAT THE AVAILABLE THORIATED SLAG VOLUME IN THE NORTH CELL IS LARGE ENOUGH TO CONTAIN ALL THORIATED SLAG EXCAVATED FROM THE EXISTING OPEN STORAGE AREA (≈8,100 CY) AND THE MATERIAL FROM THE YORK FACILITY STORED IN THE TEMPORARY STORAGE FACILITY (≈3,300 CY).

HORIZONTAL AND VERTICAL SCALE
0 5 10 20 FEET

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WASHINGTON, PA.

FIGURE 2-6
OPTION 2 – OPEN STORAGE AREA OPTION
SECTION B-B

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thoriated slag. This description is not intended to detail the construction but to provide an overview of the construction for comparison to other options.

1. Temporary erosion and sediment control devices would be installed to provide protection of the Surface Waters of the Commonwealth from sediment transport in stormwater runoff during construction activities. Clearing and grubbing (removal of grasses, brush, shrubs, and trees) would be performed in areas of cell construction and areas where thoriated slag is to be excavated.

2. The cell for Option 2 would be constructed in the open storage area where approximately 8,000 yd^3 of thoriated slag is buried and where the temporary storage structure for the thoriated soil from York would be constructed. The cell would be constructed in two phases to avoid double handling all of the excavated thoriated material. The initial phase (North Cell) would be constructed large enough to allow the placement of all thoriated slag from the open storage area (approximately 8,000 yd^3) and the thoriated soil from the York facility stored in the temporary storage structure (approximately 3,300 yd^3). Overburden and thoriated slag would be excavated from the northern portion of the open storage area to allow the North Cell construction and the materials would be stockpiled separately in the southern portion of the open storage area outside the limits of the 100-year floodplain. All stockpiled thoriated slag would be placed on impermeable liners. Fugitive dust emissions would be minimized through the use of water and/or other dust suppressants and temporary erosion and sediment controls would be installed around the stockpiles as required.

3. The North Cell would be constructed by adding fill to raise the area above the 100-year floodplain elevation and constructing perimeter and internal berms. The cell base would be graded and the liner system would be installed as indicated on the typical cell section shown in Figure 2-2.

4. Once the North Cell is constructed, all stockpiled thoriated slag and the thoriated soil contained in the temporary storage structure would be placed in the cell in 12-inch thick loose lifts and compacted. Remaining buried thoriated slag in the southern portion of the existing open storage area would be excavated and placed directly into trucks for transportation to the North Cell. These materials would be placed in the cell in 12-inch loose lifts and compacted. The overburden

excavated to allow removal of the thoriated slag would be used to fill areas of thoriated slag excavation outside the limits of the cell.

5. Once all thoriated slag has been removed from the open storage area the remaining portion of the cell (South Cell) would be constructed. Fill would be placed to raise the area above the 100-year floodplain elevation and the perimeter berms would be constructed. The cell base would be graded and the liner system would be installed as indicated on the typical cell section shown in Figure 2-2. The synthetic liner materials would be joined between the North and South Cells to create a continuous lining system along the entire cell. Approximately 6,900 yd^3 of material would be removed to create the cell base. Approximately 24,900 yd^3 of material would be needed to construct the perimeter and interim berms and raise the cell above the 100-year flood elevation. Therefore, approximately 18,000 yd^3 of off-site borrow material would be needed to construct the berms for the cell.

6. Remaining thoriated slag from other locations within the facility would be excavated and placed in the cell. Overburden would be removed and stockpiled adjacent to the removal areas. Thoriated slag would then be excavated and placed directly into trucks for transportation to the disposal cell. Dust suppression methods such as water or other sprays would be used to minimize fugitive dust emissions. Excavated thoriated slag would be placed into the cell in 12-inch thick loose lifts and compacted. Thoriated slag with more elevated concentrations of thorium would be placed along the bottom of the cell. This includes the material located in the 10,000 yd^3 pile located south of Caldwell Avenue in the open storage area. The overburden would be placed into the excavation area from which it was excavated in 12-inch thick loose lifts and compacted. Off-site borrow material would then be used to restore the area to previous grade. Approximately 17,500 yd^3 of overburden is anticipated to be removed to allow removal of thoriated slag. In order to restore the overburden and thoriated slag removal areas to grade, the 17,500 yd^3 of stockpiled overburden plus 45,300 yd^3 of off-site borrow material would be used for backfilling the excavations. Confirmation surveys would be performed to ensure that all thoriated slag with a concentration greater than 30 pCi/g has been removed prior to backfilling the removal areas. Once backfilled, removal areas would be vegetated in compliance with erosion and sediment control regulations.

7. Once all thoriated material has been placed in the cell, the cap would be constructed. The synthetic materials as indicated in Figure 2-2 would be installed over the slag. A layer of rock and shale would be placed as a "biotic" layer to prevent the intrusion of burrowing animals which may

damage the synthetic cap materials. Cover soil and topsoil would be placed and vegetation established. Vegetation on the cap would be short-rooted grasses. Maintenance would include reseeding bare areas and removal of any new growth trees which may take root naturally. Surface water which sheet flows from the cap would be collected in perimeter drainage ditches and directed to Chartiers Creek. A total of approximately 4,300 yd^3 of off-site "biotic" layer material, 6,400 yd^3 of cover soil, and 2,100 yd^3 of topsoil material would be needed from off-site sources.

A material summary of Option 2 is provided in Table 2-1.

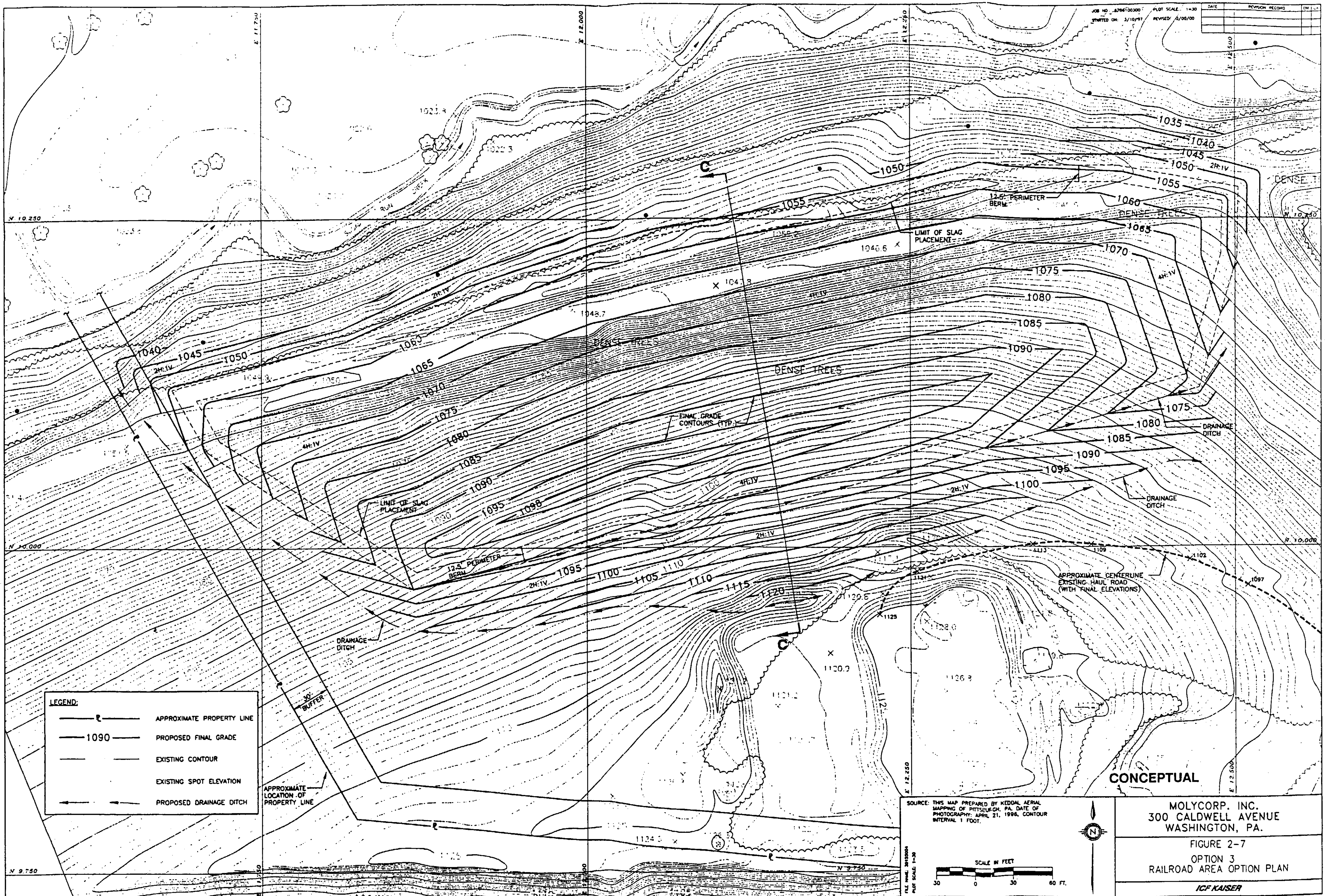
2.1.3 On-Site Management Option 3

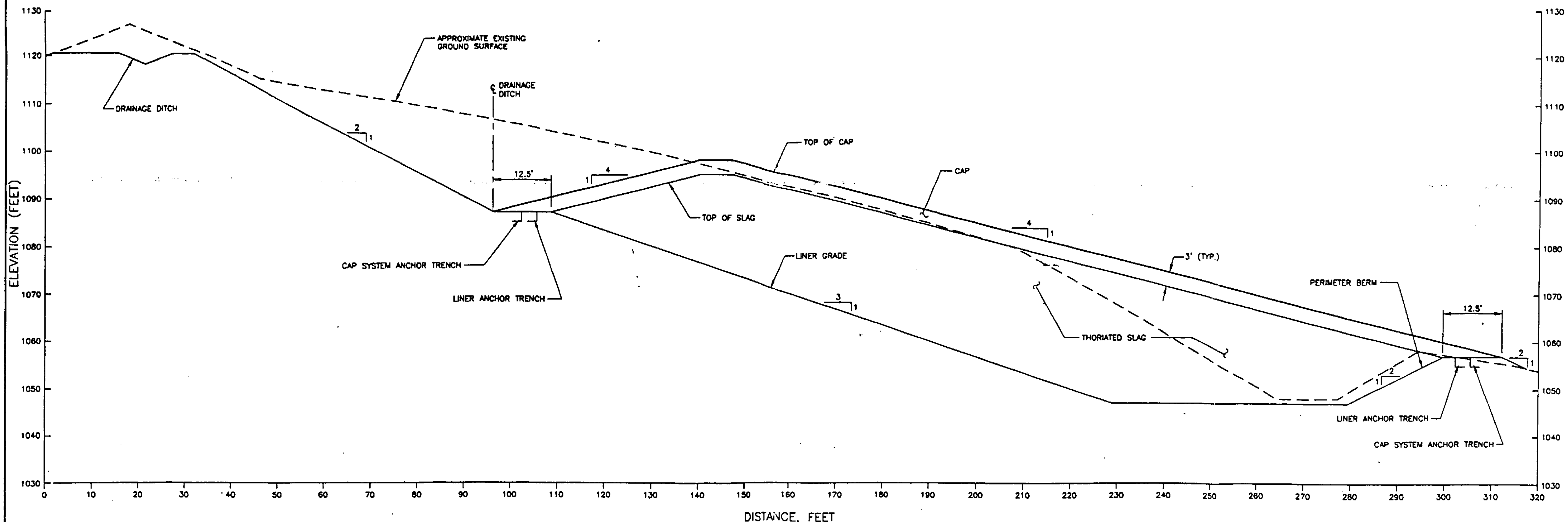
A preliminary design of on-site management Option 3 (Railroad Area Option) is presented in Figures 2-7 and 2-8. The Railroad Area Option involves the construction of the cell in the former railroad right of way which lies north of the former coal gasification plant area and south of Caldwell Avenue. The Railroad Area Option provides approximately 71,600 yd^3 of storage volume, which provides adequate storage volume for the estimated 62,000 yd^3 of thoriated slag and an excess storage volume of approximately 9,600 yd^3.

The cell section would be similar to that of Options 1 and 2 as presented in Figure 2-2. In order to provide adequate storage volume and achieve adequate slope stability, the existing railroad base area would be widened and the hill would be cut back at a three horizontal to one vertical (3H:1V) slope. Option 3 is characterized by a large quantity of cut required to construct the cell (approximately 68,300 yd^3) and the placement of thoriated slag along the 3H:1V slope created by cutting back the existing hill. A berm would be constructed along the north side of the existing railroad base to provide a buttress for the thoriated material and anchorage for the liner and cap materials.

A description of cell construction activities for the Railroad Area Option is provided below. This description is not intended to detail the construction sequence but to provide an overview of the construction for comparison to other options.

1. Temporary erosion and sediment control devices would be installed to provide protection of Surface Waters of the Commonwealth from sediment transport in stormwater runoff during


LEGEND:
APPROXIMATE PROPERTY LINE
1090 PROPOSED FINAL GRADE
EXISTING CONTOUR
EXISTING SPOT ELEVATION
PROPOSED DRAINAGE DITCH
CONCEPTUAL
SOURCE: THIS MAP PREPARED BY KEDDAL AERIAL MAPPING OF PITTSBURGH, PA. DATE OF PHOTOGRAPHY: APRIL 21, 1996. CONTOUR INTERVAL 1 FOOT.
SCALE IN FEET
30 0 30 60 FT.
MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.
FIGURE 2-7
OPTION 3
RAILROAD AREA OPTION PLAN
ICF KAISER
DENSE TREES
FINAL GRADE CONTOURS (TYP.)
LIMIT OF SLAG PLACEMENT
12.5' PERIMETER BERM
DRAINAGE DITCH
APPROXIMATE CENTERLINE EXISTING HAUL ROAD (WITH FINAL ELEVATIONS)
APPROXIMATE LOCATION OF PROPERTY LINE
30' BUFFER
2H:1V
4H:1V



SECTION C–C

CONCEPTUAL

HORIZONTAL AND VERTICAL SCALE
0 5 10 20 FEET

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 2–8
OPTION 3 – RAILROAD AREA OPTION
SECTION C–C

ICF KAISER

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

FIGURE 2-3:

OPTION 1 HILL OPTION PLAN

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER:

FIGURE 2-3

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

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FIGURE 2-4:

OPTION 1 - HILL OPTION PLAN

SECTION A-A

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FIGURE 2-4

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THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

FIGURE 2-5:

OPTION 2 - OPEN STORAGE AREA OPTION PLAN

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FIGURE 2-5

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

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THAT CAN BE VIEWED AT THE RECORD TITLED:

FIGURE 2-6: OPTION 2 - OPEN STORAGE AREA OPTION SECTION B-B

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: FIGURE 2-6

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

construction activities. Clearing and grubbing (removal of grasses, brush, shrubs, and trees) would be performed in areas of cell construction and areas where thoriated slag is to be excavated.

2. Approximately 68,300 yd^3 of material would be excavated to create the cell. Material removed would consist of soil and rippable rock; no blasting would be performed. Approximately 5,400 yd^3 of the cut material would be used to create the perimeter berm of the cell. The remaining 62,900 yd^3 of cut material would be stockpiled on-site at a designated location. This material would be used to fill in areas excavated to remove thoriated slag and may be used as cover soil material in the cap system. Temporary erosion and sediment control devices would be installed around the stockpile as necessary to minimize sediment transport in stormwater runoff.

3. The cell base would be graded and the liner would be installed. The component layers of the cell liner system is discussed in Section 2.1.

4. Thoriated slag would be placed in the cell once the cell is constructed. Thoriated slag with more elevated concentrations of thorium would be placed along the bottom of the disposal cell. This includes the material located in the 10,000 yd^3 pile located south of Caldwell Avenue in the open storage area. The method of removal and transportation of thoriated slag would consist of removing overburden and stockpiling this material adjacent to the removal area and outside the limits of the 100-year floodplain. The thoriated slag would be excavated and loaded directly on transport trucks and taken to the cell. Additionally, the temporary storage structure will be dismantled and the thoriated soil would be placed in the cell. Dust suppression methods such as water or other sprays would be used to minimize fugitive dust emissions from both overburden and thoriated slag. The thoriated material would be placed in the cell in 12-inch thick loose lifts and compacted. The previously removed overburden material and the excess cut material from the cell construction would be placed in the excavated areas in 12-inch thick loose lifts and compacted. Approximately 17,500 yd^3 of overburden is anticipated to be removed to allow removal of thoriated slag and no off-site borrow material is anticipated to be needed to return the excavation areas to original grade. Confirmation surveys would be performed to ensure all thoriated slag with a concentration greater than 30 pCi/g has been removed prior to backfilling the removal areas. Once backfilled, removal areas would be vegetated in compliance with erosion and sediment control regulations.

5. Once all thoriated material has been placed in the cell, the cap would be constructed. The synthetic materials as indicated in Figure 2-2 would be installed over the slag. A layer of rock and shale would be placed as a "biotic" layer over the synthetic materials to prevent the intrusion of burrowing animals which may damage the synthetic cap materials. Cover soil and topsoil would also be placed and vegetation established. Vegetation on the cap would be short-rooted grasses. Maintenance would include reseeding bare areas and removal of any new growth trees which may take root naturally. Surface water which sheet flows from the cap would be collected in drainage ditches around the perimeter of the cell and directed to Sugar Run. A total of approximately 5,800 yd^3 of "biotic" layer material and 2,900 yd^3 of topsoil material would be needed from off-site sources. The excess cut material from cell construction would be used as cover soil.

A material summary of Option 3 is provided in Table 2-1.

2.2 OFF-SITE MANAGEMENT ALTERNATIVES

Under the off-site management alternative, thoriated material would be removed from the site and disposed at an NRC licensed commercial disposal facility. Radioactive contamination at the Washington facility would be reduced to less than 30 pCi/g, which would require Molycorp to maintain their source material license and place restrictions upon future uses of the site. The Washington facility has approximately 62,000 yd^3 (approximately 92,070 tons, assuming a unit weight of 110 pounds per cubic foot) of thoriated material for management. Transportafion of the thoriated material to an NRC licensed commercial disposal facility could be performed by trucks using public roads or using the on-site railroad loading area to load thoriated material directly onto railcars. The estimated time to complete the actions for this alternative is dependent upon the disposal facility and the restrictions imposed on shipping acceptance rates.

2.3 NO-ACTION ALTERNATIVE

The no action alternative is required for consideration under NEPA regulations in order to provide a baseline for which other alternatives are evaluated. Under the no-action alternative, the thoriated slag at the

Washington facility would remain in its current state with no removal or processing. Under the no action alternative, the temporary management cell would be a permanent management structure, and once the thoriated soil from York was placed in the cell, no removal or processing of this material would occur. Measures to be implemented at the site would be limited to restricted site access and monitoring site conditions. Under this alternative, the Washington facility would not be decommissioned. This no-action alternative would not comply with the NRC's requirements under the Atomic Energy Act nor does it meet the interests of the public, Molycorp, or the Commonwealth of Pennsylvania. As stated previously, this alternative is a baseline to which alternative actions are compared.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Molycorp owns approximately 55 acres at this Site and the property was evaluated to determine the optimal on-site storage location. Approximately 20 acres is developed and therefore considered unsuitable for use in developing an on-site storage cell. Due to site elevations and Chartiers Creek and Sugar Run which transverse the property, approximately 25 acres lie within the floodplain. Approximately 3.253 acres have been classified as wetlands which are unsuitable for use in developing an on-site storage cell. In addition, the topography of the Washington facility includes steep slopes and hillsides which make cell construction difficult. Options 1, 2 and 3 were considered the most feasible options for location of the storage cell considering the site limitations at the Washington facility.

2.5 REGULATORY COMPLIANCE

The proposed facility decommissioning and corresponding actions would comply with the following federal statutes and regulations: Atomic Energy Act; NEPA and its implementing regulations; 40 CFR 1500-1505; the Clean Air Act and its amendments; Resource Conservation and Recovery Act as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984; Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); the Clean Water Act and its amendments; Endangered Species Act of 1973; Section 106 of the Historic Preservation Act; Occupational Safety and Health Act and its regulations (29 CFR 1910, Subpart G, Occupational Health and Environmental Controls, 29 CFR 1910, Subpart I, Personal Protective Equipment, 29 CFR 1910, Subpart J, General Environmental

Controls, 29 CFR 1926, Safety and Health Standards for Construction); NRC's regulations in 10 CFR Parts 20, 40, 61, and NRC's Implementing Regulations Concerning NEPA in 10 CFR Part 51. The action would also be required to comply with the State of Pennsylvania statutes and regulations. Consultation with the Game Commission Bureau of Land Management has been completed as required by Section 7 of the Endangered Species Act of 1973.

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED: FIGURE 2-7: OPTION 3 - RAILROAD AREA OPTION PLAN

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: FIGURE 2-7

NOTE: Because of this page's large file size, it may be more convenient to copy the file to a local drive and use the Imaging (Wang) viewer, which can be accessed from the Programs/Accessories menu.

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THAT CAN BE VIEWED AT THE RECORD TITLED:

FIGURE 2-8: OPTION 3 - RAILROAD AREA OPTION SECTION C-C

WITHIN THIS PACKAGE...OR, BY SEARCHING USING THE DRAWING NUMBER: FIGURE 2-8

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3.0 AFFECTED ENVIRONMENT

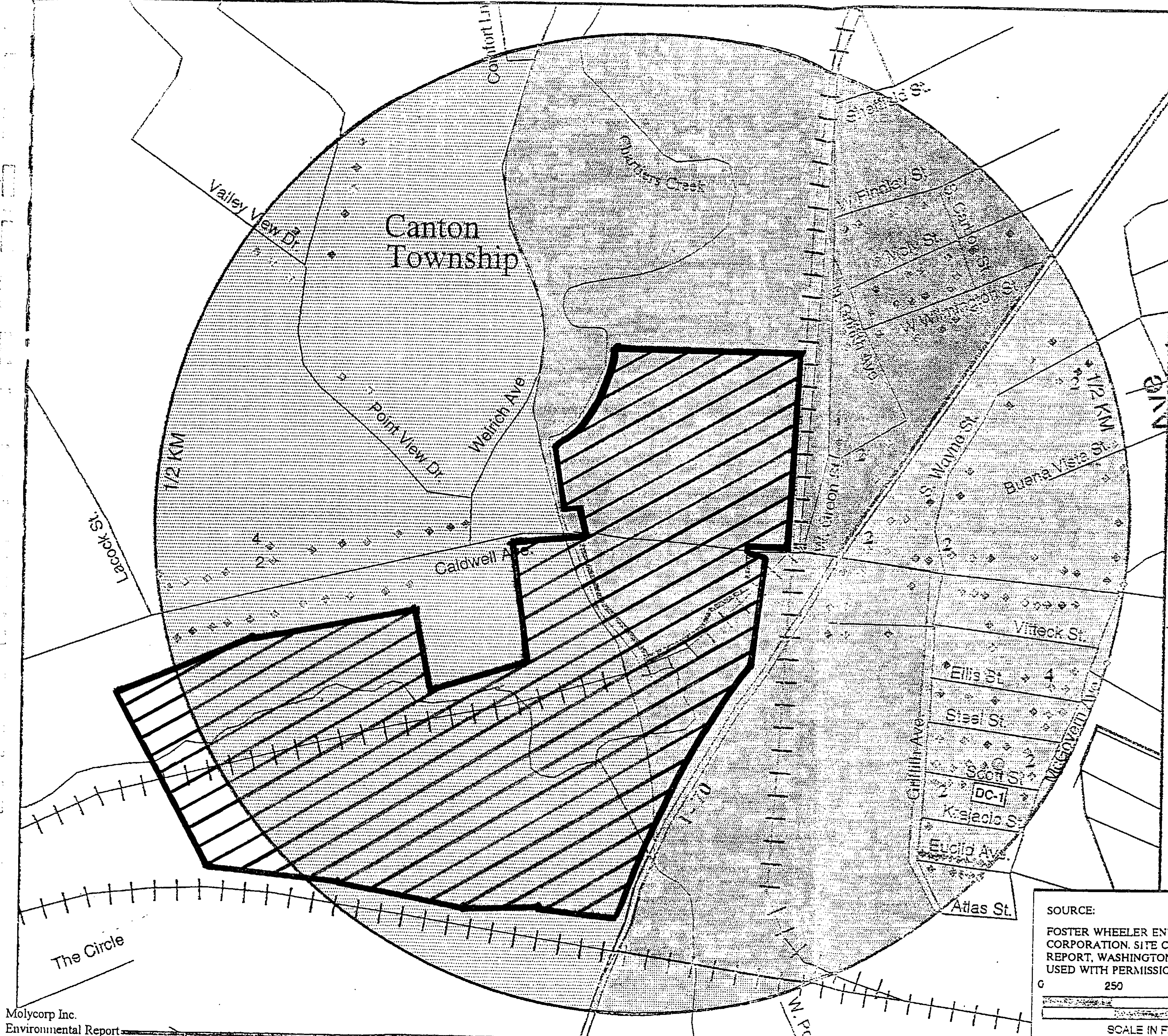
This section describes the existing natural resources and environmental conditions on and adjacent to the Molycorp facility in Washington, PA. The information and data presented in this section provides a baseline description of the environment against which the decommissioning alternatives presented in Section 2.0 will be evaluated. Each of the decommissioning alternatives will affect the environment differently. The information in this section is the reference point against which changes to the environment, both positive and negative, are assessed. These changes are assessed in Section 4.0. Unless otherwise referenced, the information contained in this section is from the Site Characterization Report by Foster Wheeler (Foster Wheeler, 1995c) and the Ecological Risk Assessment and Permitting Support Report by IT Corporation (IT, 1996) (included as Appendix A).

3.1 LAND AND WATER USE

Approximately 0.08 square kilometers (km^2) (20 acres) of the 0.2 km^2 (55 acres) property were used by Molycorp for plant operations. The remainder of the Molycorp property is comprised of the open storage area, a former coal gasification plant foundation (on top of the hill), forest, and wetlands. The thoriated material which would be managed is located within the plant area, in the open storage area, in rolloff bins, in a slag pile and in a proposed temporary storage structure that would be used to store thoriated soil from York. Access to the thoriated material is restricted by fences with locked gates and signs posted around the circumference warning of the presence of radioactivity in those areas. The remainder of this section describes the existing zoning and land use and watershed in the area of the Molycorp facility. The Molycorp facility is considered to be the center of any radial area discussed.

3.1.1 Land Use

There are seven zoning districts in Canton Township; five of the seven districts are present within 1/2 km (approximately 0.3 mile (mi.)) of the Molycorp property (study area) as shown on Figure 3-1. Table 3-1 presents a brief description of the districts, including permitted uses within each district. Less than one-half of the study area is zoned for residential purposes including low density and medium density residential districts. The bulk of the residential district is zoned R-1 for low density residential development. The



LEGEND

- Project Site
- Residences
- 4 Multiple Housholds

178 Residences in 1/2 km Radius

2.64 Persons per Household

469.92 Total Persons in 1/2km Radius

SENSITIVE POPULATION IDENTIFICATION

DAY CARE CENTERS (Map Key: DC-#):
DC-1 148 Scott Ave. Family Day Care Center (Cynthia Bayus)

NURSING & PERSONAL CARE HOMES:
None

HOSPITALS & CLINICS:
None

GROUP QUARTERS:
None

SCHOOLS :
None

PRISONS:
None

ZONING (Canton Township, 1977)

- Residential - Low Density
- Residential - Medium Density
- Industrial - Heavy
- Commercial - Neighborhood
- Commercial - General

SOURCE:
FOSTER WHEELER ENVIRONMENTAL CORPORATION. SITE CHARACTERIZATION REPORT, WASHINGTON, PA FIGURE 4-34 USED WITH PERMISSION

0 250 500 750
SCALE IN FEET

MOLYCORP, INC.
300 CALDWELL AVENUE
WASHINGTON, PA

FIGURE 3-1
1/2 KM VICINITY MAP AND ZONING

FOSTER WHEELER ENVIRONMENTAL CORPORATION

TABLE 3-1

CANTON TOWNSHIP ZONING DISTRICTS PRESENT WITHIN 1/2 KM RADIUS OF MOLYCORP

District Name	Permitted Uses	Development Standards
Residential - Low Density (R-1)	Farms & agricultural uses; single-family residences; public schools; recreational facilities; mobile homes on 1+ acre; essential services	10 acres for farms; 1 acre for residences with septic tanks; 1/2 acre for residences with sewers
Residential - Medium Density (R-2)	Farms & agricultural uses; single-family residences; public recreational facilities; planned unit residential developments; essential services	12,000 square feet minimum lot size with public water/sewer; R-1 regulations apply with on-site services
Residential - Medium Density (R-3)	Single-family detached houses; single-family semi-detached houses; public recreational facilities; planned unit residential developments; essential services	Lot size varies based upon used; R-1 regulations apply with on-site services.
Industrial - Light (I-1)	Small Manufacturing Plants (electronics, pharmaceuticals, some food products, etc.)	1/2 acre min. lot size; 50% lot cover
Industrial - Heavy (I-2)	Large Manufacturing Plants (chemicals, metals, machinery, etc.)	1/2 acre min. lot size; 50% lot cover
Commercial - Neighborhood (C-1)	General retail establishments; professional/business offices; planned unit commercial development	10,000 square feet minimum lot size; floor area less than 2,000 square feet
Commercial - General (C-2)	General merchandise stores; offices; public buildings; personal services; motels; gas stations; indoor recreational facilities; planned unit commercial development	1/2 acre minimum lot size

Sources: Foster Wheeler, 1995a, HMT & Associates, 1996 and Kendree and Shepherd Planning Consultants, 1977.

central portion of the 1/2 km (0.3 mi) study area is zoned I-2, heavy industry. The 0.08 km^2 (20-acre) active portion of the facility lies entirely within the area zoned for heavy industry while most of the remainder of the property falls within the Township's R-1, low density residential zone. In the northeast quadrant of the study area, a C-1 neighborhood commercial district covers approximately one-eighth of the area and is generally bounded by I-70 on the east and Greene Street on the west. The residential property directly west of the Molycorp facility is low density. A small C-2 general commercial district located along the southern boundary of the area lies immediately adjacent to the old Baltimore and Ohio Railroad right-of-way, now owned and operated by CSX. Land use also includes vacant woodlands to the west and south, and additional industrial land use (Findlay Refractories Co.) to the north. After the facility has undergone decommissioning, it will continue to be used for some undetermined heavy industrial purpose, the specifics of which have not been established at this time. The 2 km (approximately 1.25 mi.) radius surrounding the Molycorp Washington facility covers 12.6 km^2 (3,106 acres) in portions of Canton and North Franklin Townships, and the City of Washington. Existing land uses in the 2 km (1.25 mi) radius are shown on Figure 3-2 and are summarized on Table 3-2.

As Figure 3-2 shows, the project facility is located in a built-up industrial (Canton Township) and residential (City of Washington) area. Future land uses adjacent to Molycorp are not expected to change significantly. Canton Township is currently in the process of redefining zoning in the area. The bulk of the property zoned RI is proposed to be rezoned light industrial, the existing heavy industrial will remain heavy industrial.

Residential uses, in general, comprise less than 50 percent of the 2 km (1.25 mi) radius study area. Residential use areas are concentrated primarily in the City of Washington and in occasional residential clusters, such as Elwood Park and Log Pile in Canton Township and Franklin Farms in North Franklin Township. Residential land use is divided by density into low (single family), medium (single/duplex), and high (urban) use areas. What is defined as Other uses comprise approximately 30 percent of the 2 km (1.25 mi) radius study area. Other land use covers non-primary uses such as vacant land, schools, churches. hospitals and military reservations. Vacant land comprises the majority of the non-primary uses of land. With the exception of hospitals and military reservations, all other non-primary land uses are present within the 2 km radius. Agricultural uses in the study area total approximately seven percent. The Public/Private Open Space category includes historic sites in the region. The Pennsylvania Historical and Museum Commission has indicated that there are no archeological sites of significance in the study area,

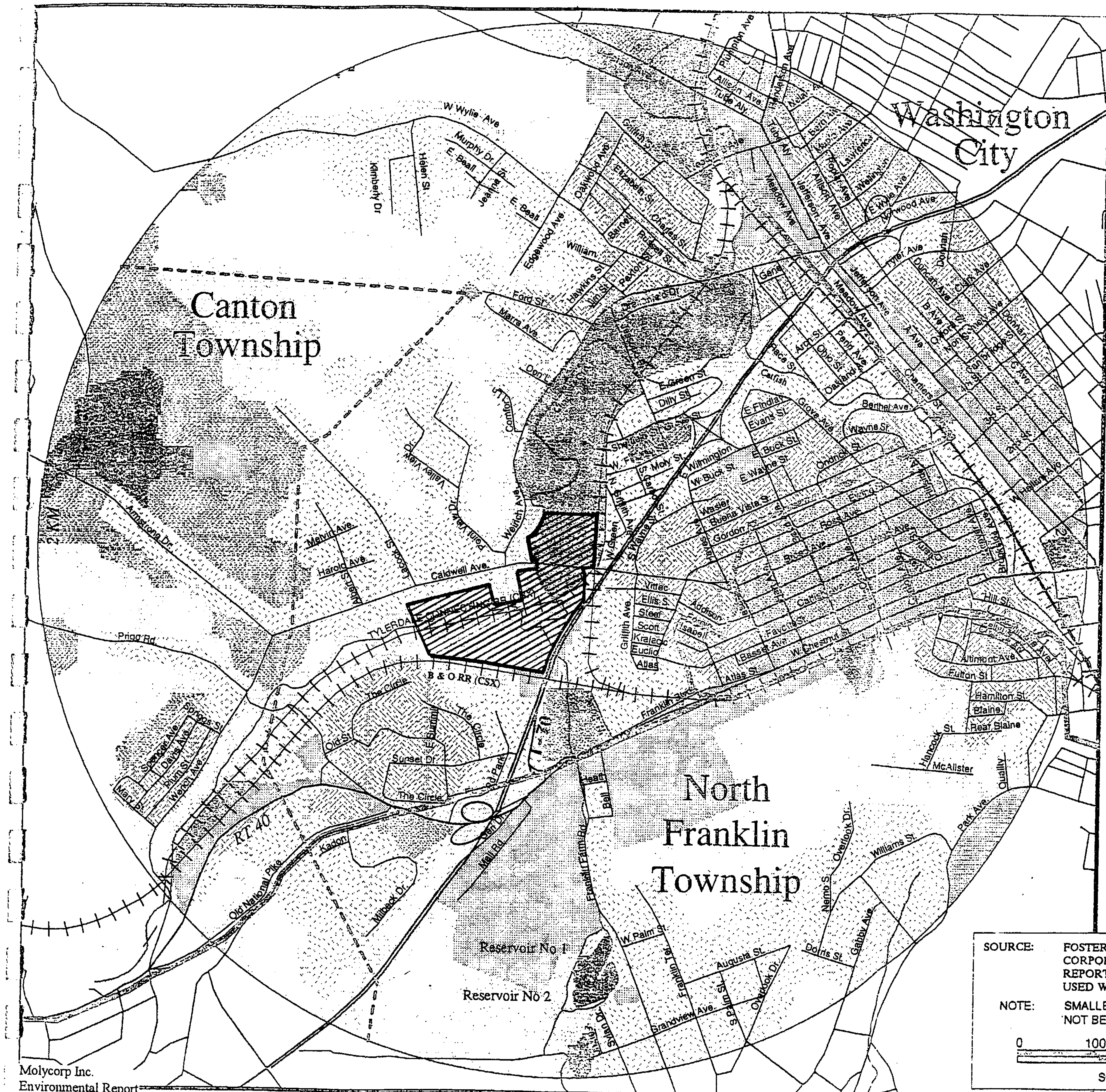
TABLE 3-2

EXISTING LAND USES IN THE 2 KM RADIUS

Land Use Category	Acres	% of Total
Low density residential	884	28
Medium density residential	441	14
High density residential	191	6
Commercial	244	8
Light industrial	22	1
Heavy industrial	178	6
Agriculture/cropland	45	1
Pasture, grass, open land	177	6
Public & private open space	30	1
Other	894	29
Total:	3,106	100

Notes: Residential - low density refers to single family homes; medium density refers to two-family homes; high density refers to urban residences and planned unit residential developments.
Commercial - includes office/business, mixed urban, and shopping centers.
Light industrial - includes R&D, non-durable manufacturing, industrial parks, warehousing.
Heavy industrial - includes durable manufacturing.
Transportation - includes highways, railroads and airports.
Agricultural land - is divided into cropland, and pasture/grass/open land.
Public and private open space - includes forest, parks, golf courses, historic sites, cemeteries.
Other - includes vacant, institutional (i.e., government offices, schools, churches, hospitals), military reservations.

Source: Foster Wheeler Environmental Corporation. Site Characterization Report for License Termination of the Washington, Pennsylvania Facility, January 1995.



2 KM RADIUS EXISTING LAND USES

(3105.5 Total Acres)

Use	Percent
Residential	48.81
Industrial	6.42
Commercial	7.87
Cropland	1.44
Pasture, Open, Grasses	5.70
Public/Private Open Space	0.96
Other (vacant, institutional, schools, etc.)	28.80
TOTAL	100.00 %

LEGEND

- Resid-L Density
- Resid-M Density
- Resid-H Density
- Light Industrial
- Heavy Industrial
- Commercial
- Agriculture/Croplands
- Pasture/Open Areas/Grasses
- Public/Private Open Spaces
- Other
- Project Site
- Power Line

SOURCE: FOSTER WHEELER ENVIRONMENTAL CORPORATION. SITE CHARACTERIZATION REPORT, WASHINGTON, PA FIGURE 4-30 USED WITH PERMISSION

NOTE: SMALLER LAND USE AREAS MAY NOT BE ACCURATE

0 1000 2000 3000

SCALE IN FEET

MOLYCORP, INC.
300 CALDWELL AVENUE
WASHINGTON, PA

FIGURE 3-2

2 KM EXISTING LAND USE

FOSTER WHEELER ENVIRONMENTAL CORPORATION including the facility itself. Commercial land uses are intense along major roadways such as Jefferson Avenue and West Chestnut Street. Other commercial centers include the Franklin Mall and the Ramada Inn complex. Farther out in the 2 km (1.25 mi) radius, the land is vacant (without buildings on it but buildable), residential (largely single family with an occasional development or the high density areas in the City of Washington), or agricultural (in this area, mainly pasture for grazing).

3.1.2 Water Use

Chartiers Creek flows generally from south to north through the 2 km (1.25 mi) study area and through the lowland areas of the Molycorp property. Sugar Run, flowing from southwest to northeast, joins Chartiers Creek within the Molycorp property. The Chartiers Creek watershed drains a total area of 666 km^2 (257 square miles (mi^2)), however only 47 km^2 (18 mi^2) of watershed lie above the Molycorp property. Beyond the Molycorp property, Chartiers Creek drains to the northeast and enters the Ohio River at Carnegie, Pennsylvania.

Four reservoirs are located upstream of the Molycorp property on Chartiers Creek. Reservoirs No. 1, 2, 3, and most of No. 4 are located within North Franklin Township. The reservoirs are owned by Pennsylvania American Water Company, who is in the process of selling all four reservoirs that are not currently used for any purpose (Pennsylvania American Water Company, 1997a).

Pennsylvania American Water Company services Canton Township, North Franklin Township, and the City of Washington. The Hayes-Mine/Becks Run pumphouse and the Aldrich pumphouse service the facility and surrounding area. The intake for the Becks Run pumphouse is milepoint 4.5 on the Monongahela River and the Aldrich pumphouse intake is milepoint 25.5 on the Monongahela River. Neither the facility surface water nor groundwater units discharge into the Monogahela River. Services are provided to customers by forced main distribution systems (Pennsylvania American Water Company, 1997b).

A forced main sanitary sewer line runs through the Molycorp property through the open storage area.

There are no registered wells within 2 km of the Molycorp facility (PADEP, 1997a).

3.2 COMMUNITY RESOURCES

3.2.1 Socioeconomic Characteristics

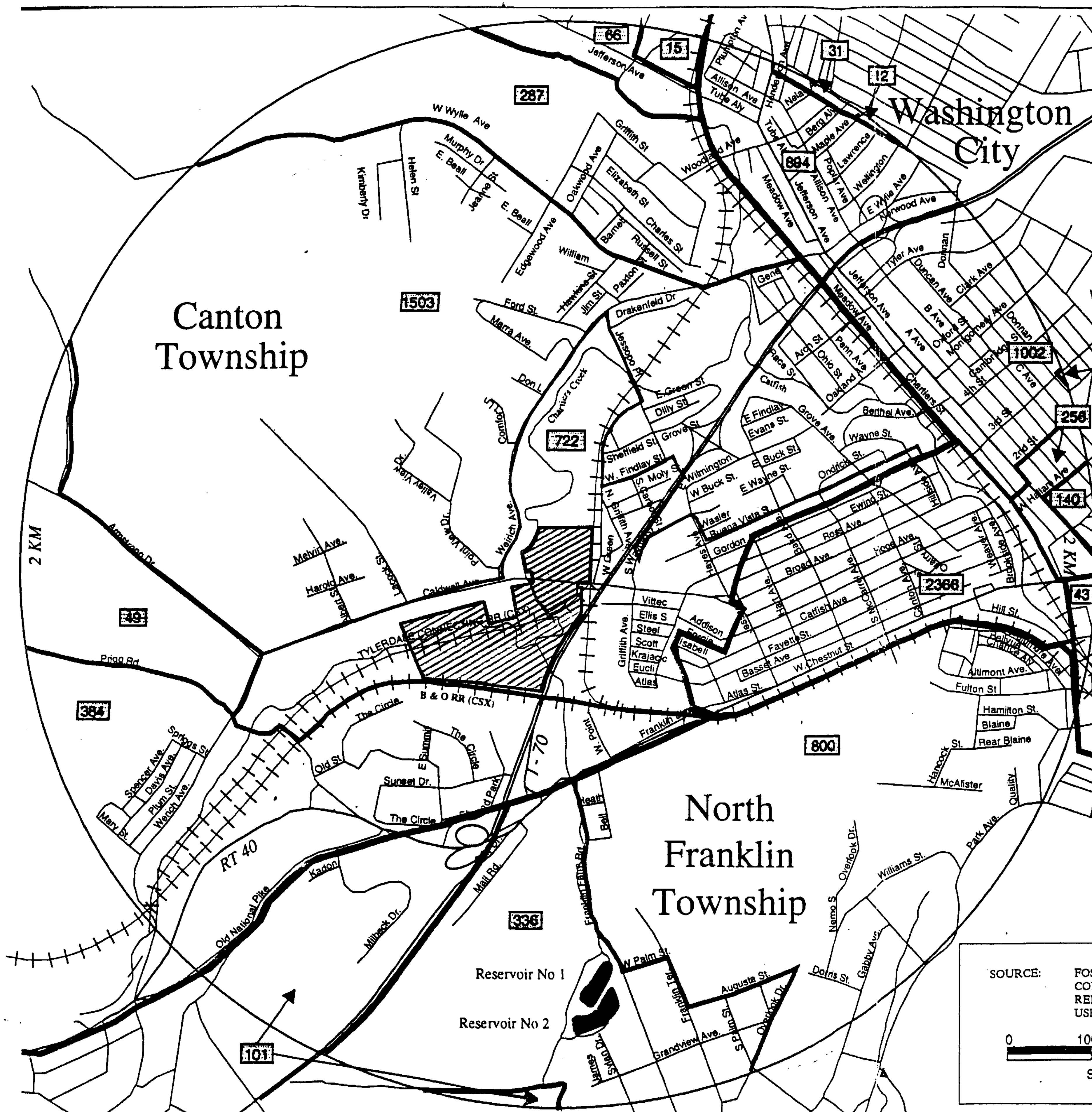
3.2.1.1 Population

The Molycorp facility, situated in Canton Township, lies adjacent to the city limits of Washington, (the county seat) and North Franklin Township. Based on these local boundaries, the distribution of area within the 2 km (1.25 mi) radius of the facility is 59 percent Canton Township, 26 percent North Franklin Township and 15 percent City of Washington. The majority of the population within a 2 km (1.25 mi) radius lies within the city limits of Washington. Smaller population clusters are found in Elwood Park and Log Pile in Canton Township and Franklin Farms in North Franklin Township (Figure 3-3). Table 3-3 shows the 1990 populations for these areas. These figures were obtained from the 1990 U.S. Census TIGER/Line files linked to a USGS-type base map. Figure 3-3 presents the population distribution within the study area and within Washington County. Between 1980 and 1990 the municipalities of Canton and Washington experienced a slight decrease in their density patterns, while North Franklin's density increased slightly.

Periodic variations in the study area's baseline permanent population consist of daily commute to and from work, day care centers, health care facilities, government services, and local schools. This area has a typical amount of these facilities that create fluxes in population movement.

Typical daily variations in the area's baseline permanent population have been studied and there appear to be no significant transient (non-permanent) population patterns in the 2 km (1.25 mi) radius. This can be attributed to:

1. The Washington and Jefferson College campus, just outside the 2 km (1.25 mi) study area, is basically a resident campus where only 15 percent of the students commute. Most students leave for the summer in May and return in August. Some students stay for summer courses.
2. Raising dairy cattle is the major agricultural industry in the area and unlike crop farming, it is not labor-intensive.



LEGEND

- Project Site
- Census Group
- 722 # Persons Per Census Group

SOURCE: FOSTER WHEELER ENVIRONMENTAL CORPORATION. SITE CHARACTERIZATION REPORT, WASHINGTON, PA FIGURE 4-32 USED WITH PERMISSION

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SCALE IN FEET

N

MOLYCORP, INC.
300 CALDWELL AVENUE
WASHINGTON, PA

FIGURE 3–3

2 KM POPULATION AREAS

FOSTER WHEELER ENVIRONMENTAL CORPORATION

TABLE 3-3

1990 POPULATION WITHIN THE 2 KM RADIUS OF THE MOLYCORP FACILITY

Municipality	Study Area Population	Washington County Population
Canton Township	3,026	9,256
North Franklin Township	1,237	4,997
City of Washington	4,744	15,864
TOTAL:	9,007	30,117

Source: Foster Wheeler Environmental Corporation, 1995c.

3. There are no large county or state parks, resorts, or recreation facilities that would affect seasonal population movement.
4. Tourism is growing in this area, but it has not established itself to the point of significant seasonal activity.

3.2.1.2 Housing

The locations of current residences in the 1/2 km (0.3 mi) radius from the center of the Molycorp facility outward are identified on Figure 3-1. The U.S.G.S. Washington West Quadrangle Map (1969) was utilized and information was updated using the 1990 aerial photograph of the Washington West, SE and field verification conducted on July 18-30, 1994 by Foster-Wheeler.

The 1/2 km (0.3 mi) study area is situated entirely in Canton Township. The total number of inhabitants in this area has been calculated and is presented below:

- Number of Residences (1/2 km radius): 178
- Average Persons Per Household (1990): 2.64
- Total Residential Population (1/2 km radius): 470

3.2.1.3 Public Infrastructure

There are two public school systems with facilities within the 2 km radius, the Washington School District and the Trinity Area School District. There is also a private Diocese of Pittsburgh school (S-3) present in the study area as well as the Intermediate Unit I - Clark School (S-4), a specialized facility for the severely handicapped. In total, there are four educational institutions within the study area. Several other schools lie just outside the 2 km (1.25 mi) radius.

Trinity West Elementary School (S-2), in the Gabby Heights area of North Franklin Township, is within the 2 km (1.25 mi) radius and has an enrollment of 454 students and 39 employees including 34 teachers (Trinity West Elementary School, 1997). Trinity High School, located on Park Avenue in North Franklin Township, lies approximately 305 meters (m) (1,000 feet(ft.)) outside the study area. Trinity Middle School, also located in North Franklin Township, is located approximately 610 m (2,000 ft.) outside of the study area. These schools have a combined enrollment of 2,155 students and a total of 263 employees (Trinity High School, 1997).

The Washington School District has one school in the 2 km (1.25 mi) radius. Washington High School (S-1), located on Jefferson Avenue (State Route E844), has a total of 547 students and 80 employees at the school (Washington High School, 1997). The Intermediate Unit 1 - Clark School (S-4), located on Allison Avenue, provides special education via the Washington County Intermediate Unit I. This facility is located in the study area in the City of Washington. The Diocese of Pittsburgh private elementary school, St. Hilary School (S-3), is located on Henderson Avenue, within the study area and has a 1996-1997 enrollment of 63 students (St. Hilary School, 1997). This school is anticipated to close June 1997 due to low enrollment. The John F. Kennedy School, located on West Spruce Street, is another Diocesan school in close proximity, but lies outside the 2 km study area. The school's 1996-1997 enrollment was 484 students, an additional 66 students were enrolled in the school's nursery school program (John F. Kennedy, 1997).

There are three nursing homes and one independent living complex for the elderly (ages 65 and over) in the study area. There are living accommodations for 158 elderly residents in the 2 km (1.25 mi) radius in nursing homes, personal care homes, and independent living apartments.

The Kade Nursing Home (N-1), located on West Wylie Avenue in Canton Township, provides nursing care for 65 residents. Maiden Pines (N-3) is a personal care home in North Franklin Township providing living accommodations for 16 elderly residents; Lincoln Manor (N-4) is a personal care home in Canton Township with a capacity for 12 elderly residents. Century Plaza (N-2), located on Route 40 in North Franklin Township provides 65 apartments for the elderly.

There are 9 day care centers in the 2 km (1.25 mi) radius providing care in a variety of settings for infants to school-aged children. These centers have the capacity to provide day care services for 365 children with a variety of needs. There are three family day care centers in the study area; family day care services are licensed by the Department of Public Welfare to serve a maximum of six children at a time. There are four group day care centers in the study area capable of serving between 35 and 110 children. The Department of Public Welfare's regulations establish standards to determine a center's licensed capacity. The

Brownson House (DC-8) provides nursery school in morning and afternoon sessions for children ages 3 to 4, and the Magic Time (DC-9) program provides after-school care for children in grades K through 5.

Information about economic status and the racial and ethnic composition of the populations of Washington County and Pennsylvania are presented in Tables 3-4 and 3-5. The tables are drawn from 1990 Census data.

Washington and Jefferson College (W & J), a four-year co-educational private liberal arts college, is a major educational institution in the Washington area. Although it lies outside the 2 km (1.25 mi) radius, it is referenced in the text because of its significance to the area. The college had a 1994-1995 enrollment of 1,128 students. There is a faculty of 86 full-time and 18 part-time teachers. It employs 250 employees of which 237 are full-time (Washington & Jefferson College, 1997). The college, with 40 buildings, is located outside the study area at South Lincoln Street, Washington, PA.

Washington Hospital, a 364-bed licensed medical care facility, is located 914 m (3,000 ft.) outside the edge of the 2 km (1.25 mi) radius. Due to its size and predominance as the major medical facility for most of Washington County, it is included in this report. The hospital is located at 155 Wilson Avenue, Washington, PA. The hospital has 260 members on its medical staff, and is the single largest employer in Washington County, with 1,590 employees. The hospital offers a complete spectrum of medical services including family practice, internal medicine, emergency room, open-heart surgery, and a cancer center. The hospital also offers an ongoing series of wellness programs and provides support groups and seminars for the community at large. Washington Hospital has four satellite facilities, none of which are located in the 2 km (1.25 mi) radius. The Stat Care Clinic (H/C-1) is located in the basement of a former school on Jefferson Avenue and serves as a small osteopathic clinic.

The United Cerebral Palsy Adult Center (GQ-2), located on Jefferson Avenue in Washington, is a day care center that provides daily care for mentally, physically and developmentally challenged adults between the ages of 18 and 60 years. Although many of the center's clients have cerebral palsy, the programs are designed to help people with developmental delay, Down's syndrome and spina bifida.

All persons not living in households are classified by the U.S. Census Bureau as living in group quarters. The Census further refines the group quarters population into two general categories, those living in

TABLE 3-4

RACIAL AND ETHNIC COMPOSITION OF POPULATION OF WASHINGTON COUNTY AND PENNSYLVANIA

Place	Percent White	Percent Black	Percent American Indian, Eskimo, or Aleut	Percent Asian or Pacific Islander	Percent Other (Excluding Hispanics)	Percent Hispanics (Excluding Persons Who Reported Themselves as Black, American Indian, or Asian)	Percent Minority[a]
Washington County	95.73	3.20	0.11	0.30	0.13	0.53	4.27
Pennsylvania	86.95	8.99	0.13	1.12	0.99	1.82	13.05

[a] The percentage minority is equal to the total of the percentages for Black, American Indian, Asian, Other, and Hispanic. Persons represent themselves as belonging to a race and ethnicity categories reported by the Census. Persons who identified themselves as both Black or American Indian or Asian and Hispanic are not included in the Hispanic category here to avoid double counting minority populations.

Source: U.S. Bureau of the Census 1990.

TABLE 3-5

ECONOMIC STATUS OF POPULATION OF WASHINGTON COUNTY AND PENNSYLVANIA

Place	Total Population[a]	Percent in Poverty	Percent of Low Income[b]	Per Capita Income in 1989 ($)
Washington County	199,210	12.8	16.9	12,744
Pennsylvania	11,293,849	9.2	15.2	14,068

a Persons for whom poverty status is determined. This figure may differ from actual population.
b Persons defined as having "low income" have incomes below 125 percent of poverty level.

Source: U.S. Bureau of the Census 1990.

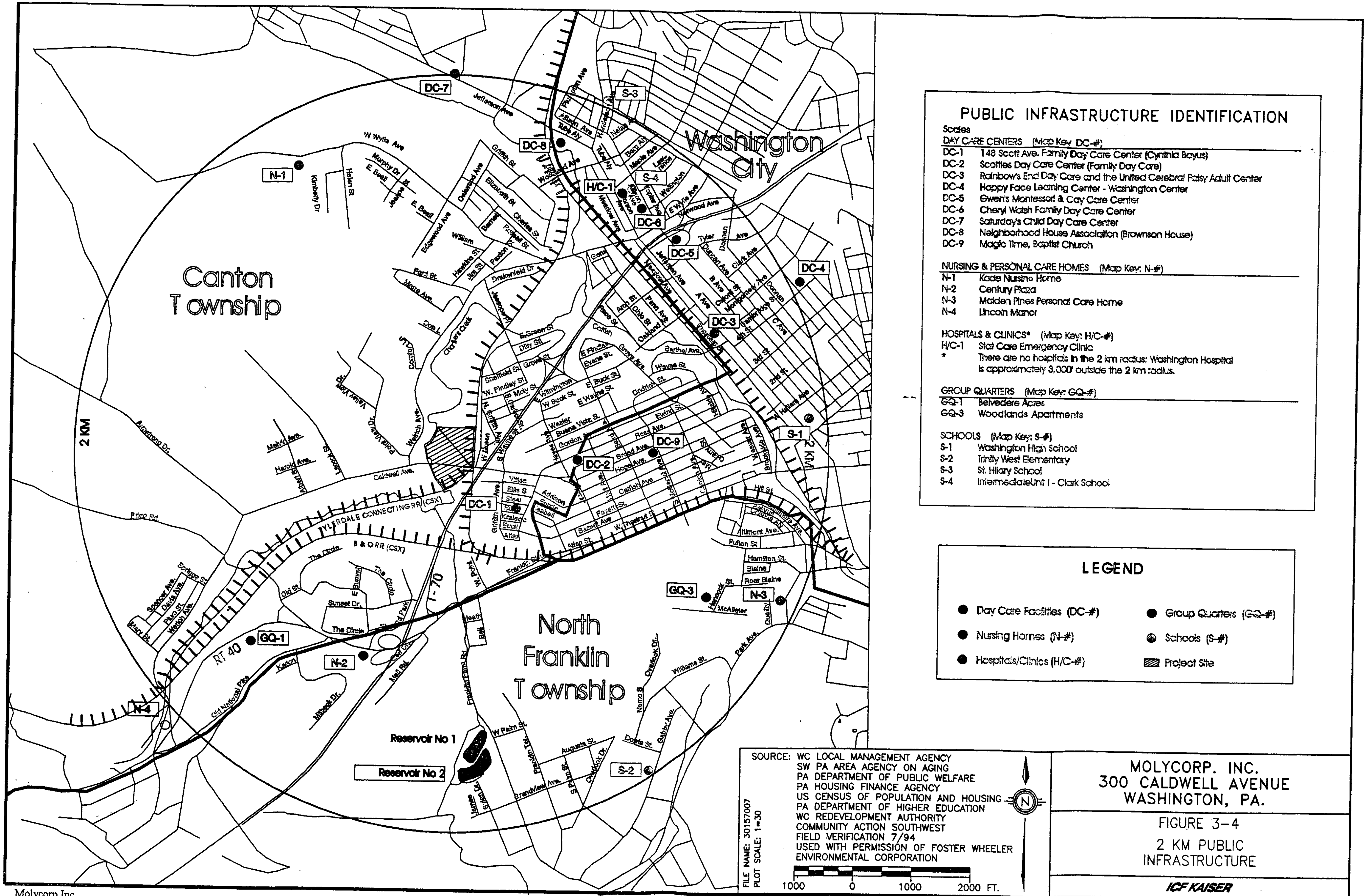
institutions and those who are not living in institutions. In this study, the term group quarters applies to large-scale government financed housing complexes and group homes occupied by mentally challenged adults. (It should be noted that the latter is typically included in the noninstitutional group quarters category.)

There are three group quarters housing facilities in the study area, two are subsidized housing complexes and one is a group home for mentally challenged adults. These facilities are located on Figure 3-4. The two subsidized housing projects include Belvedere Acres (GQ-1), located on Bel Aire Drive off U.S. Route 40 in Canton Township, and the Woodlands Apartments(GQ-3), located on Hancock Street in North Franklin Township. Both apartment complexes were financed by the U.S. Department of Housing and Urban Development (HUD) as subsidized housing under Section 8 of the Housing and Community Development Act of 1974. Belvedere Acres, owned and managed by the NDC Asset Management, Inc., has a total of 96 dwelling units. Although the majority of the units are designated for general family usage, six apartments are set aside for the elderly and another six are identified as special needs apartments for the handicapped. The Woodlands Apartments complex contains 50 units, 42 for general family use, six for the elderly, and two for special needs families and individuals. The Woodlands is owned by Paul Voinovich and managed by NDC Asset Management, Inc.

The daily local rush hour (cars and trucks) is known to take place from west to east primarily along Jefferson Avenue (see Figure 3-2). However, transportation in the study area is dominated by Interstate 70. Based on 24-hour traffic counts, the estimated number of vehicles is approximately 6,140 each way through the study area during the morning and evening rush hour peaks on Interstate 70.

3.2.1.4 Economic Resources

Information regarding Economic Resources of Washington County were excerpted from the Washington County Profile issued by the Washington County Planning Commission and included as Appendix C. Industries and businesses employing the largest number of people in Washington County today are manufacturing (12,003 persons), services (16,212 persons), and the wholesale/retail trade (15,806 persons) (Washington County Planning Commission, 1996). Major manufacturing employment includes primary and fabricated metals, electrical machinery and repairs, glass, machine shops, plastic, paper, trucking, and advanced technology industries. The mining of coal, oil and gas, and non-metallic minerals has also seen a 1990's resurgence in the local/regional economy. Employment at small and large plastics companies (over


PUBLIC INFRASTRUCTURE IDENTIFICATION
DAY CARE CENTERS (Map Key DC-#)
DC-1 148 Scott Ave. Family Day Care Center (Cynthia Bayus)
DC-2 Scotties Day Care Center (Family Day Care)
DC-3 Rainbow's End Day Care and the United Cerebral Palsy Adult Center
DC-4 Happy Face Learning Center - Washington Center
DC-5 Gwen's Montessori & Day Care Center
DC-6 Cheryl Walsh Family Day Care Center
DC-7 Saturday's Child Day Care Center
DC-8 Neighborhood House Association (Brownson House)
DC-9 Magic Time, Baptist Church
NURSING & PERSONAL CARE HOMES (Map Key: N-#)
N-1 Kade Nursing Home
N-2 Century Plaza
N-3 Maiden Pines Personal Care Home
N-4 Lincoln Manor
HOSPITALS & CLINICS* (Map Key: H/C-#)
H/C-1 Stat Care Emergency Clinic
* There are no hospitals in the 2 km radius; Washington Hospital is approximately 3,000' outside the 2 km radius.
GROUP QUARTERS (Map Key: GQ-#)
GQ-1 Belvedere Acres
GQ-3 Woodlands Apartments
SCHOOLS (Map Key: S-#)
S-1 Washington High School
S-2 Trinity West Elementary
S-3 St. Hilary School
S-4 Intermediate Unit I - Clark School
LEGEND
Day Care Facilities (DC-#)
Nursing Homes (N-#)
Hospitals/Clinics (H/C-#)
Group Quarters (GQ-#)
Schools (S-#)
Project Site
Washington City
Canton Township
North Franklin Township
2 KM
RT 40
I-70
Reservoir No 1
Reservoir No 2
SOURCE: WC LOCAL MANAGEMENT AGENCY
SW PA AREA AGENCY ON AGING
PA DEPARTMENT OF PUBLIC WELFARE
PA HOUSING FINANCE AGENCY
US CENSUS OF POPULATION AND HOUSING
PA DEPARTMENT OF HIGHER EDUCATION
WC REDEVELOPMENT AUTHORITY
COMMUNITY ACTION SOUTHWEST
FIELD VERIFICATION 7/94
USED WITH PERMISSION OF FOSTER WHEELER ENVIRONMENTAL CORPORATION
FILE NAME: 30157007
PLOT SCALE: 1=30
1000 0 1000 2000 FT.
MOLYCORP, INC.
300 CALDWELL AVENUE
WASHINGTON, PA.
FIGURE 3-4
2 KM PUBLIC INFRASTRUCTURE
ICF KAISER

20 in the County) is on the increase. There are 20 industrial parks, such as Henderson, Arden, and Southpointe (mixed use) in Washington County. The most dynamic sector in the County today is services, such as business services, amusement and recreation services, and health and social services. Table 3-6 presents the major employers in Washington County (excluding utilities and institutions).

The County has 95,400 persons in its resident labor force; 66,860 people work in establishments located within the County (Washington County Planning Commission, 1996). Table 3-7 lists the light and heavy industrial establishments by municipality found in the 2 km (1.25 mi) radius. There are 2,597 persons (approximately 36 percent) employed in the industrial sector (i.e., industries with 20 or more employees). Some companies in the study area have recently been bought by larger firms and have proposed expansion. Examples are Drakenfeld Colors (now owned by Cerdec Corporation), Washington Steel (now owned by Lukens Steel) and Jessop Steel (purchased by Allegheny Ludlum). Other establishments are expanding existing facilities, such as Washington Hospital (heliport, cardiac and cancer centers) just outside the 2 km (1.25 mi) study area radius.

3.2.2 Cultural Resources

The Molycorp facility was formed from the Electric Reduction Company on June 16, 1920. The site occupies 0.2 km^2 (55 acres) today, some of which remains undeveloped. No historic properties listed on the National Register of Historic Places are found in the 2 km (1.25 mi) radius. The Pennsylvania Historical and Museum Commission has indicated that there are no archeological sites of significance in the study area, including the facility itself. (IT Corp, 1996)

3.3 GEOLOGY AND HYDROGEOLOGY

The geology of the area has been compiled from data provided from the United States Geological Survey (USGS) (Berryhill et. al, 1971), Foster-Wheeler (Foster-Wheeler 1995d), and field work by ICF Kaiser, performed in 1997.

TABLE 3-6

MAJOR EMPLOYERS IN WASHINGTON COUNTY[1]

Company	Municipal Location	Employment
Washington Steel Co.[2,7]	Canton Township	804[4]
Corning, Vitro Corp.	Charleroi Borough	700
Jessop Steel Co.[2,3]	Canton Township	670[4]
Black Box Corporation	Cecil Township	515
Wheeling-Pittsburgh Steel Co.	Allenport Borough	500
Beth Energy Mines, Inc.	Somerset Township	500
U.S. Steel Mining Co., Inc.	New Eagle Borough	471
Drakenfeld Colors[5,6]	Canton Township	301
Ross Mould, Inc.[2]	City of Washington	300
MAC Plastics, Inc.[2]	Canton Township	241[4]

Notes:
1 Utilities and institutions were not included in this list. Washington Hospital is the County's largest employer with 1,590 employees (Washington County Industrial Development Agency, 1994).
2 Within the vicinity of the study area.
3 Facility under new ownership of Allegheny Ludlum.
4 Southwestern PA Regional Planning Commission, 1994.
5 Facility under new ownership of Cerdec Corporation.
6 Not listed in the W.C. Board of Commissioners Report of 1993.
7 Facility under new ownership of Lukens Steel.

Source: Foster Wheeler Environmental Corporation, 1995c.

TABLE 3-7

INDUSTRIAL EMPLOYMENT IN THE 2 KM RADIUS

Establishment	Location	Product	Number of Employees
CANTON TOWNSHIP			
Allegheny Ludlum (Jessop Steel Company)	500 Greene Street	Stainless plate and tool steels manufacturing	670
Cerdec Corporation (Drakenfeld Colors)	W. Wylie Avenue	Ceramic pigments, glass, enamel manufacturing	301
Findlay Refractories Co. of PA (Division of Adience, Inc.)	Greene Street	Refractories fireclay, zircone, bonded day tanks and pots	53
MAC Plastics, Inc.	250 W. Wylie Avenue	Miscellaneous plastics manufacturing	241
Master Woodcraft Corp.	61 West Point Road	Architectural woodworking	25
Molycorp, Inc.	Caldwell Avenue	Ferromolybdenum	15
Penn Mould	1660 Jefferson Avenue	Moulds for glass industry	210
Tatano Plastics	1480 Jefferson Avenue	Custom blow molding	40
V-Bat Plastic Processing Corp.	1500 Weirich Avenue	Thermoplastic materials processing	46
Washington Steel Co. (Lukens Steel)	Woodland and Griffith Avenues	Stainless steel production	804
NORTH FRANKLIN TOWNSHIP			
Polymer Grinding & Recycling, Inc.	Baird Avenue	Industrial plastic scrap recycler	22
Washington Tool & Machine Co.	873 Baird Avenue	Precision machine work fabricated steel, carbon, aluminum alloys	57
CITY OF WASHINGTON			
C.B.P. Engineering Corp.	185 Plumpton Avenue	Abrasion resistant pipe & lining systems	25
Star Dynamics, Inc.	4th and Meadow Streets	Hydraulic cylinders	48
Washington Mould Co.	Greene and Madison Avenues	Grey & ductile iron castings and machining manufacturing	55
		TOTAL:	**2,597**

NOTES: * Industries with 20 or more employees

SOURCE: Foster Wheeler Environmental Corporation, 1995c.

3.3.1 Physiography and Topography

The Washington facility lies within the Pittsburgh Low Plateau Section of the Appalachian Plateaus Physiographic Province. This section is characterized by nearly flat-lying to gently folded sedimentary rock units which have been maturely dissected by stream erosion. The geomorphology of this area generally consists of rounded hills and ridges separated by open valleys.

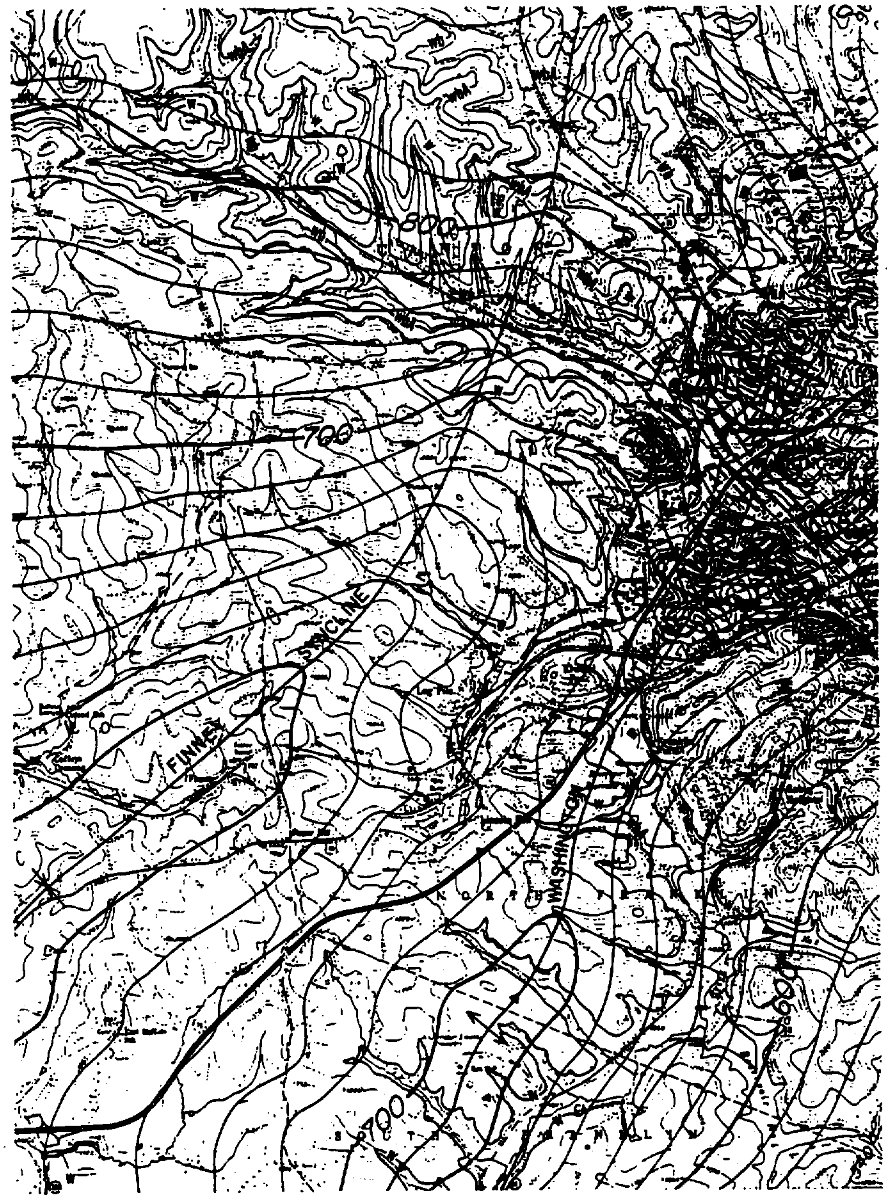
The elevations of the hills and ridges range from between 1,200 and 1,250 (ft.-msl) in northern Washington County to a maximum of elevation of about 1,500 ft.-msl in southern Washington County. The Washington facility, which lies within the Chartiers Valley of central Washington county, ranges from approximately 1,010 ft.-msl along Chartiers Creek to 1,128 ft.-msl at the hill along the southern edge of the facility.

3.3.2 Regional Geology

Structurally, the bedrock beneath the Washington facility is gently folded. More specifically, the facility lies approximately 1/2 mi. northwest of the axial trace of the north plunging, Washington anticline and approximately 1.1 mi. southeast of the axial trace of the south plunging, Finney Syncline. These folds generally trend north 23-30 degrees east. Based on this regional structure, bedrock beneath the Washington facility is expected to dip gently to the northwest toward the Finney syncline (Figure 3-5). Dips in this area are reported to be less than 10 degrees. No major faults have been mapped in this area. (Skema, et al., 1964)

Bedrock mapped in the facility area consists of cyclic sequences of sand, clay, limestone, and coal (cyclothems) deposited during the Pennsylvanian and Permian ages (Figure 3-6). Accumulations of alluvium (unconsolidated sediments) are usually present in the valleys.

The bedrock beneath the facility is mapped as the Permian age Washington Formation and the underlying Pennsylvanian-Permian age Waynesburg Formation. The Washington formation consists of alternating beds of shale and sandstone with several coal beds. Most of these units vary horizontally in composition and texture. Discontinuous, thin-bedded, limestone members are also present. Most sandstones within this formation are light gray, medium-grained and cross bedded. The limestone units are generally gray and



EXPLANATION

CROP LINES

Washington coal

Waynesburg "A" coal

Waynesburg coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge.

700

Structure contour
Altitude of the base of the Pittsburgh coal, in feet above mean sea level. Contour interval 20 feet.

FILE NAME: NOCADA09
PLOT SCALE: 1=1

SOURCES

Crop lines slightly modified by V. W. Skema from Berryhill, H. L., Jr., and Swanson, V. E. (1964). *Geology of the Washington West quadrangle, Pennsylvania*, U.S. Geological Survey Geologic Quadrangle Map GQ-283, scale 1:24,000. Structure contours modified by V. W. Skema from Berryhill, H. L., Jr., Schweinfurth, S. P., and Kent, B. H. (1971). *Coal-bearing Upper Pennsylvanian and Lower Permian rocks, Washington area, Pennsylvania—Part 1, Lithofacies; Part 2, Economic and engineering geology*, U.S. Geological Survey Professional Paper 621, Plate 1.

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET

N

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FIGURE 3-5

COAL CROP LINES AND
STRUCTURE CONTOURS

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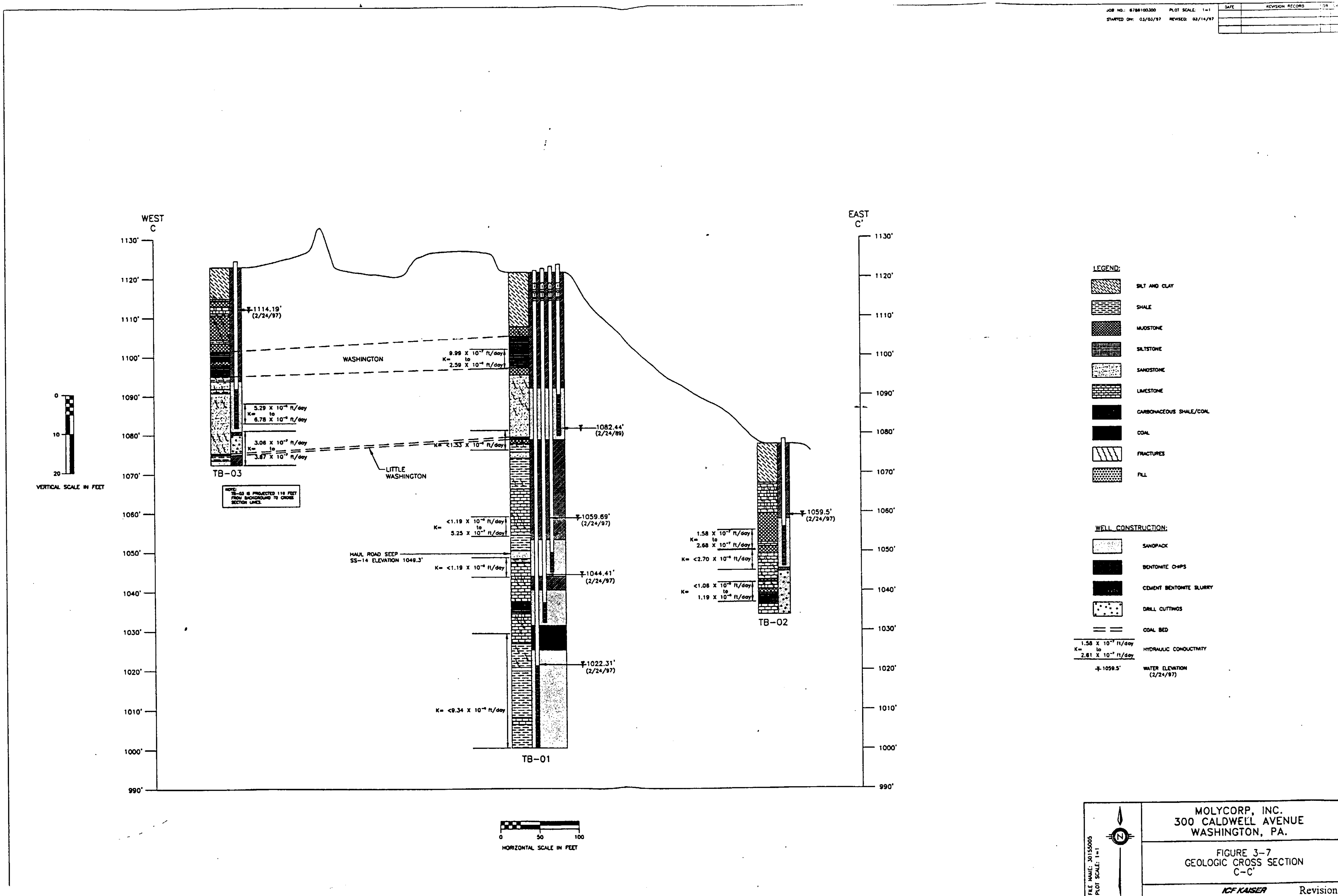
WEST
C
EAST
C'
1130'
1120'
1110'
1100'
1090'
1080'
1070'
1060'
1050'
1040'
1030'
1020'
1010'
1000'
990'
WASHINGTON
LITTLE WASHINGTON
TB-03
TB-01
TB-02
1114.19' (2/24/97)
1082.44' (2/24/89)
1059.69' (2/24/97)
1044.41' (2/24/97)
1022.31' (2/24/97)
1059.5' (2/24/97)
HAUL ROAD SEEP
SS-14 ELEVATION 1049.3'
VERTICAL SCALE IN FEET
HORIZONTAL SCALE IN FEET
LEGEND:
SILT AND CLAY
SHALE
MUDSTONE
SILTSTONE
SANDSTONE
LIMESTONE
CARBONACEOUS SHALE/COAL
COAL
FRACTURES
FILL
WELL CONSTRUCTION:
SANDPACK
BENTONITE CHIPS
CEMENT BENTONITE SLURRY
DRILL CUTTINGS
COAL BED
HYDRAULIC CONDUCTIVITY
WATER ELEVATION (2/24/97)
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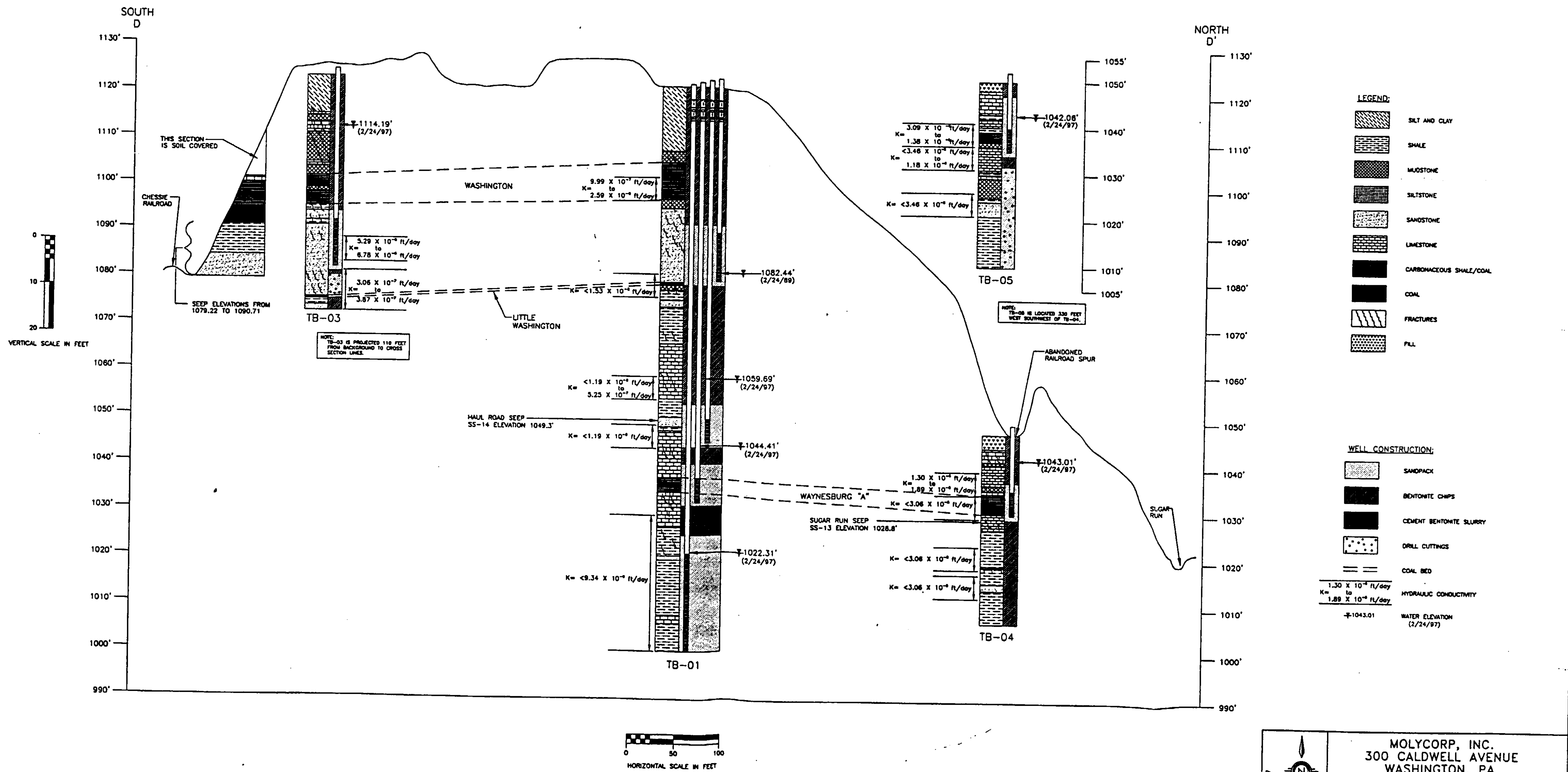
WASHINGTON, PA.
FIGURE 3-7
GEOLOGIC CROSS SECTION
C-C'
ICF KAISER

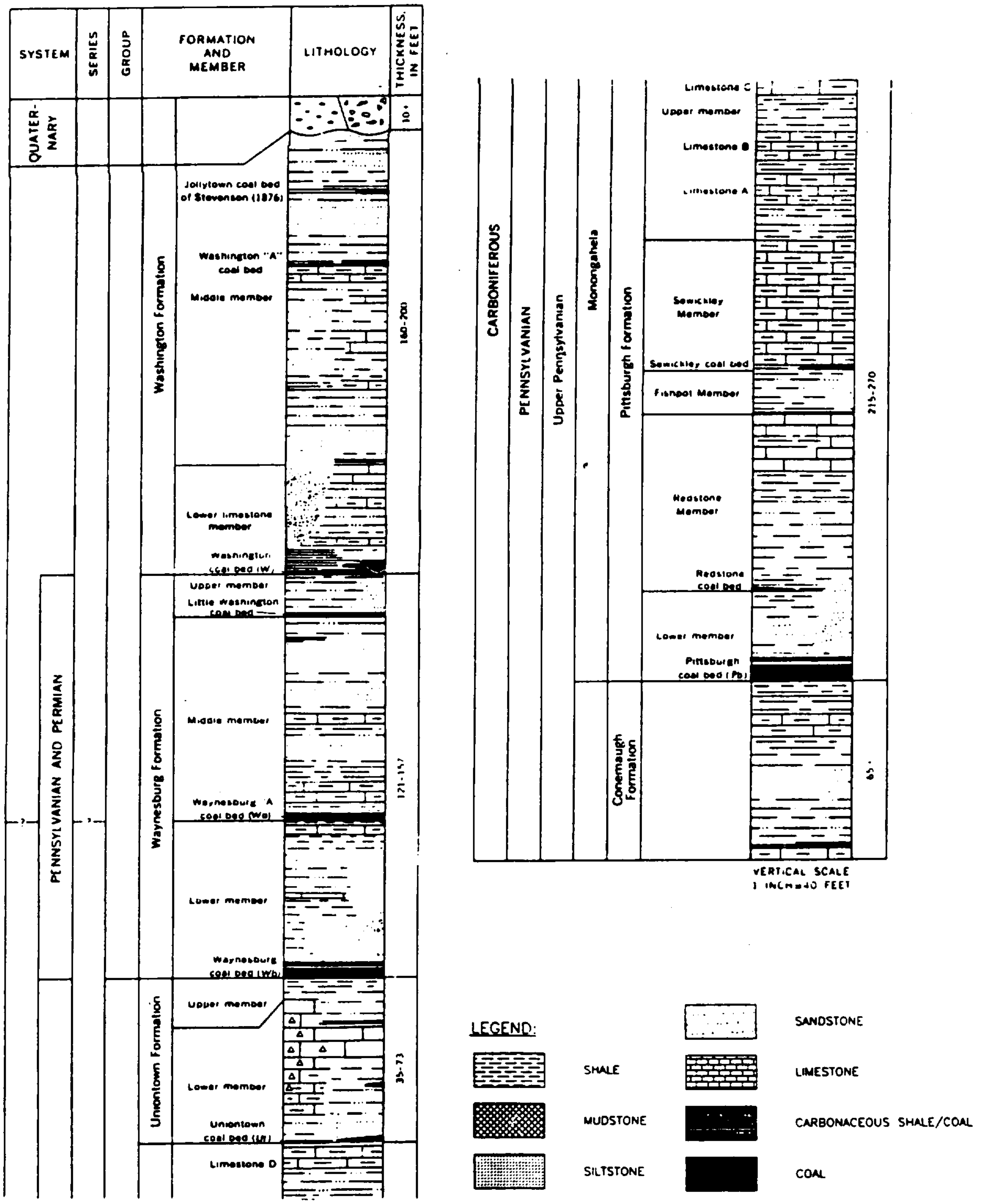


MOLYCORP, INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 3-8
GEOLOGIC CROSS SECTION
D-D'

ICF KAISER

Revision: 0
4/1/97



SOURCE: BERRYHILL, HENRY L. JR., SCHWEINFURTH, STANLEY P., AND KENT, BION H., U.S. DEPARTMENT OF INTERIOR, GEOLOGICAL SURVEY PROFESSIONAL PAPER 621, COAL-BEARING UPPER PENNSYLVANIAN AND LOWER PERMIAN ROCKS, WASHINGTON AREA, PENNSYLVANIA.

FILE NAME: NOCADA08
PLOT SCALE: 1=1

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WASHINGTON, PA.

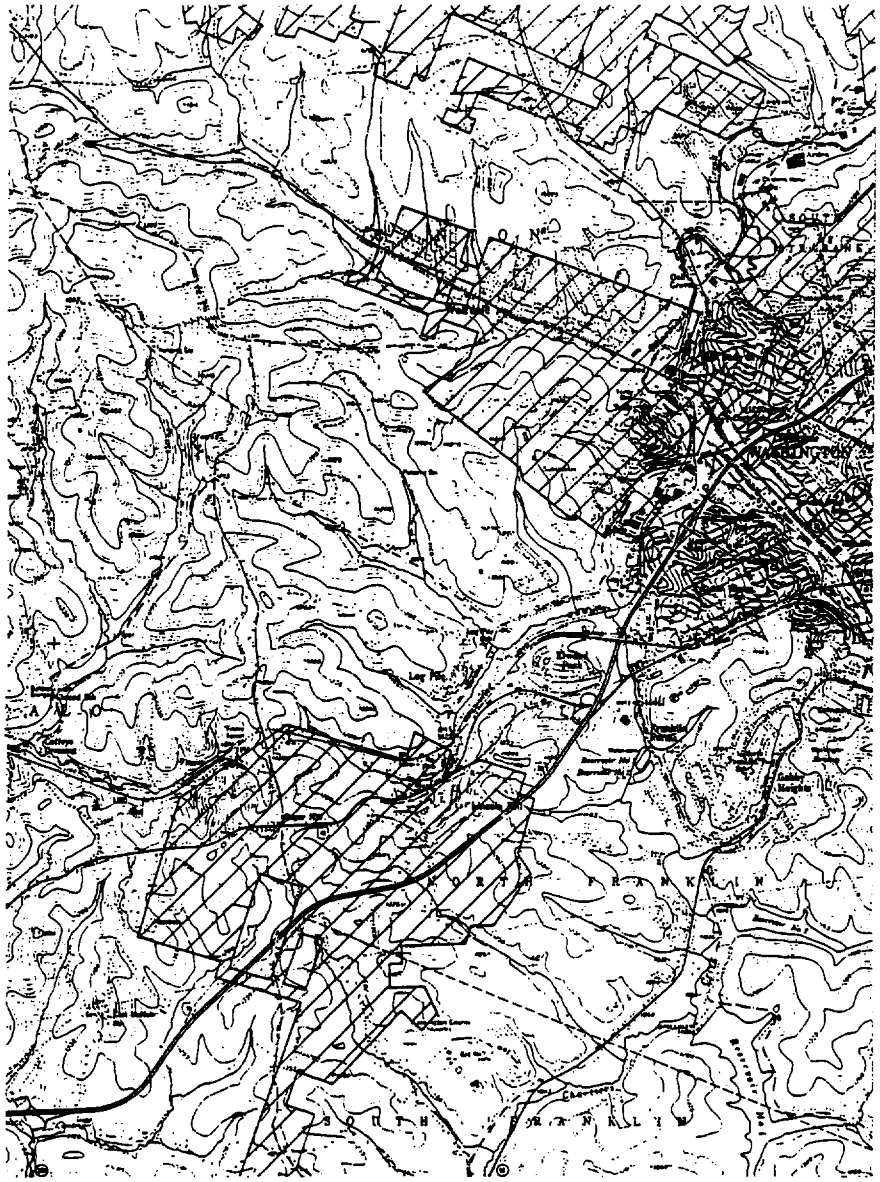
FIGURE 3-6
STRATIGRAPHIC COLUMN IN WASHINGTON WEST QUADRANGLE

ICF KAISER

finely crystalline. The limestone may also be very argillaceous (clayey) with interbeds of gray shale. The total thickness of this unit ranges from approximately 160 to 234 ft. Due to erosion, this formation is only present on the hill along the southern edge of the facility. The entire thickness of the Washington Formation is not present. The base of the Washington Formation is mapped at an elevation of approximately 1,080 ft.-msl in the area. The maximum thickness of this unit at the facility appears to be less than 50 ft. and is believed to be the Lower Limestone Member of the Washington formation. It should be noted that the limestone units within this member are discontinuous and do not occur in all areas. The base of the unit is identified as the base of the Washington coal bed (w on Figures 3-7 and 3-8) which is found approximately at an elevation of 1,080 ft.-msl in the vicinity of the facility. Coal beds are visually distinctive and are typically used as stratigraphic marker beds between otherwise indistinguishable units.

The Pennsylvanian to Permian age Waynesburg formation stratigraphically underlies the Washington formation. The Waynesburg formation is mapped as the uppermost bedrock unit on portions of the facility below an elevation of 1080 ft.-msl. This unit consists of cyclic sequences of sandstone, shale, limestone, and siltstone with some claystone and coal. Most of these units vary horizontally in texture and composition. The limestone is typically gray, argillaceous and interbedded with claystone. The sandstone is generally light gray, very fine to medium grained, and crossbedded. The shale is typically gray and locally calcareous. The total thickness of this unit generally ranges from approximately 100 to 245 ft. The base of this unit is marked by the Waynesburg coal (wb on Figure 3-7 and 3-8) which is present at an elevation of approximately 920 ft.-msl in the facility area. Two other coal marker beds, the Little Washington and the Waynesburg "A", are present and divide the Waynesburg formation into upper, middle, and lower members.

The Pennsylvanian age Monongahela group, consisting of the Uniontown and the underlying Pittsburgh formations, stratigraphically underlies the Waynesburg formation and is mapped at the surface approximately 2,000 ft. north of the Washington facility. The Monongahela group consists of cyclic sequences of sandstone, siltstone, claystone, coal, underclay, and limestone. The total thickness of this group ranges from approximately 270 to 350 ft. thick. The Uniontown formation is divided from the Pittsburgh formation by the Uniontown coal bed. The Pittsburgh coal bed, which marks the base of the Pittsburgh formation, is the only commercially mined coal in the site area. This coal occurs at an elevation of approximately 330 to 450 ft. ft-msl, a depth of approximately 680 ft. beneath the facility. Reportedly, the Pittsburgh coal has not been mined beneath the Washington facility. Figure 3-9 shows the known extent of mining in the facility area (PADER, 1978).



EXPLANATION

Extent of known deep mining

SOURCE: LIMITS OF DEEP MINING MODIFIED BY V.W. SKEMA FROM PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES, BUREAU OF MINING AND RECLAMATION (1978), UNPUBLISHED MAP.

FILE NAME: NOCADA14
PLOT SCALE: 1=1

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FIGURE 3-9

MINED OUT AREAS OF THE PITTSBURGH COAL

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Quaternary to Recent age alluvium, colluvium, and man-made fill is commonly found in the stream valleys. The alluvial sediments consist of unconsolidated clay, silt, sand, and gravel. Colluvium and landslide deposits consisting of slumped, hummocky masses of soil and rock are commonly present along the valley margins.

3.3.2.1 Regional Earthquake Activity

Data from the U.S. Geological Survey, National Earthquake Information Center as presented in Appendix D, did not indicate recent measurable seismic activity in the area. The nearest known seismic activity (unknown magnitude) occurred September 26, 1885, approximately 12.4 mi. northeast of the facility. Two earthquakes, with magnitudes of 3.0 (Richter Scale), occurred October 8, 1995 and were centered approximately 25.5 mi. and 28 mi. east of the Washington facility (USGS, 1997).

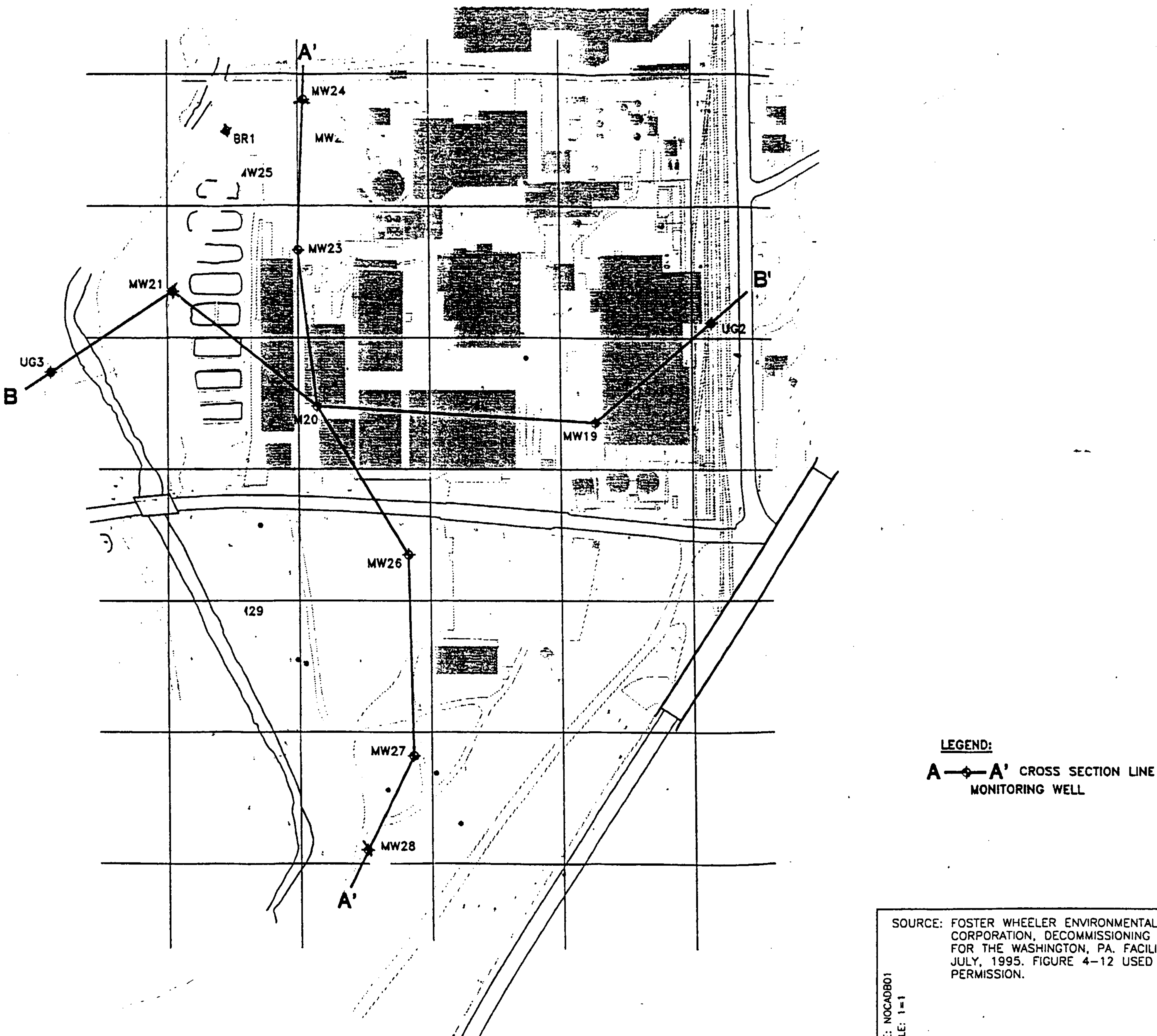
3.3.2.2 Facility Hydrogeology

Discussion of the facility geology has been divided into two sections: the lowland section surrounding the streams that bisect the main production areas of the facility; and the upland section which consists of the hill adjacent to the production area on the southern edge of the facility. The description of the lowland geology is based on borings drilled in the lowland areas during the Site Characterization Study performed in 1995 (Foster Wheeler, 1995d). A map showing the location of the test holes and geologic sections in the lowland area is provided as Figure 3-10. Geologic logs of the lowland test holes were included in Volume 3 of the Site Characterization Report (Foster Wheeler, 1995c).

Descriptions of the upland geology is based on five rock core borings advanced through the hill and on field mapping performed on the hill in 1997 by ICF Kaiser. A map showing the location of the upland test holes and the geologic cross sections through this area are provided as Figure 3-11. Geologic logs of the upland test holes are provided in Appendix E of this report.

Lowland Section

The description of lowland facility geology is based on data obtained from 418 boreholes drilled to depths of between 4.3 ft. and 36 ft. Geologic cross sections of this area are provided on Figures 3-12 and 3-13.



SOURCE: FOSTER WHEELER ENVIRONMENTAL CORPORATION, DECOMMISSIONING PLAN FOR THE WASHINGTON, PA. FACILITY, JULY, 1995. FIGURE 4–12 USED WITH PERMISSION.

FILE NAME: NOCADB01
PLOT SCALE: 1=1

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WASHINGTON, PA.

FIGURE 3–10

GEOLOGIC CROSS SECTION LOCATIONS

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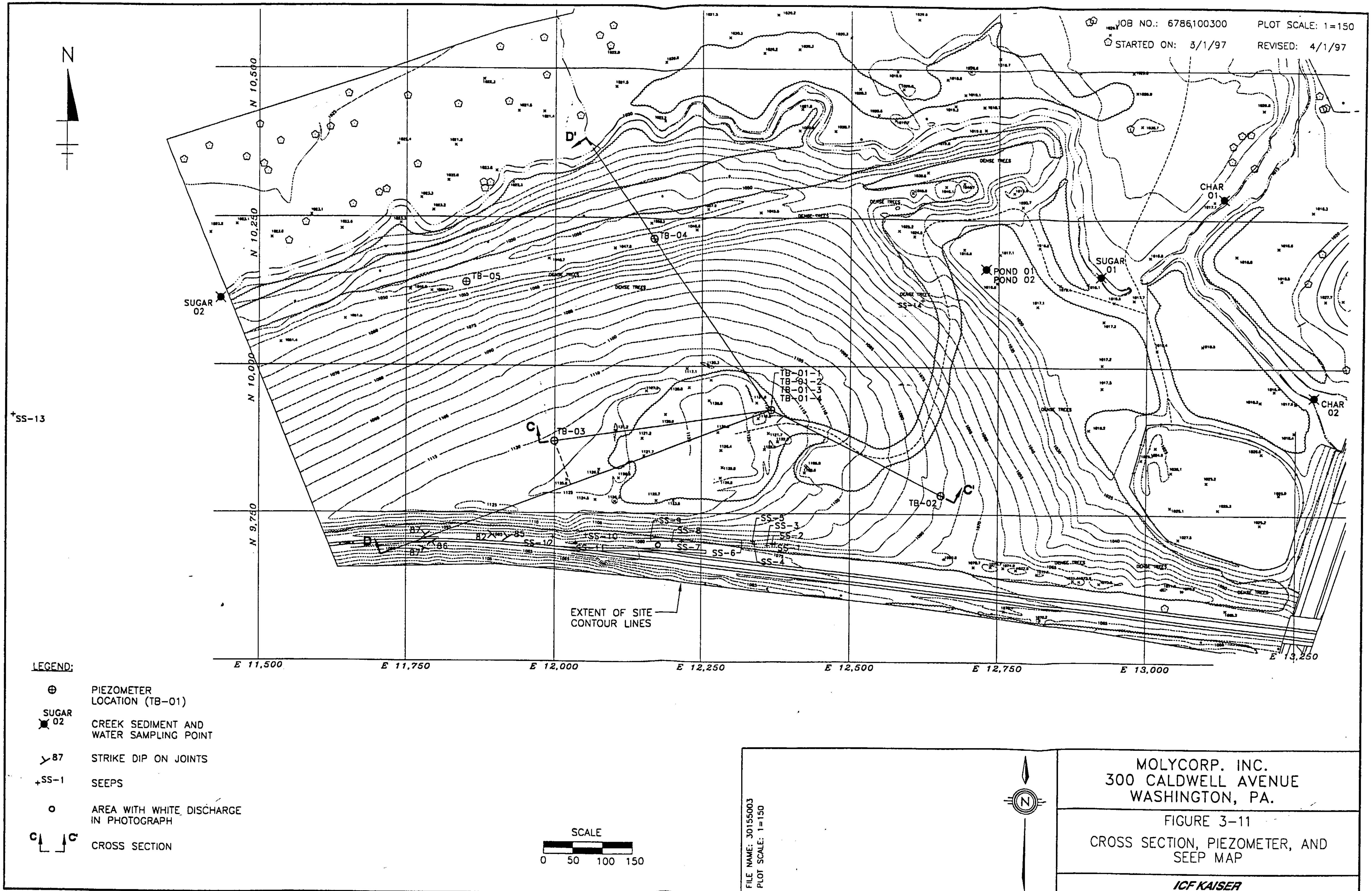
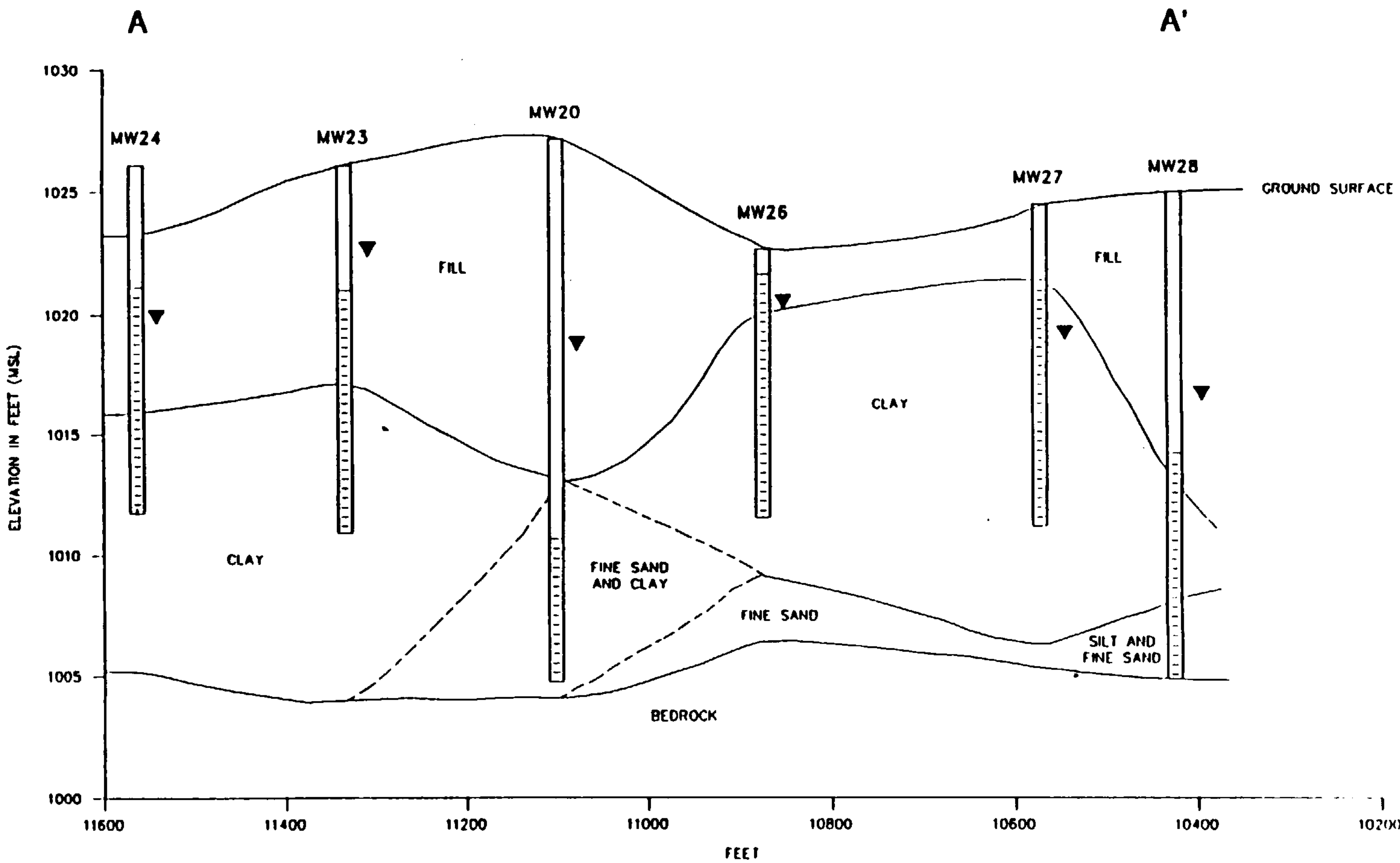


JOB NO.: 6786100300
PLOT SCALE: 1=150
STARTED ON: 3/1/97
REVISED: 4/1/97
N
N 10,500
N 10,250
N 10,000
N 9,750
E 11,500
E 11,750
E 12,000
E 12,250
E 12,500
E 12,750
E 13,000
E 13,250
SUGAR 02
SUGAR 01
CHAR 01
CHAR 02
POND 01
POND 02
TB-01-1
TB-01-2
TB-01-3
TB-01-4
TB-02
TB-03
TB-04
TB-05
SS-1
SS-2
SS-3
SS-4
SS-5
SS-6
SS-7
SS-8
SS-9
SS-10
SS-11
SS-12
SS-13
SS-14
DENSE TREES
EXTENT OF SITE CONTOUR LINES
LEGEND:
PIEZOMETER LOCATION (TB-01)
CREEK SEDIMENT AND WATER SAMPLING POINT
STRIKE DIP ON JOINTS
SEEPS
AREA WITH WHITE DISCHARGE IN PHOTOGRAPH
CROSS SECTION
SCALE
0 50 100 150
FILE NAME: 30155003
PLOT SCALE: 1=150
MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.
FIGURE 3-11
CROSS SECTION, PIEZOMETER, AND SEEP MAP
ICF KAISER



SOURCE: FOSTER WHEELER ENVIRONMENTAL CORPORATION, DECOMMISSIONING PLAN FOR THE WASHINGTON, PA. FACILITY, JULY, 1995. FIGURE 4-13 USED WITH PERMISSION.

FILE NAME: NOCADA15
PLOT SCALE: 1=1

▼ APPROXIMATE WATER LEVEL 8/16/94

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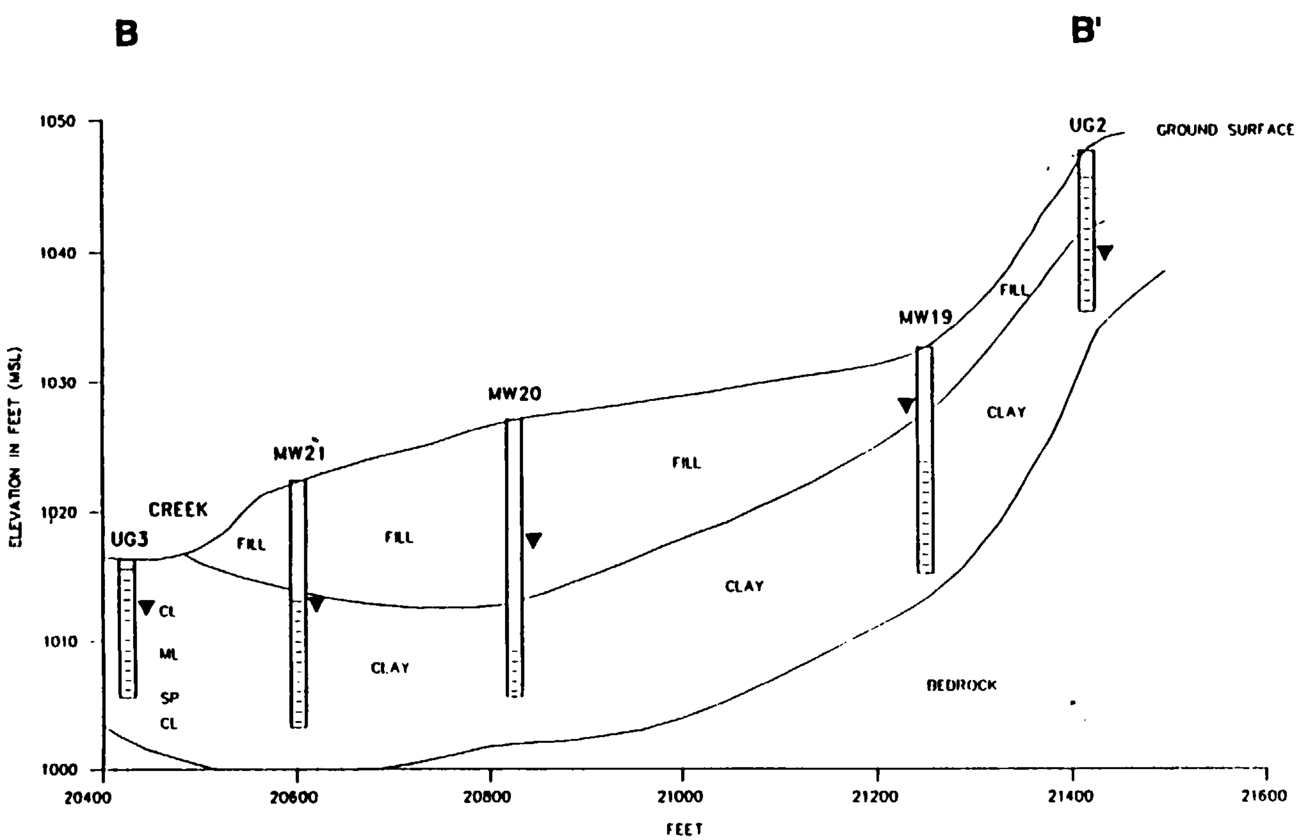
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 3-12

CROSS SECTION A-A'

ICF KAISER



SOURCE: FOSTER WHEELER ENVIRONMENTAL CORPORATION, DECOMMISSIONING PLAN FOR THE WASHINGTON, PA. FACILITY, JULY, 1995. FIGURE 4-15 USED WITH PERMISSION.

FILE NAME: NOCADA16
PLOT SCALE: 1=1

▼ APPROXIMATE WATER LEVEL 8/16/94

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 3-13

CROSS SECTION B-B'

ICF KAISER

Cross section locations are shown on Figure 3-10. The lowland area lies on the alluvial floodplain of Chartiers Creek, which has been built up with various fill materials. The fill material varies in thickness from 2 ft. to 12 ft. and is comprised of slag, refractory bricks, and mixed natural sediments. Underlying the fill is 5 ft. to 16 ft. of unconsolidated alluvium consisting of poorly sorted clay, silt, sand, and gravel. Below this unit is a clayey to silty sand with gravel which averages 2 ft. in thickness. Bedrock, a gray claystone, is found at depths of from 15 to 22 feet below ground surface (ft.-bgs). The regional stratigraphic sequence indicates that this unit correlates to the Waynesburg Formation.

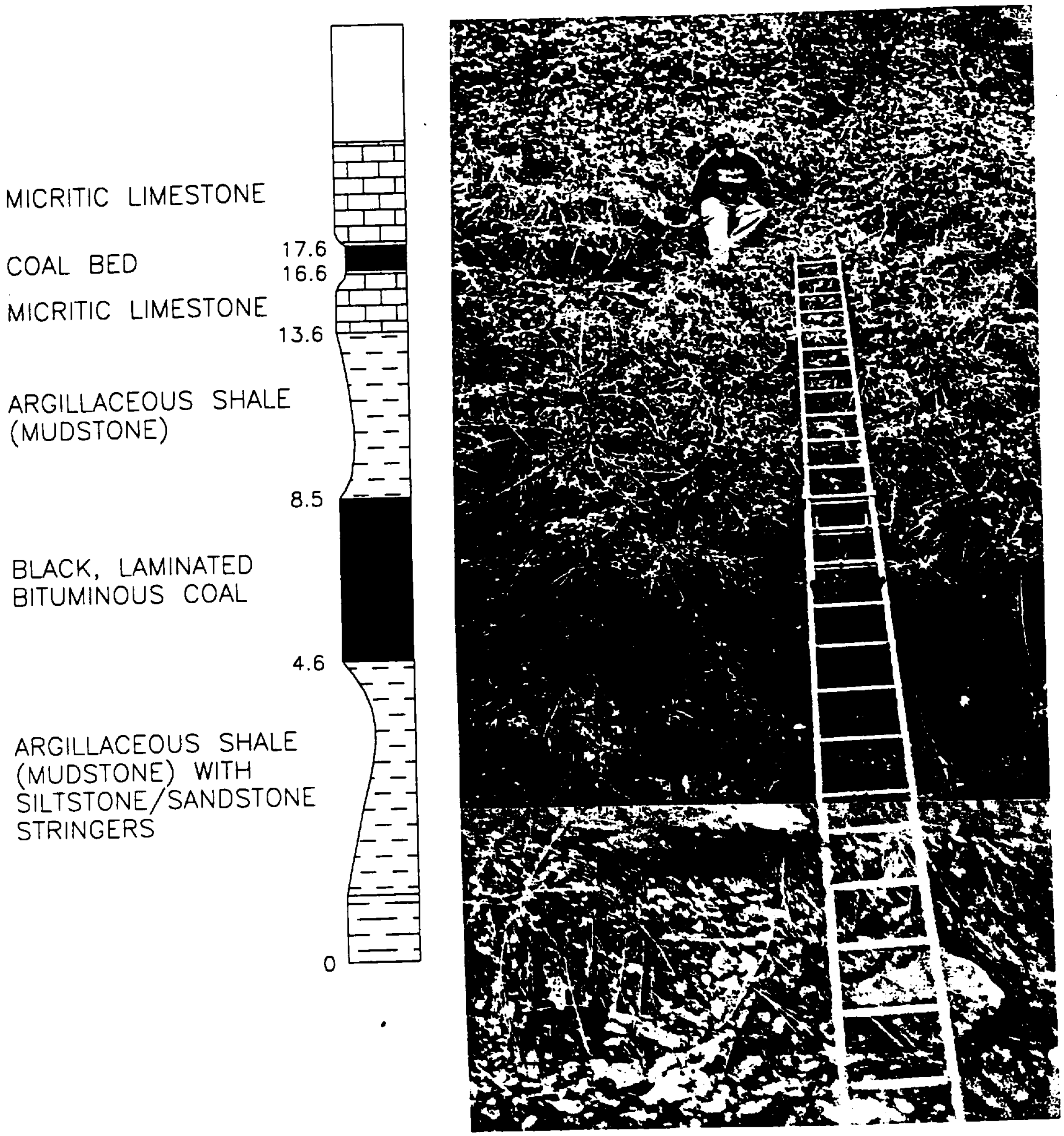
Upland Section

The geology of the upland section that includes the Hill Area was investigated by mapping rock outcrops along the north railroad cut and drilling five test holes to correlate stratigraphy with the general geology of the area. Test hole TB-01 provides a continuous record of strata encountered from the top of the hill to below the level of Chartiers Creek. Outcrop mapping and the drilling of four additional test holes were used to correlate stratigraphy and provide information on the dip of the strata underlying the hill. Coal seams, due to their regional extent, are the most commonly identifiable marker beds for the stratigraphic sequences. For this reason the coal beds are used to assist in organizing the discussion of the upland stratigraphy and geology.

The coal beds that occur within the upper 120 ft. of the stratigraphic sequence are correlated to the Washington Coal, the Little Washington Coal and the Waynesburg "A" Coal. Geological cross sections through this area are included as Figures 3-7 and 3-8.

Mappable outcrops in the Hill Area occur along the active railroad cut south of the hill. A stratigraphic section of this exposure is provided as Figure 3-14 and on cross section D-D'. At this section, the strike and dip of joints in the Washington Coal and from the underlying sandstone were measured. These measurements are shown on Figure 3-11.

The near surface stratigraphic sequence in the upland section is dominated by slightly to highly weathered. iron-stained, mudstones and carbonaceous shales. The carbonaceous shale coal (Washington Coal) that occurs from 16.2 to 24.3 ft. bgs in test boring TB-01 was broken in the core. In the active railroad cut this unit is nonresistant and highly weathered. The strata beneath the Washington Coal is primarily a cross-



FILE NAME: 20155001
PLOT SCALE: 1=1

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300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 3-14
MEASURED STRATIGRAPHIC SECTION
SOUTH OF HILL AREA

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bedded, laminated, fine to medium-grained sandstone. Horizontal iron stained fractures were observed within the sandstone. The upper portion of this sandstone unit outcrops along the railroad cut. The sandstone is underlain by the Little Washington Coal.

Between the base of the Little Washington Coal and the top of the Waynesburg "A" Coal (approximately 40 ft.) is a sequence dominated by unweathered to slightly weathered shales and shaley limestones. Occasional sandstone lenses are also present within this interval. From the base of the Little Washington Coal (42.6 ft. bgs in TB-01 to 55.8 ft. bgs) the sequence is nearly 90% mudstones and shales. An isolated stained fracture zone occurs within a shale at 43.7 to 46.3 ft. bgs. At 55.8-67.6 ft. bgs is an interval of gray to hard limestone/shaley limestone. This unit contains a fracture zone in test boring TB-01 at 62.9 to 64.1 ft. bgs. A gray shale, carbonaceous shale and sandstone lens sequence occurs from 67.6 to 73.9 ft. bgs in TB-01 and separates the overlying shaley limestone from a hard limestone interval. An isolated fracture occurs at 73.7 ft. bgs in TB-01 within this shale/sandstone sequence. The underlying limestone which occurs from 73.9 to 84.1 ft. bgs in test boring TB-01 is hard and lacks primary porosity. Stained fractures occur at 74, 75 and 79.3 ft. bgs. At test borings TB-04 and TB-05 this limestone is closer to the surface and as a result contains many stained fractures.

The Waynesburg "A" coal seam, which occurs from 85.0 to 85.8 ft. bgs in test boring TB-01 lies beneath this limestone. Although the coal is naturally fractured, the fractures are not stained.

Beneath the Waynesburg "A" coal the stratigraphic sequence consists of hard, gray unfractured limestones and shales. In test boring TB-01, shale sequences occur from 85.8-87, 94.5-100.4, 101.1-103.9 and 115-118.9 ft. bgs, while limestones occur from 87-94.4 and 112.8-115.0 ft. bgs. An isolated sandstone lens occurs at 100.4 to 101.1 ft. bgs.

3.3.3 Hydrogeology

The following discussion of the regional and facility hydrogeology is based on geologic characteristics discussed in the previous section, available information on regional groundwater resources, and specific groundwater investigations performed at the Molycorp facility.

3.3.3.1 Regional Hydrogeology

Groundwater in the regional area occurs under both unconfined (water table) and confined conditions. The following section discusses the hydrogeology of the geologic units identified in the vicinity of the facility.

The Washington Formation, which is mapped as the uppermost unit in the Hill Area, is generally a poor water bearing unit. Soft shale units comprise the major part of the formation and have particularly low well yields. Only a small amount of water is available from fractures and bedding plane partings within the shale. Regional well yields in this formation range from less than 1 to 70 gallons per minute (gpm), and the median yield is 2 gpm (PADER, 1973). The cyclic nature of bedding in all of the bedrock units suggests that hydraulic conductivity is anisotropic. This anisotropy may promote perched lenses of water above the water table. Additionally, horizontal flow is expected to be preferential in the beds with higher hydraulic conductivity as opposed to downward, vertical groundwater migration.

The Waynesburg Formation underlies the Washington Formation in the Hill Area and is mapped as the uppermost bedrock unit in the main production area. Like the Washington, the Waynesburg Formation is also generally a poor water producing unit. The paucity and small size of fractures within the formation limits well yields. The mean reported yield of wells tapping the Waynesburg Formation regionally is 10 gpm (Foster Wheeler, 1995c).

The Monongahela Group, consisting of the Uniontown and underlying Pittsburgh Formations, underlies the Waynesburg Formation. The Monongahela Group consists of limestones, shales, sandstones, and coals. The yields of wells in the Monongahela Group are generally low due in part to the lack of fractures and partly because the rocks may have been dewatered if coal mining has occurred in the coal seams beneath the water-bearing units in the group. Groundwater quality within this Group is locally poor due to high dissolved solids and chloride concentrations (PADER, 1973).

Well yields in the alluvium depend primarily upon the permeability and the thickness of the saturated deposits penetrated. Alluvium deposits in valley areas are generally not of sufficient thickness to support production wells. There are no known active production wells developed within this unit in the vicinity of the facility. The permeability is highly variable over short distances due to the degree of sorting and particle size variation in the sediments comprising this unit.

3.3.3.2 Facility Hydrogeology

Discussion of the facility hydrogeology has been divided into two sections consistent with the geological discussion: 1) the lowland section which lies east of Chartiers Creek and comprises the main production areas of the plant site; and 2) the upland section which consists of the southwest hill adjacent to the production area on the southern edge of the site.

The description of the lowland hydrogeology is based on hydraulic tests and measurements made during the Site Characterization Study performed in 1995 (Foster Wheeler, 1995c). Information regarding the upland hydrogeology is based on field mapping, borehole logging, and hydraulic testing performed in 1997 by ICF Kaiser, in conjunction with the development of this report.

<u>Lowland Area</u>

The facility specific investigation of the lowland section is based on borings, piezometers, and wells completed in the alluvium and fill material adjacent to Chartiers Creek and in the underlying Waynesburg Formation.

The vadose zone, or unsaturated zone, is generally less than four ft. thick in the lowland area. The unsaturated zone primarily consists of fill material. At some on-site locations, the water table falls below the base of the fill and the upper portion of the underlying clayey alluvium is unsaturated. Infiltration tests were performed at two locations, the infiltration rate is defined as moderately low at both locations (0.9 and 0.2 feet/day(ft/d)). The majority of the production areas are paved or covered with buildings, which preclude the infiltration of precipitation in these areas.

The water table occurs approximately 4 ft-bgs in the lowland section of the site. This corresponds with the surficial sediments, comprised of fill material and the underlying alluvium.

The upper portion of the alluvium, located immediately below the fill, consists of a clay zone. This clay zone is comprised of fine-grained flood plain sediments. Beneath the clay zone is a highly variable, mixed alluvium zone comprised of silts, silty sands, sands and in places, sandy gravels. This highly variable zone is characterized as sand and gravel in the Site Characterization Report (Foster Wheeler, 1995c). In the facility area, the alluvium along Chartiers Creek is fine grained and the saturated thickness is typically less than 15 ft.. Therefore, the alluvium in the facility area can not sustain sufficient supplies of water to practically serve as an aquifer.

The upper portion of the claystone bedrock, which underlies the alluvium, is weathered and fractured. The permeability of this upper bedrock zone is comparable to the alluvium above.

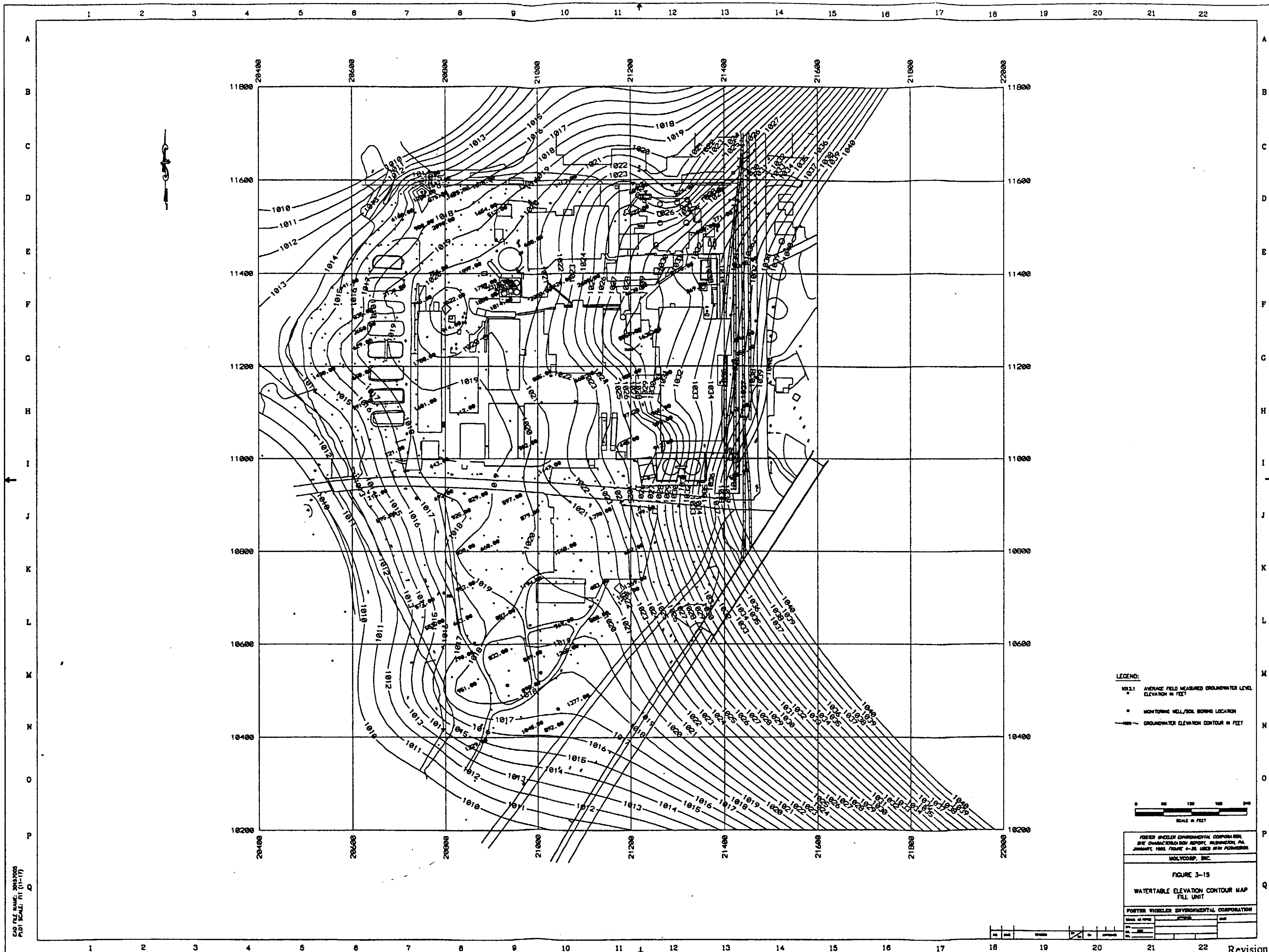
Two constant rate pumping tests were conducted in the saturated portion of the fill. Slug tests were conducted in seventeen wells. These wells were screened in the following units: bedrock (1 well), fill material (6 wells), and the mixed alluvium zone beneath the clay (10 wells).

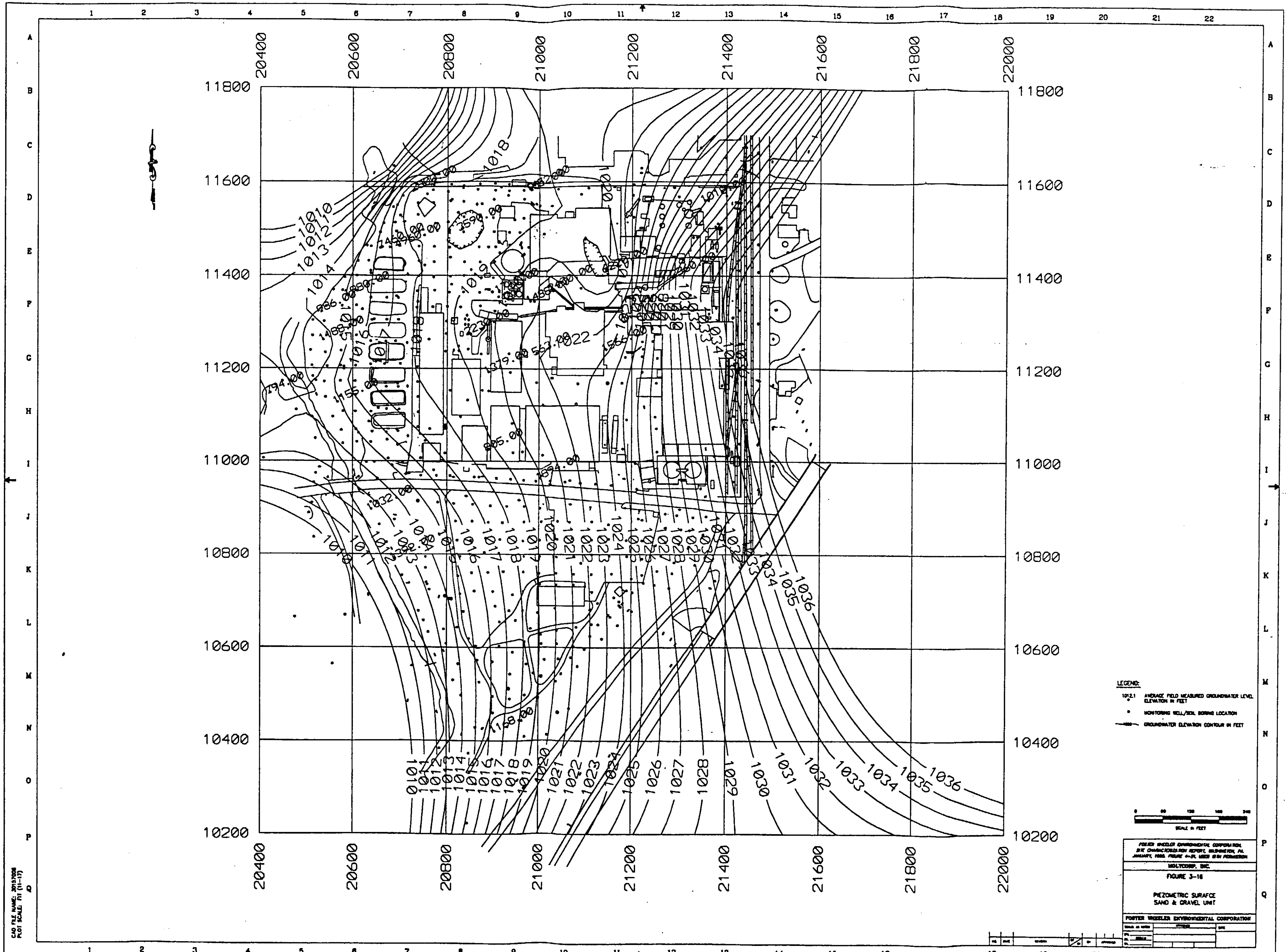
The pumping test data indicates the transmissivities in the fill range from 118 square ft./day (ft^2/d) up to 196 ft^2/d. The storage coefficient ranges from 0.062 to 0.064. The calculated radius of influence for 41 hours of pumping is 110 ft. Given the measured saturated thickness of 5 to 10 ft, the calculated hydraulic conductivities range from approximately 13 to 27 ft/d.

Monitoring well M-18, screened in the mixed alluvium beneath the clay layer, responded to pumping in the overlying fill. This indicates that the clay zone is not contiguous or has been breached, thus the clay only locally confines the lower unit.

The data from the slug tests indicate an average hydraulic conductivity value for the fill of 1.25 ft/d (ranging from 0.45 to 2.8 ft/d). In the mixed alluvium beneath the clay, the hydraulic conductivity averages 0.57 ft/d (ranging from 0.059 to 2.15 ft/d).

Potentiometric surface maps were prepared depicting static water levels in the fill (Figure 3-15) and the mixed alluvium (Figure 3-16). The maps indicate horizontal hydraulic gradients toward Chartiers Creek in both units. An average gradient of 0.03 feet per foot (ft/ft) was noted for each unit. However, the water level in the mixed alluvium was approximately 3 ft. lower than the water level in the fill. The clay alluvium that separates these two units is approximately 10 ft. thick, thus the differences in water level elevation above and below the clay impart a downward vertical hydraulic gradient across the clay of approximately 0.3 ft/ft.


LEGEND:
1012.1 AVERAGE FIELD MEASURED GROUNDWATER LEVEL ELEVATION IN FEET
MONITORING WELL/SOIL BORING LOCATION
GROUNDWATER ELEVATION CONTOUR IN FEET
SCALE IN FEET
FOSTER WHEELER ENVIRONMENTAL CORPORATION, SITE CHARACTERIZATION REPORT, WASHINGTON, PA. JANUARY, 1995. FIGURE 4-20. USED WITH PERMISSION
MOLYCORP, INC.
FIGURE 3-15
WATERTABLE ELEVATION CONTOUR MAP
FILL UNIT
FOSTER WHEELER ENVIRONMENTAL CORPORATION


LEGEND:
1012.1 AVERAGE FIELD MEASURED GROUNDWATER LEVEL ELEVATION IN FEET
MONITORING WELL/SOIL BORING LOCATION
GROUNDWATER ELEVATION CONTOUR IN FEET
SCALE IN FEET
MOLYCORP, INC.
FIGURE 3-16
PIEZOMETRIC SURAFCE
SAND & GRAVEL UNIT
FOSTER WHEELER ENVIRONMENTAL CORPORATION

The gradient on the water table (Figure 3-15) in the northwest portion of the site is significantly lower than in the south and east portions of the site. This area of lower horizontal gradient lies upgradient of a slurry wall constructed between the surface impoundments and Chartiers Creek. The change in the horizontal gradient in this area is likely a result of the slurry wall. The plateau in the groundwater surface created by the slurry wall results in an increased downward vertical gradient from the fill unit to the underlying alluvium.

A groundwater flow model developed for the site using the MODFLOW (McDonald and Harbaugh, 1983) numerical code and site specific data confirmed the direction of flow and gradients in both the fill and underlying alluvium.

Hill Area

Information regarding the hydrogeology of the Hill Area was acquired to support this report by mapping the locations of groundwater seeps, examining test boring cores, conducting pressure packer tests, and measuring water levels in on-site piezometers.

Five test borings were completed at the site (TB-01 through TB-05 on Figures 3-7 and 3-8). The initial test boring TB-01, was constructed to obtain geologic and hydrogeologic data regarding the bedrock strata on the hill. After collecting the rock core for observation, specific intervals were selected to test for permeability by performing packer tests. Stratigraphic intervals with fractures and/or high permeability rock type (ie. the sandstone intervals), were preferentially chosen for isolation using packers and testing. The results of these permeability tests and details of the calculations are provided in Appendix F. After completing the packer tests, the boring was enlarged to accommodate four piezometers. The interval screened in these piezometers was selected based on information gained from the geologic log of the rock core and the results of the permeability tests. The piezometer installation within TB-01 was designed to assess the hydraulic head within the various rock strata.

Four other test holes, TB-02 through TB-05, were constructed to obtain additional geologic and hydrogeologic data. Each of these four secondary test holes were similarly cored, pressure tested for permeability and a single piezometer was constructed in each. The results of the permeability tests and the water levels observed in the piezometers are shown on the geologic cross sections (Figures 3-7 and 3-8). The discussion of the hydrogeology of the various stratigraphic units will proceed from the surface downward.

The Washington coal at the base of the Washington Formation is the shallowest unit to be pressure packer tested. At TB-01 the coal is fractured and has an average permeability of approximately 3.7 ft/d.

The sandstone located just beneath the Washington coal was pressure tested at two horizons in TB-03. The permeability of this sandstone unit is slightly lower than in the overlying coal and permeability decreased with depth. The sandstone is underlain by the Little Washington Coal seam which tested to be impermeable (<3.5 x 10^{-8}ft/d) at test hole TB-01. Groundwater was observed perched just above the Little Washington Coal seam in TB-01. In TB-03, however, the water level observed in the piezometer screened within the sandstone was at a higher elevation. The sandstone unit outcrops along the railroad cut just south of TB-01 and TB-03. Groundwater seeps were observed from the top to the bottom of this sandstone outcrop and may be due to percolation through vertical stress relief fractures. Vertical stress relief fractures are generally more prevalent at the extremities of hills than in their centers.

Between the Little Washington and Waynesburg Coal seams are interbedded shales, sandstones and limestones. The limestones at TB-01 had minor fractures and the pressure packer tests indicated these units were impermeable (<3.5 x 10^{-8} ft/d) or only slightly permeable (0.023 ft/d). At TB-04 and TB-05 the lower limestone unit from this group was more highly fractured and tested to be more permeable (approximately 2.8 ft/d). Groundwater was found perched above the lower limestone unit at TB-01.

In TB-02, the piezometer is screened across the contact between a limestone and an overlying mudstone. This contact occurs at about the same elevation as a seep (SS-14) near the base of the new haul road (1049 ft.-msl). Packer tests within TB-02 showed the limestone to be impermeable (<3.5 x 10^{-8} ft/d). Fractures in the mudstone may likely have caused it to be more permeable. Within the mudstone the permeability is as high as 0.55 ft/d. This permeability contrast could explain the occurrence of the haul road seep. This observation is consistent with observations made by Berryhill et. al (1971) in their account of the seep occurrence in the Washington Area.

The Waynesburg 'A' coal seam was pressure tested for permeability at TB-04 and TB-05. In this interval the coal tested impermeable (<3.5 x 10^{-8} ft/d) in TB-04. At TB-05, the tested zone also includes the overlying limestone bed and is not believed to be representative of the coal. This zone had a permability of approximately 5.7 ft/d. The water levels measured in the piezometer wells TB-01, TB-03, TB-04, and TB-05, completed in the Waynesburg 'A' coal bed were at approximately the same elevation (1042-1044 ft-msl).

The limestone below the Waynesburg 'A' coal was pressure tested in TB-01, TB-04 and TB-05. In TB-01 and TB-04 this interval was impermeable (<3.5 x 10^{-8} ft/d). In TB-05, this interval was shown to be permeable at the top decreasing to impermeable at the bottom of the hole (from 1.38 x 10^{-5} ft/d to <3.5 x 10^{-8} ft/d). At TB-01 groundwater in this lower unit was found at an elevation approximately 22 ft. below the water level in the Waynesburg coal bed just above.

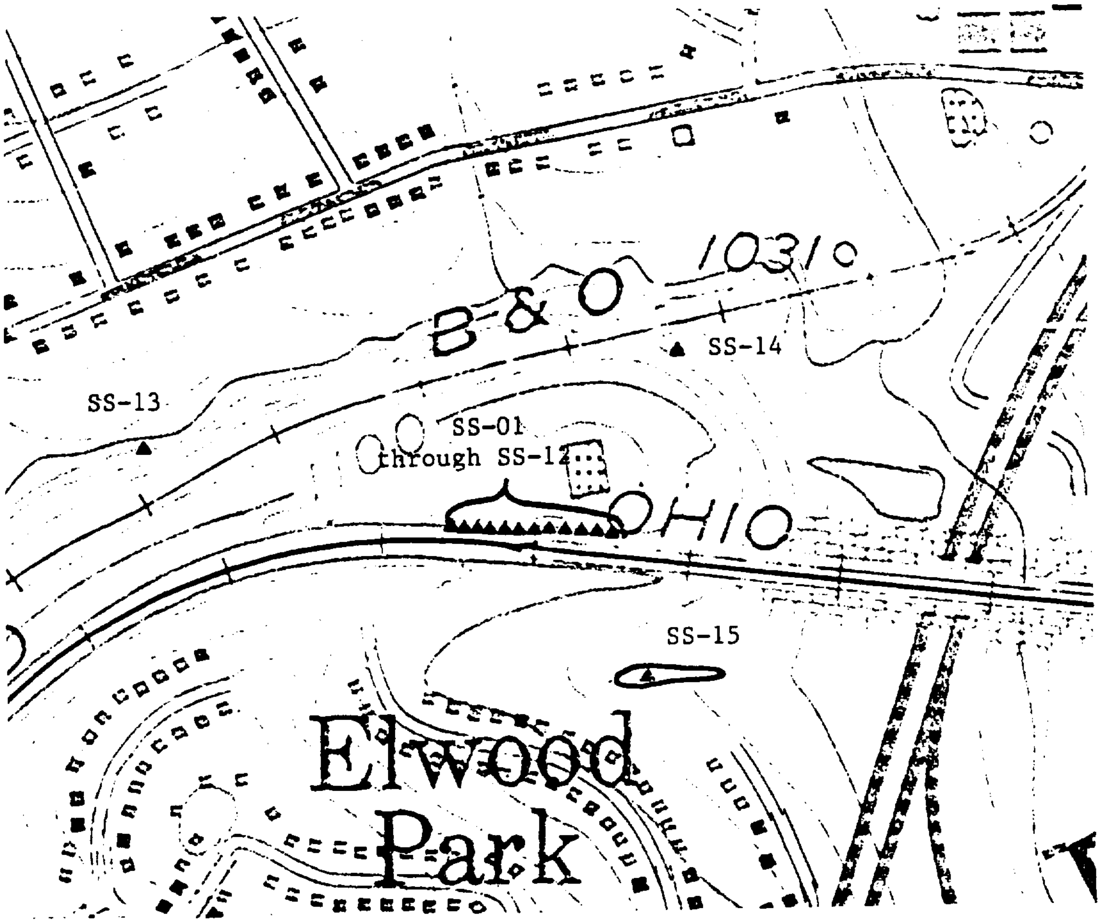
Surface Seeps

The groundwater seeps mapped in the area of the hill (as shown on Figure 3-17) appear to correlate with three separate hydrogeologic units.

1) Seeps mapped along the CSX railroad (SS-01 through SS-12) were observed from the sandstone at the top of the Waynesburg Formation. These rocks were tested and are relatively permeable. This unit was saturated in TB-03 and unsaturated at TB-01.

2) The seep located along the access road (SS-14), and the wetland observed in the Elwood Park subdivision both lie at an elevation of between 1048 and 1049 ft-msl. This elevation correlates to the sandstone seam observed in TB-01 approximately 15 ft. above the Waynesburg coal seam and at the contact between a permeable mudstone and impermeable limestone bed in TB-02.

3) A seep was observed along Sugar Run at an elevation of approximately 1028 ft-msl (SS-13). This elevation may correlate with the contact between the limestone just beneath the Waynesburg Coal seam and the underlying shale.



SEEP NO.	NORTHING	EASTING	ELEVATION
SS-01	9699	12376	1085.8
SS-02	9698	12371	1083.8
SS-03	9696	12362	1081.4
SS-04	9699	12341	1083.4
SS-05	9703	12337	1087.7
SS-06	9701	12319	1084.1
SS-07	9703	12200	1082.3
SS-08	9703	12200	1082.3
SS-09	9708	12163	1085.7
SS-10	9713	12053	1090.7
SS-11	9700	12036	1079.2
SS-12	9709	11997	1086.1
SS-13,	9912	11085	1028.8
SS-14	10113	12622	1049.3
SS-15	9268 through 9334	12378 through 12682	1034 through 1048

LEGEND:

▲ IDENTIFIED GROUNDWATER SEEPAGE LOCATION

SCALE IN FEET

0 500 1000 FEET

FILE NAME: NOCADA10
PLOT SCALE: 1=1

N

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 3-17
ON-SITE AND OFF-SITE SEEPS
IN PROXIMITY TO HILL AREA

ICF KAISER

These seeps are believed to form when the downward percolation of groundwater encounters a lower permeable bed, resulting in perched water lenses and horizontal groundwater movement along the top of the low permeability unit.

Conceptual Groundwater Flow Model

The rocks that comprise the Hill Area are largely unsaturated. Groundwater in the Hill Area results from precipitation that infiltrates through the permeable surficial soils and saprolite (highly weathered bedrock) that covers the surface of the hill. This infiltrating water migrates downward through the rocks and then perches or pools on layers of less permeable strata. This perched water migrates laterally along bedding planes or along fractures and joints, until it intersects the saprolite along the hill sides. The water then flows in the subsurface beneath this weathered rock and soil until it reaches the valley floor and discharges into either Sugar Run or Chartiers Creek through the underlying alluvium. Where unweathered rock lies at the surface, groundwater discharges to the surface as seeps.

In the lowland area, recharge to the site groundwater flow system is from infiltration of precipitation in open unpaved areas, or as groundwater that migrates beneath the site from the areas upgradient. Discharge of site groundwater in the lowland areas is to Chartiers Creek. Flow from this system is governed by Darcy's law, which defines groundwater flow through porous medium (i.e., alluvial sediments). The velocity of groundwater flow toward Chartiers Creek is a function of the hydraulic conductivity and porosity of the sediments and the hydraulic gradient. Using facility data for these parameters, groundwater flow from the fill to Chartiers Creek migrates at a rate of approximately 1.5 to 3 ft/d. In the underlying mixed alluvium the groundwater flow velocity is approximately 0.1 ft/d.

3.3.4 Surface Water

3.3.4.1 Chartiers Creek

Chartiers Creek enters Molycorp from the southeast and crosses the property to run along the western property line. Chartiers Creek drains an area of approximately 47 km^2 (18 mi^2) of dissected plateau above the site. Chartiers Creek continues to the northeast to Carnegie, PA where it flows into the Ohio River. Average streamflow as Chartiers Creek enters the site is estimated at over 8,000 gpm. Flow measurements were obtained using a Pygmy meter at four locations along Chartiers Creek, one upstream, one downstream, and two intermediate locations. This data was collected by Foster Wheeler on August 11 and 16, 1994 and November 3, 1994. Approximately 28 gpm are contributed by the Molycorp property of which 7 to 8 gpm are estimated to be baseflow from groundwater.

The 100-year floodplain elevation of Chartiers Creek, based on Federal Emergency Management Agency (FEMA) flood insurance rate map ranges from 1023.5 ft-msl at the north end of the plant to 1025 ft-msl at the south property line (Figure 3-18) (FEMA, 1986).

3.3.4.2 Sugar Run

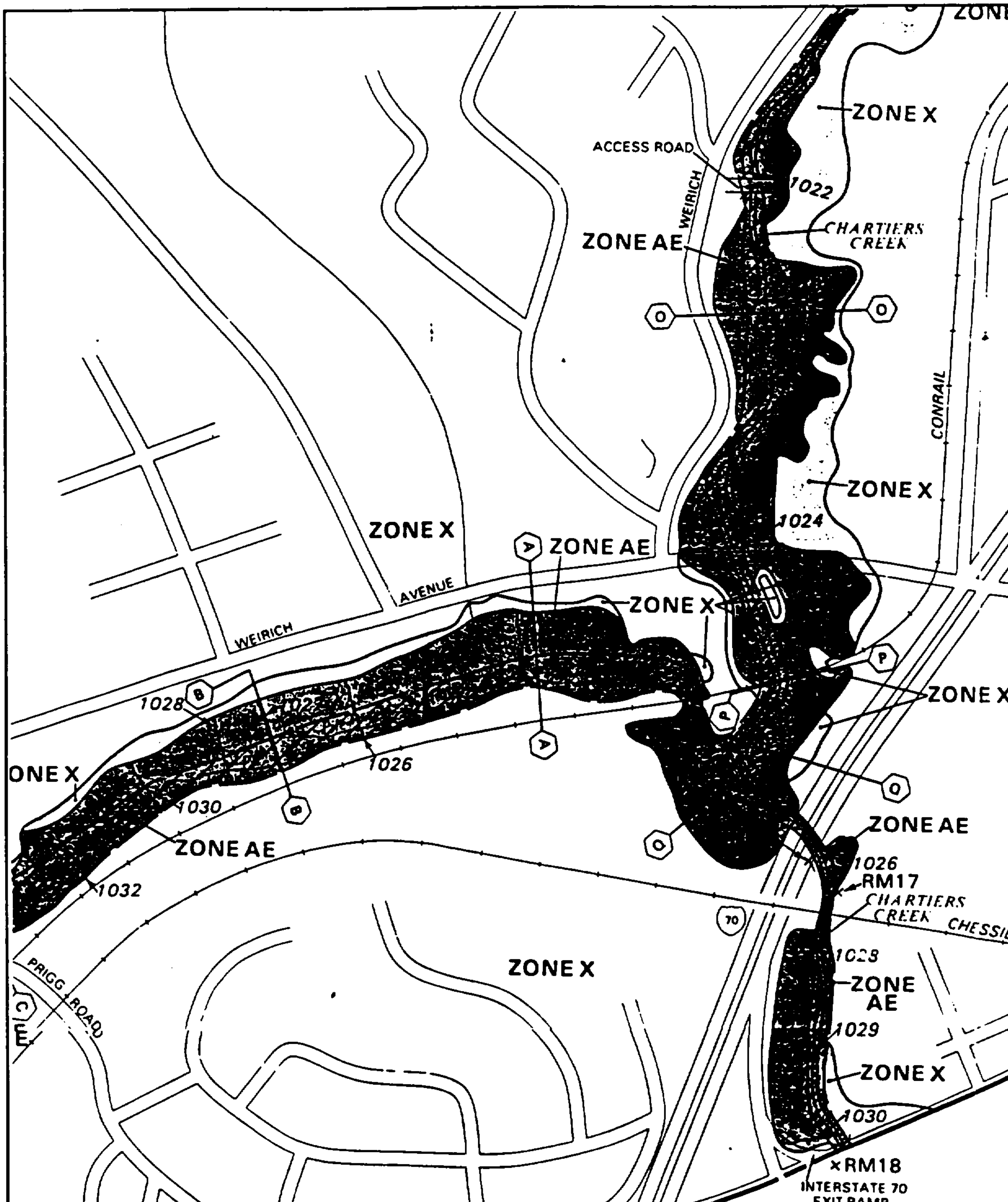
Sugar Run enters Molycorp from the west and joins with Chartiers Creek in the southeast corner of the facility. Sugar Run is identified as a scrub/shrub wetlands (Wetland A) in the Ecological Risk Assessment by IT. A crossing of Sugar Run is provided by two 1.1 m (42 inch) diameter corrugated metal pipe (CMP) culverts located near the confluence of Sugar Run and Chartiers Creek. Fill which was placed south of Sugar Run during creation of the previous railroad bed reduced the size of the Sugar Run floodplain. Streamflow measurements were collected by ICF Kaiser on January 16, 1997. The measurements range from 131 and 188 cubic ft. per minute (cfm).

The 100 year floodplain elevation for Sugar Run, based on FEMA flood insurance rate map, ranges from 1025 ft.-msl at the confluence of Sugar Run and Chartiers Creek to 1027 ft.-msl at the west end of the site (Figure 3-18) (FEMA, 1986).

3.4 METEOROLOGICAL, AIR QUALITY, VISIBILITY, AND NOISE

3.4.1 Meteorological and Climate

The area around Washington County is characterized as a humid continental climatic region. The region experiences distinct seasons with temperature, cloud cover, and precipitation affected by the Great Lakes. Climate and meteorological data presented are from the Washington County Profile included as Appendix C and information collected by the National Climatic Data Center at the Greater Pittsbrugh Airport included in Appendix G.



SOURCE: FIRM FLOOD INSURANCE RATE MAP, FEDERAL EMERGENCY MANAGEMENT AGENCY, FLOOD INSURANCE RATE MAP EFFECTIVE: 11/5/86

FILE NAME: NOCADA12
PLOT SCALE: 1=1

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 3-18

FLOOD INSURANCE RATE MAP, MOLYCORP, WASHINGTON, PA.

ICF KAISER

The summer season is generally mild but frequently humid because of invasions of tropical air from the Gulf of Mexico. The average summer temperature is 82° Farenheit (F). The winter months are brisk with occasional periods of extreme cold. The average winter temperature is 36.5°F. The frost depth is approximately 15 inches below ground surface (Stewart, 1975). Cloud cover is persistent during the winter because of the frequent passage of moisture laden air masses from the Great Lakes and the region's location in the path of west-to-east migratory storms. However, lake effect precipitation is not significant. Spring and fall are transitional seasons with moderate to cool temperatures. The average annual rainfall is 92 cm (36.29 inches), most of which occurs in April through September. Average seasonal snowfall is 115 cm (45.3 inches). Rapid and wide variations in day-to-day weather conditions are common during the spring and fall.

Average monthly wind speed for the 30-year period range from 6.9 miles per hour (mph) in August to 10.7 mph in March. The average wind speed is 9.1 mph. The prevailing wind direction is west-southwest. The fastest wind speed based on a 1 minute observation was 58 mph in February 1967 and a peak gust of 83 mph was recorded in July 1992.

3.4.2 Air Quality

3.4.2.1 Ambient Air Quality

National Ambient Air Quality Standards (NAAQS) exist for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), lead (Pb), and particulate matter small enough to move easily into the lower respiratory tract (particles < 10 micrometers in aerodynamic diameter, designated PM-10). The NAAQS are expressed as pollutant concentrations that are not to be exceeded in the ambient air - that is, in the outdoor air to which the general public has access [40 CFR 50.1(e)]. Primary NAAQS are designated to protect human health; secondary NAAQS are designated to protect human welfare by safeguarding environmental resources (such as soils, water, plants, and animals) and manufactured materials. The Washington facility is in an area that is in attainment for PM-10.

3.4.2.2 Visibility

Construction of all storage cell options include excavation of the material in the open storage area. This activity will be visible to the residents and motorists along Caldwell Avenue and the motorists traveling along Interstate 70 (I-70). It will also be visible to the residents east of the facility. All of the cell construction activities for Option 2 will occur in the open storage area, therefore visibility is limited to the residents and motorists already mentioned.

In addition to the activities in the open storage area, the construction activities for Option 1 include excavation and construction on top of the hill. This will be visible to the residents south and west of the area. The activities for Option 3 will include excavation and construction along the abandoned railroad and this will be visible to the residents and motorists along Caldwell Avenue.

3.4.2.3 Noise

Background noise at the facility of the proposed activity is mostly from traffic on I-70 and surrounding areas. Noise level data collection was performed on the top of the southwest hill, on the north berm of the abandoned railroad and along Molycorp's fence at West Green St. and is presented in Appendix H. Based on data collected, noise levels on the hill and in the railroad area average 59 decibels (dB) and 55 dB respectively. This would be representative of noise levels in a residential area. Noise levels at the plant fence along West Green St. average 70 dB due to traffic on I-70. Data collected are presented in Appendix C. The nearest residents (i.e. potentially sensitive receptors) are located along the southside of Caldwell Avenue and residents along West Green Street and Vitteck Street.

3.5 ECOLOGICAL RESOURCES

This section characterizes the on-site and off-site ecological resources that could be potentially affected by the proposed action and alternatives.

The plant/buildings are all located north of Caldwell Avenue. South and west of Caldwell Avenue is the open storage area, the wetlands, and the 7646 cubic meters (m^3) (10,000 yd^3) slag pile. The buildings at the facility are located along the east bank of Chartiers Creek as is the 7646 m^3 (10,000 yd^3) slag pile. Chartiers Creek flows within 7.6 m (25 ft.) of the slag pile. With the exception of the roads, the built-up industrial areas, and the slag pile, most of the site consists of upland old fields, successional woods, wet meadows, scrub/shrub wetlands, and lowland floodplain woods. The original vegetation on the property was probably a mixture of upland and lowland woods, depending on local soil and drainage conditions.

A coal gasification plant was previously on top of the hill at the facility. The foundation is still in place and there is some remaining residue from the gasification process. The rest of the coal tar is in a state-approved, closed impoundment at the base of the hill in the southeast property corner. The coal tar storage area was a disposal site approved by the Pennsylvania Department of Environmental Resources in 1984 to allow for storage of coal tar residual material which was located throughout the south property of the facility. Coal tar residue was consolidated into the storage area, capped, and access of area restricted by means of fencing and signage.

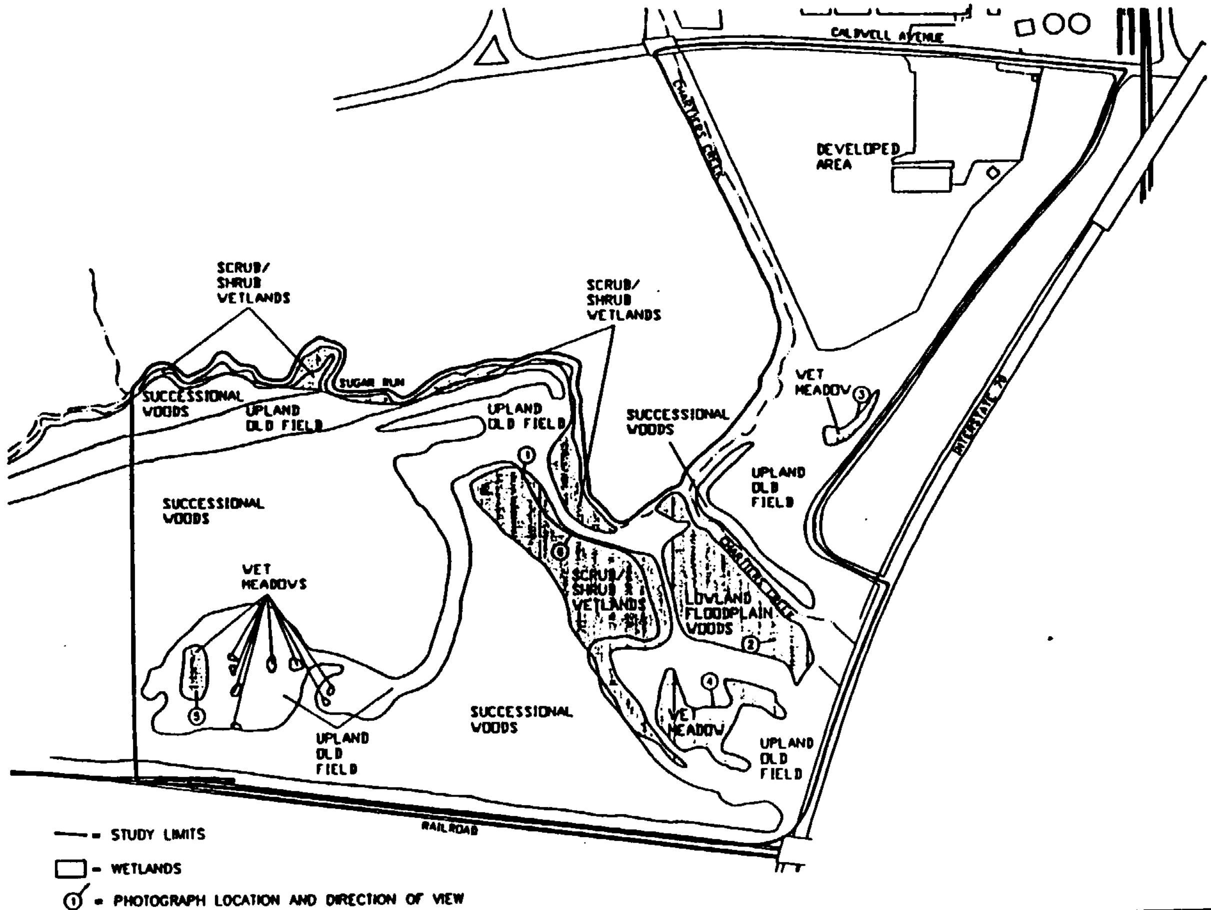
3.5.1 Terrestrial Communities

A site-specific terrestrial survey has not been conducted for the Molycorp facility. Through communication with a Deputy Game Warden for the Pennsylvania Game Commission, it was stated that the following animals are commonly found in Washington County though not necessarily on the Molycorp property: squirrels, chipmunks, rabbits, deer, bear, bobcat, various rodents, and various birds (Sproull, 1997).

The principal nonwetland plant communities on the property include upland old fields and successional woods. Figure 3-19 is a map of the major plant communities.

3.5.2 Wetlands

A total of 0.01 km^2 (3.253 acres) of wetlands lie within the facility's boundary, including scrub/shrub wetlands, lowland floodplain woods, and wet meadows. Figure 3-20 lists the acreage for each area of wetlands and shows the distribution of wetlands identified on the facility. Any dredging and filling activities in these or off-site wetlands and associated streams would require notification and a permit from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and may also require a plan for mitigation of any loss of wetlands.



SOURCE: IT CORPORATION , ECOLOGICAL RISK ASSESSMENT AND PERMITTING SUPPORT FOR UNOCAL/MOLYCORP, INC., WASHINGTON, PA., ATTACHMENT I USED WITH PERMISSION

FILE NAME: NOCADA08
PLOT SCALE: 1=1

0 200'

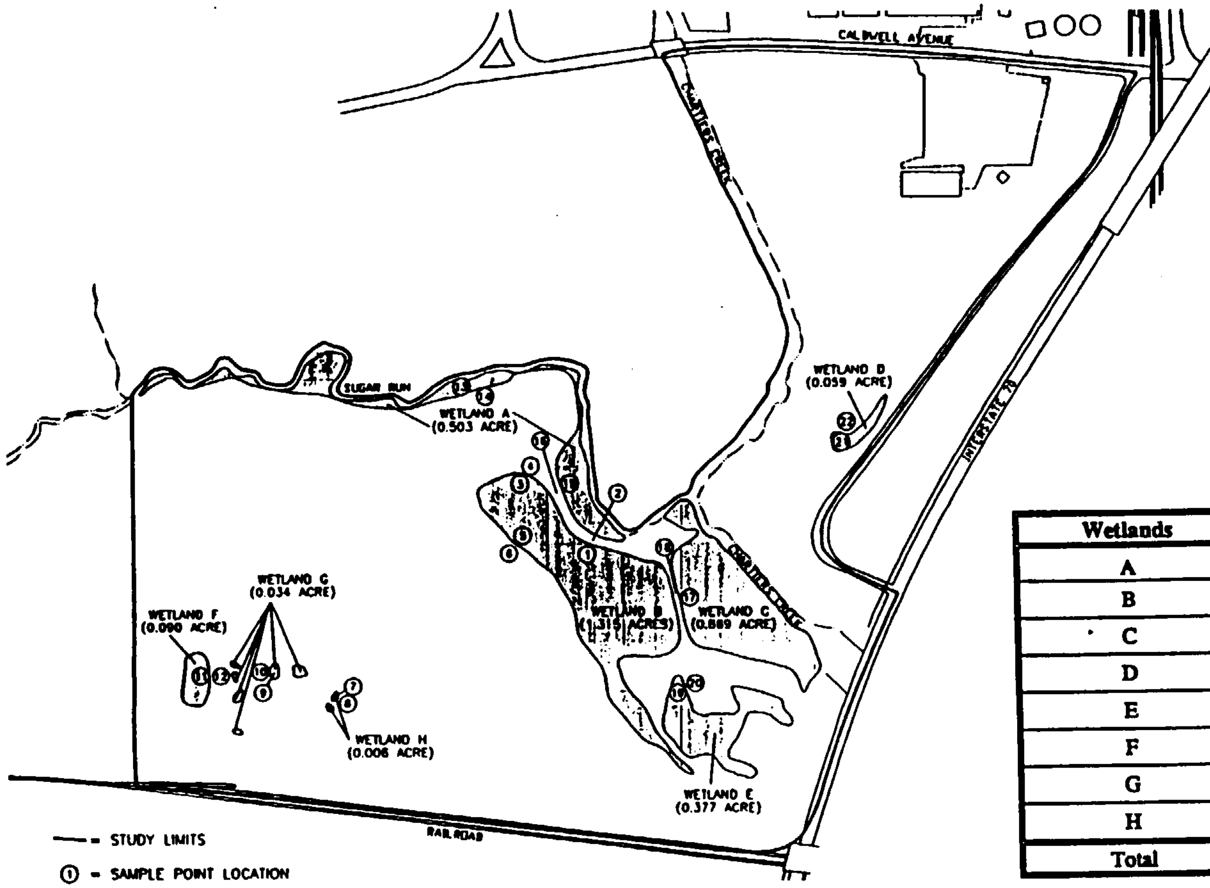
N

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 3-19

MAP OF MAJOR PLANT COMMUNITIES

IT CORPORATION



Wetlands	Acreage
A	0.503
B	1.315
C	0.869
D	0.059
E	0.377
F	0.090
G	0.034
H	0.006
Total	3.253

SOURCE: IT CORPORATION , ECOLOGICAL RISK ASSESSMENT AND PERMITTING SUPPORT FOR UNOCAL/MOLYCORP, INC., WASHINGTON, PA., ATTACHMENT L USED WITH PERMISSION

FILE NAME: NOCADA08
PLOT SCALE: 1=1

0 200'

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 3-20

DERIVED WETLANDS BOUNDARIES

IT CORPORATION

The largest contiguous wetland within site boundaries is Wetland B, which is approximately 0.005 km^2 (1.315 acres) in area and is described as a scrub/shrub wetland and is dominated by silky dogwood. This wetland lies at the base of the hill area. Areas of fill and an existing roadbed are found near Chartiers Creek and Sugar Run. This has likely restricted the drainage for this area, causing water to pond during wet periods.

The majority of the wetlands at the facility have either resulted from or been affected by previous disturbance. Fill materials form the southern boundary of Wetland A and have reduced the size of the Sugar Run floodplain. The placement of fill materials along the edges of Wetlands B and C has restricted drainage and caused these areas to expand hydrogeologically. Wetland D appears to be the remnant of a drainage ditch within a more recently disturbed area. Wetland E is a wet meadow which has formed within the fill over the tar impoundment. Wetlands F, G, and H are wet meadow pockets resulting from disturbances associated with previous excavation activities.

The haul road constructed to the top of the southwest hill in 1996 and 1997 did not intrude into the wetland areas.

3.5.3 Aquatic Communities

No aquatic survey has been conducted for Chartiers Creek or Sugar Run adjacent to the Molycorp property. Through communication with the Fish and Boat Commission in Harrisburg, it was stated that the following fish are commonly found in waters of Washington County, although not specifically in Chartiers Creek: bass, pike, trout, muskee (including tiger muskee), suckers, and walleye (Copp, 1997).

3.5.4 Ecological Risk

An Ecological Risk Assessment was performed by IT Technology Corporation in December 1996. Risk predictions were made for the terrestrial receptor, an aquatic receptor and an aquatic predator using published dose models and toxicity based benchmark values. Based on the information at hand, no ecological risks were predicted for the terrestrial and aquatic biota associated with the Washington facility.

3.5.5 Species of Special Concern

The Pennsylvania Fish and Wildlife data base identified 34 endangered, threatened or special concern species within Washington County. This list includes one fish species, one reptile species, one mammal species, one mollusk species, and 30 bird species (Table 3-8). Although some of the land use and cover types associated with these species exist on the facility, none of the species found in Washington County have been documented on or near the project study area.

The Bureau of Wildlife Management, Pennsylvania Game Commission, was contacted to provide information regarding the documentation of state and federal threatened or endangered species in the area. In a letter to IT Corporation from the Pennsylvania Game Commission dated October 2, 1996, it was documented that no records of threatened or endangered species exist in the area near the facility. PADEP was also contacted to conduct a Pennsylvania Natural Diversity Inventory Search. PADEP's search also reported the finding of no known records for species of special concern at the facility (Appendix D).

3.6 RADIOLOGICAL CONTAMINANTS

3.6.1 Soils

Thoriated slag at Washington is in a glass like format which does not degrade or break down due to weathering. The thoriated slag can be shattered by high impact. Access to soils containing thoriated slag is restricted by fencing with warning. In addition a majority of the thoriated slag on site has a clean soil cover or is located in rolloff boxes. Wetlands soils lie outside the Molycorp thoriated slag area of concern and are physically separated from the area of concern by Chartiers Creek and Sugar Run.

3.6.2 Stream Sediment and Stream Bank Materials

Stream sediment and stream bank materials were sampled in July of 1994 during the Site Characterization for Th-232 at seven locations (SS1 through SS7) along Chartiers Creek as shown in Figure 3-21. At each location (e.g. SS1), a letter suffix was used to indicate the sample location across the stream from an east to west direction. The first sample (e.g. SS1A) and the last sample (e.g. SS1D) were obtained from the east and west banks respectively. Sediment samples (e.g. SS1B and SS1C) consisted of the first six inches of sediment across the stream section. Results were presented in Appendix K of the Site Characterization.

TABLE 3-8

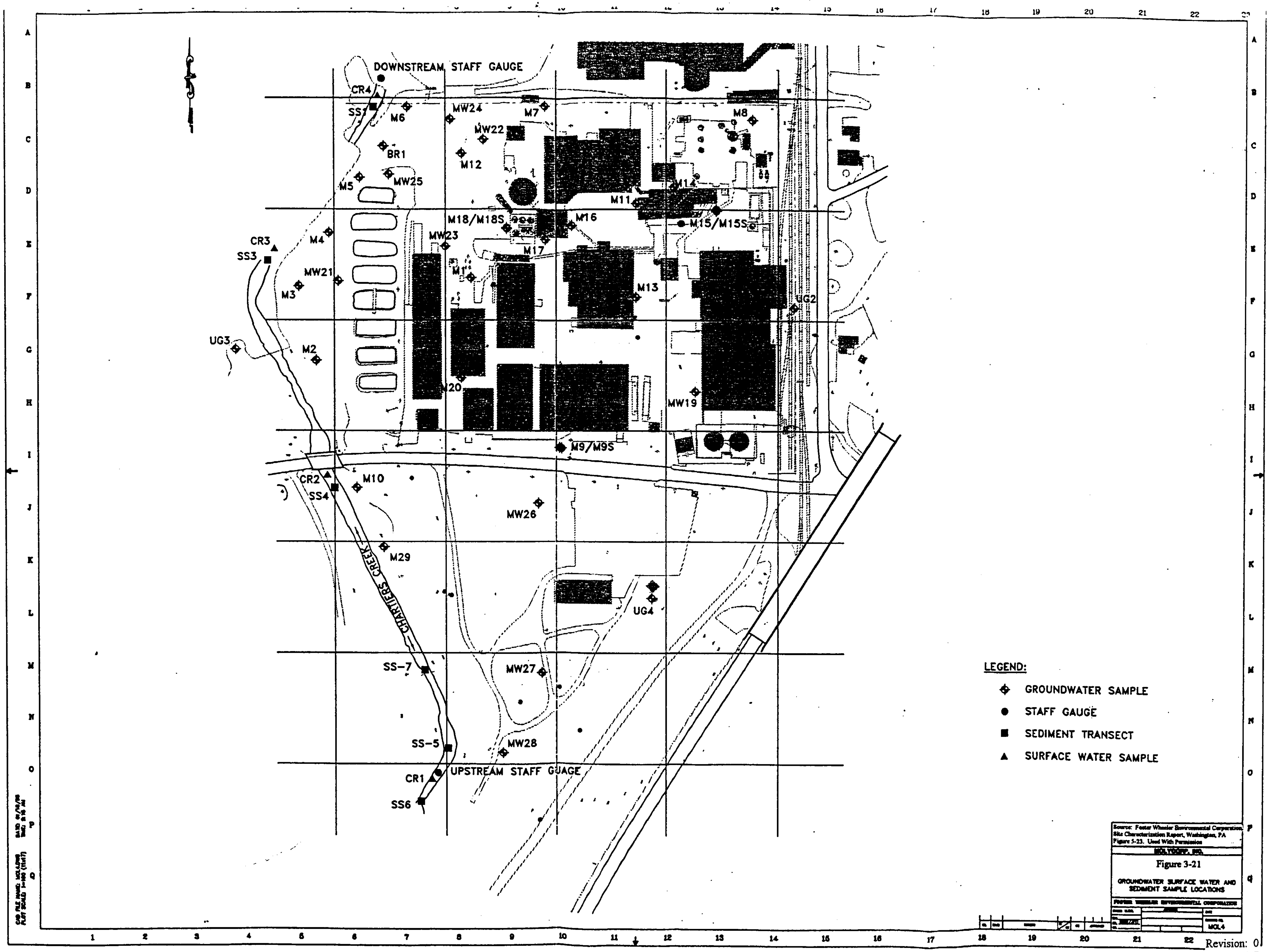
SPECIES OF SPECIAL CONCERN IN WASHINGTON COUNTY

Common Name	Scientific Name	Status	Status[a]
Eagle, Bald	*Haliaeetus leucocephalus*	PA/Fed Endangered	A
Falcon, Peregrine	*Falco peregrinus*	PA/Fed Endangered	A
Osprey	*Pandion haliaetus*	PA Endangered	E
Owl, Short-eared	*Asio flammeus*	PA Endangered	E
Tern, Black	*Chlidonias miger*	PA Endangered	E
Mussel, Pink Mucket Pearly	*Lampsilis abrupta*	Fed Endangered	F
Bittern, American	*Botaurus lentiginosus*	PA Threatened	T
Flycatcher, Yellow-bellied	*Empidonax flaviventris*	PA Threatened	T
Heron, Yellow-crowned Night	*Nycticorax violaceus*	PA Threatened	T
Sandpiper, Upland	*Bartramia longicauda*	PA Threatened	T
Harrier, Northern	*Circus cyaneus*	Candidate - At Risk	U
Owl, Common Barn	*Tyto alba*	Candidate - At Risk	U
Snipe, Common	*Gallinago gallinago*	Candidate - At Risk	U
Sparrow, Henslow's	*Ammodramus henslowii*	Candidate - At Risk	U
Coot, American	*Fulica americana*	Candidate - Rare	V
Goshawk, Northern	*Accipiter gentilis*	Candidate - Rare	V
Grebe, Pied-billed	*Podilymbus podiceps*	Candidate - Rare	V
Grosbeak, Blue	*Guiraca caerulea*	Candidate - Rare	V
Tanager, Summer	*Piranga rubra*	Candidate - Rare	V
Teal, Green-winged	*Anas crecca*	Candidate - Rare	V
Thrush, Swainson's	*Catharus ustulatus*	Candidate - Rare	V
Bobwhite, Northern	*Colinus virginianus*	Candidate - Undeterm	W
Crossbill, Red	*Loxia curvirostra*	Candidate - Undeterm	W
Dickcissel	*Spiza americana*	Candidate - Undeterm	W
Duck, Ruddy	*Oxyura jamaicensis*	Candidate - Undeterm	W
Egret, Cattle	*Bubulcus ibis ibis*	Candidate - Undeterm	W
Gadwall	*Anas strepera*	Candidate - Undeterm	W
Nighthawk, Common	*Chordeiles minor*	Candidate - Undeterm	W
Owl, Northern Saw-whet	*Aegolius acadicus*	Candidate - Undeterm	W
Pintail, Northern	*Anas acuta*	Candidate - Undeterm	W
Wigeon, American	*Anas americana*	Candidate - Undeterm	W
Weasel, Least	*Mustela nivalis*	Candidate - Undeterm	W
Madtom, brindled	*Noturus miurus*	Candidate Species	Y
Rattlesnake, Timber	*Crotalus horridus*	Candidate Species	Y

[a] Key:

Status Codes:
A = State/Federally Endangered
E = State Endangered
F = Federally Endangered
T = Threatened

Candidate Classifications:
U = At Risk
V = Rare
W = Undetermined Status
Y = Unspecified


DOWNSTREAM STAFF GAUGE
CR4
SS1
M6
MW24
M7
MW22
M8
BR1
M12
M5
MW25
M14
M11
M18/M18S
M16
M15/M15S
CR3
M4
MW23
SS3
M17
M1
MW21
M3
M13
UG2
UG3
M2
M20
MW19
M9/M9S
CR2
M10
SS4
MW26
M29
CHARTIERS CREEK
UG4
SS-7
MW27
SS-5
MW28
CR1
UPSTREAM STAFF GUAGE
SS6
LEGEND:
GROUNDWATER SAMPLE
STAFF GAUGE
SEDIMENT TRANSECT
SURFACE WATER SAMPLE
Source: Foster Wheeler Environmental Corporation, Site Characterization Report, Washington, PA Figure 5-23. Used With Permission
Figure 3-21
GROUNDWATER SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS
MOL4

The concentration of Th-232 in the samples varied from 0.23 to 0.89 pCi/l with uncertainty from 0.06 to 0.28 pCi/l suggesting no significant site-related impacts.

In January 1997 following completion of the Site Characterization, additional sediment samples were obtained from upstream and downstream on Sugar Run (Sugar02 and Sugar01, respectively) and Chartiers Creek (Char02 and Char01, respectively), and from the ponded area located at the northern end of the Hill Area. These locations are shown on Figure 3-11. No stream bank samples were obtained during this sampling. Samples were collected from mid-width of the stream channel. These samples were analyzed for radionuclides of thorium, radium, and uranium, the results are presented in Appendix J.

Results indicated radionuclides were generally less than 1 pCi/l for both upstream and downstream locations sampled on Sugar Run and Chartiers Creek. The upstream location on Sugar Run showed Ra-228 to be slightly above 1 pCi/l decreasing to below 1pCi/l at the downstream location. The pond samples showed the presence of Ra-228 at less than 1 pCi/l, U-238 at 1.04±0.13 pCi/l, and U-234 at 1.01±0.13 pCi/l in one of the two duplicate samples obtained.

3.6.3 Groundwater

Groundwater from over 30 monitoring wells was sampled during the Site Characterization Report for specific radioisotopes of thorium, radium and uranium between June 28 and July 12, 1994 (Round 1) and July 26 and August 3, 1994 (Round 2). These radioisotopes included parent radionuclides (e.g. Th-232, U-238, and U-235) and the products of radioactive decay of the parent radionuclides (e.g. Ra-228 and Th-228; Ra-226, Th-230, and U-234). The locations of the wells sampled are shown on Figure 3-21. Wells M-2, M-3, M-4, M-5, and M-6 north of Caldwell Avenue and near Chartiers Creek were also sampled during mid-August to coincide with the second round of Chartiers Creek surface water sampling.

Th-232 was found above the detection limit of 0.5 pCi/l in one of two groundwater samples obtained from both M-12 and MW25 located in the northwest corner of the plant area. The maximum value was 1.38±0.39 pCi/l at MW25. These detections were not repeated in both rounds of sampling. Th-228 was found above the detection limit of 0.5 pCi/l in one of two groundwater samples obtained from MW25 and M6 located in the northwest corner of the plant area and in M15S located near the eastern corner of building 14. The maximum value was 1.36±0.78 pCi/l at M15S. Ra-228 was found above the detection limit of 2 pCi/l at least once in 15 wells. Ra-228 was above the detection limits in both rounds in three wells, M5, M12, and MW29. M5 and MW25 are located in the northwest corner of the plant area while MW29 is located adjacent to the above ground slag pile. The maximum Ra-228 value was 5.32±2.20 pCi/l at M21 adjacent to the western plant area border north of Caldwell Avenue.

U-238 was found above the detection limit of 0.5 pCi/l in one of the two groundwater samples obtained from 13 wells sampled. Eight wells were above the detection limit for both rounds of sampling. With the exception of one well (M10), all wells with samples above detection were located in the plant area north of Caldwell Avenue. The maximum U-238 value was 2.6±0.39 pCi/l at M11 near the western end of building 14. Wells above the U-238 detection limit were generally also above the detection limit of 0.5 pCi/l for U-234. The maximum U-234 value was 3.58±0.49 pCi/l also at M11 near the western end of building 14. Th-230 was found above the detection limit of 0.5 pCi/l in only four well samples, M15S and M14 near building 14 and M12 and M18S near the northwest corner of the main plant area. The maximum Th-230 value was 2.97±0.97 pCi/l at M12 near the northwest corner of the plant area. Likewise, Ra-226 was found above detection limits in only three well samples M3, M4, and MW20 along the western part of the main plant area. The maximum Ra-226 value was 0.92±0.27 pCi/l at MW20.

3.6.4 Surface Water

Surface water was sampled during the Site Characterization in July of 1994 for specific radionuclides of thorium, radium and uranium at two locations (CR1 and CR4) proceeding downstream along Chartiers Creek as shown in Figure 3-21. Stream flow measurements were obtained at the time of sampling. Five monitoring wells adjacent to the creek were sampled at the same time as the surface water sampling.

Only Ra-228 was detected in the surface water samples at both the upstream and downstream locations. Results were in the 5 to 6 pCi/l ranges at CR1 (upstream) and the 3 pCi/l range at CR4 (downstream). Adjacent monitoring wells had Ra-228 concentrations in the 3 to 4 pCi/l range for M-3 and M-5.

In January 1997 following completion of the Site Characterization, additional surface water samples were obtained from upstream and downstream on Sugar Run (Sugar02 and Sugar01, respectively) and Chartiers Creek (Char02 and Char01, respectively), and from the ponded area located at the northern end of the Hill Area. These locations are shown on Figure 3-11. These samples were analyzed for radionuclides of thorium, radium, and uranium, the results are presented in Appendix J. Upstream locations on both Sugar Run and Chartiers Creek showed the presence of Ra-228 at less than 1pCi/l whereas downstream locations were below detection limits. U-234, U-238 and Ra-226 were above the detection limit but less than 0.5 pCi/l at either the upstream (Sugar Run) or downstream location (Chartiers Creek). The pond samples showed the presence of Ra-228 at less than 1.5 pCi/l, U-238 at 2.38±0.37 pCi/l, and U-234 at 2.70±0.41 pCi/l in one of the two duplicate samples obtained.

4.0 ENVIRONMENTAL CONSEQUENCES AND RECOMMENDED MONITORING AND MITIGATION

Section 3.0 provided baseline information about the existing environment at and adjacent to the Molycorp, Washington facility. This section describes the effects to the environment at and adjacent to the facility which are predicted to occur during and following implementation of each of the alternatives for facility decommissioning detailed in Section 2.0. This section presents data, describes methods of predicting future environmental effects, and presents the results of these methods.. Mitigating actions are also described in this section.

The analyses in this section are both quantitative and qualitative. The qualitative analyses use conservative assumptions to estimate potential impacts. The quantitative analyses utilize models and empirical analytical methods to predict future environmental consequences; the models are industry accepted standards which utilize conservative but realistic means to estimate consequences.

4.1 LAND USE

To analyze the potential for land use impacts, existing land use patterns and plans for future land use are compared to the land use resulting from the implementation of the alternative actions.

4.1.1 On-Site Management Alternative

Remediation

Approximately 0.16 km^2 (4 acres) of land for Options 1 and 2, and 0.21 km^2 (5.25 acres) of land for Option 3 would be disturbed during remedial activities. All of this land is well within Molycorp's property boundaries. This disturbance of land would not affect land use for Option 2 (open storage area) because that section of property is already zoned as heavy industrial and would continue to be devoted to heavy industrial use while in Molycorp's possession. Option 1 (hill area) and 3 (abandoned railroad) are currently zoned as light residential. The direct impacts on land use would be confined to the Molycorp property.

The quantity of off-site fill materials needed to complete remediation varies depending upon which on-site management option is selected. Option 1 will require an estimated 39,700 yd^3 of off-site materials. Option 2 will require an estimated 76,100 yd^3 of off-site soil materials. Option 3 will require an estimated 8,700 yd^3 off-site soil materials. Numerous local sources of off-site fill material are available for use. Off-site fill sources will be evaluated for existing land use to ensure that excavation of the material would not result in undesired changes in land use such as destruction of wetlands or altering surface runoff which would negatively impact surrounding lands.

The work force utilized for construction of the containment cell within the facility would be primarily local. Therefore the projected economic impact to the area due to the employment of temporary workers would be a community gain.

Postremediation

Any of the three storage cell options would result in restricted land use of the storage cell area as defined by the NRC. Therefore, the land would have restricted potential for future economically productive use. Molycorp would retain their Source Material License for the facility, maintain the property, and ensure compliance with NRC regulations, including maintenance of security fences and warning signs. If either Option 1 (Hill Area) or Option 3 (abandoned railroad) are implemented, the removal of the thoriated material may allow the open storage area land to be put to economically productive use. The economic return that would result would depend on how the land was used (commercial or future industrial development). Because some of this area is located within the 100-yr floodplain, commercial or industrial development may be restricted.

4.1.2 Off-Site Management Alternative

Remediation

The off-site management alternative would not require land on the Molycorp property to be used. The open storage area would be used as a staging area to load the railcars or trucks. Removal of thoriated materials with a thorium concentration greater than 30 pCi/g would also require retention of the Source Materials License for the Washington facility and a continuance of restricted use of the affected areas. The direct impacts on land use would be confined to the Molycorp property and would not conflict with current facility usage. Molycorp intends to retain the property and utilize the facility for industry.

Potential impacts to the NRC approved, licensed commercial disposal facility would be minimal because this facility is licensed to receive these types of material. Indirect impacts to land use are not anticipated because the project's work force will be local and the economic impact is not anticipated to be significant.

The quantity of off-site soil materials required for this alternative is estimated to be 45,300 yd^3. Numerous local sources of off-site fill material are available for use. Off-site fill sources will be evaluated for existing land use to ensure that excavation of the material would not result in undesired changes in land use such as destruction of wetlands or altering surface runoff which would negatively impact surrounding lands.

Postremediation

The off-site disposal alternative for thoriated material above 30 pCi/g would result in restricted land use as defined by the NRC. Molycorp would retain their Source Material License for the facility, monitor and maintain the property, and ensure compliance with NRC and PADEP regulations including maintenance of security fences and warning signs. The economic return that would result would depend on how the land was used (commercial or further industrial development). Because this area is located within the 100-yr floodplain, commercial or industrial development may be restricted. No adverse land use impacts would be anticipated because this affected area of the property is currently zoned light industrial.

4.1.3 No-Action Alternative

The impacts of this alternative would be the same as the existing impacts described in Section 3.1.1 because no land disturbances or land use conversion would occur. Molycorp would retain its Source Material License for the facility. Areas of thoriated material would be monitored and maintained. Access to the facility would be restricted using fences and signs.

4.2 COMMUNITY RESOURCES

4.2.1 Socioeconomic Resources

Socioeconomic impacts can result from demands of the project on and from the demand for goods and services required by laborers.

4.2.1.1 On-Site Management Alternative

Remediation

The projected labor work force (not including design and construction management/oversight) for the on-site management options is 15 to 30 persons over a 2 to 3 year period. The work force will consist of local laborers who will have the requisite training to work with the thoriated materials. The exception will be the liner installation, which will be performed over a short period of time relative to the total project duration, by specially trained non-local technicians who also have been trained to work with the thoriated materials. The impact of these non-local technicians on socioeconomic resources is negligible, therefore these actions would not induce population related impacts to housing or public infrastructure.

Construction of any of the three on-site options is not expected to increase Molycorp's use of natural gas, or electricity because no night-time construction operations will occur. An estimated 7571 L (2000 gal) of water would be pumped from Chartiers Creek or delivered by water trucks each day for fugitive dust control. Impacts to the public water systems will be insignificant (Pennsylvania American Water Company, 1997c). Local solid waste management capacity is ample and would not be affected by additional demand from the construction of any of the storage cell options since the only municipal waste created will be incidental to construction.

The volume of the off-site borrow material needed for the on-site management cell options varies due to differences in designs. Table 4-1 presents a summary of the off-site borrow material needed. Additional traffic impacts to the area would be the result of workers commuting to the Molycorp facility. Approximately 20 to 35 passenger vehicles would be utilized by workers throughout the duration of the project. The movement of thoriated material will be performed using tarped trucks and restricted to

TABLE 4-1

SUMMARY OF OFF-SITE BORROW MATERIAL

Alternative	Total Volume of Off-Site Borrow Material (yd^3)	Number of Dump Trucks	Number of Trucks per Day	Delivery Duration (days)
Option 1	39,700	1,985	100	20
Option 2	76,100	3,805	100	38
Option 3	8,700	435	40	11
Option 4	45,300	2,265	100	23

Molycorp property. The exception to the above would be the movement of material from the plant area to the area south of Caldwell Avenue.

The impact to traffic patterns is anticipated to be minimal due to the low increase in daily traffic associated with the construction of the on-site options (maximum daily traffic increase of 50 vehicles). Daily traffic volume for I-70 is 39,300 vehicles (PennDot, 1997). Warning signs stating that trucks are entering and exiting the Molycorp facility to the south of Caldwell Avenue will be posted to notify motorists. If it is determined that the trucks experience difficulty entering or exiting the highway, a traffic control plan will be developed and implemented to minimize the impact.

The 15 to 30 person labor work force would increase total employment in Washington County by less than one percent. The current unemployment rate for Washington County is 4.5% (Washington County Planning Commission, 1997). This employment increase and the corresponding revenue increase will have a positive (although temporary) effect on Washington County. Workers will be chosen from the local labor force and specially trained in accordance with Molycorp, Occupational Safety and Health Administration (OSHA), and NRC requirements. This training will provide increased occupational opportunities for these workers that will last long after completion of the on-site storage cell.

Postremediation

Assuming local social, political, and economic conditions remain relatively stable in the near future, no significant postremediation socioeconomic impacts are anticipated.

4.2.1.2 Off-Site Management Alternative

Remediation

Local socioeconomic impacts of this alternative would be similar to those for the on-site management alternative. However, local purchases and expenditures would be less than those that are associated with the on-site management alternative. This is due to the fact that capping material would not be required for this alternative.

It is assumed that the thoriated material would be directly loaded onto railcars or trucks in the open storage area for transportation to an NRC licensed commercial disposal facility. Transportation of materials to an NRC licensed commercial disposal facility by others in the past have not caused socioeconomic impacts along the transportation routes, therefore, it is not anticipated there will be any socioeconomic impacts from transportation of thoriated materials to the selected commercial disposal facility.

Postremediation

Assuming local social, political, and economic conditions remain relatively stable in the near future, no significant postremediation socioeconomic impacts are anticipated.

4.2.1.3 No-Action Alternative

Assuming local social, political, and economic conditions remain relatively stable in the near future and the fencing and signage remain in place, no significant socioeconomic impacts are anticipated.

4.2.2 Cultural Resources

Remediation

The Pennsylvania Historic and Museum Commission has confirmed that there are no historic structures located within the area of thoriated slag removal or the area of any of the on-site storage options. Therefore, implementation of either off-site or on-site management alternative will not result in disturbance or cultural impact to historic structures. The Pennsylvania Historic and Museum Commission has also confirmed that there are no identified archaeological sites within the Molycorp property. It is unlikely that any archaeological finds will be identified during earth moving activities. Should any such finds be identified, the work in that area will be halted and the Pennsylvania Historic and Museum Commission will be notified immediately. This will assure negligible impact to cultural resources.

For the off-site management alternative, cultural resources located along the transport routes between the Molycorp facility and the selected commercial disposal facility could be damaged or destroyed in the unlikely event of a serious transport accident such an accident could affect the cultural resources or the public's opportunity to appreciate the resources. The existing risk of such an event would only be slightly increased by this action because use of the transport routes will increase only slightly. Therefore, the off-site management alternative is unlikely to affect cultural resources.

Postremediation

There would be no postremediation impacts on cultural resources under any alternative, other than those that would be addressed during the remediation phase.

4.3 GROUNDWATER AND SURFACE WATER

4.3.1 Surface Water

All temporary and permanent erosion and sediment controls and stormwater conveyance structures will be constructed and installed in accordance with the Pennsylvania DEP Erosion and Sediment Pollution Control Program Manual (PADER, 1990).

4.3.1.1 On-Site Management Alternative

Remediation

During thoriated slag excavation and storage cell construction activities. temporary erosion and sediment and stormwater runoff control measures will be implemented to minimize the transport of sediment in stormwater runoff. Silt fence barriers and straw bale dikes will be installed around construction areas and stockpiles as needed to control sediment transport. Temporary drainage ditches and/or berms will be constructed as needed to divert stormwater runoff from construction areas. During soil handling activities, dust control measures such as water or other dust suppression sprays will be used to minimize the transport of airborne particles. All temporary erosion and sediment control measures will be removed following excavation and subsequent backfilling and stabilization activities.

All of the options include excavation of thoriated slag from the 100 year floodplain where the thoriated slag is also below the groundwater table. Appropriate controls will be utilized to prevent sediment laden runoff from entering streams and creeks.

Additional consideration will be given to Option 2, the Open Storage Area Option. Approximately one half of the current proposed design area lies within the 100 year floodplain (approximate elevation 1024 ft-msl). As described in Section 2, a ten foot wide berm will be constructed at elevation 1025 ft-msl around the perimeter of the containment cell where the existing grade is less than 1025 ft-msl. Options 1 and 3 are not located within the 100 year floodplain and no additional activities are anticipated to build up these areas.

Postremediation

Following construction of the storage cell and backfilling of the excavated areas, permanent stormwater control measures such as drainage ditches and revegetation will be used to route stormwater runoff. Drainage ditches and swales will be constructed to convey stormwater runoff from capped storage cell and direct stormwater runoff away from the storage cell. Revegetation of disturbed areas will be conducted during the first normal growing season after construction and/or backfilling activities have been completed.

Construction of any of the storage cell options is not anticipated to significantly alter watershed drainage areas. Perimeter drainage ditches will convey flow which would normally have been conveyed as sheet flow or shallow concentrated flow. The presence of shrubbery, trees, and grasses following revegetation activities will decrease stormwater runoff volumes by increasing the effects of evapotranspiration. Additionally, a healthy vegetative base should prevent erosion of the storage cell cap.

4.3.1.2 Off-Site Management Alternative

Remediation

The off-site management alternative will involve excavating and stockpiling of thoriated slag and overburden materials. Temporary erosion and sediment control measures such as straw bale dikes and silt fences will be installed as needed around excavation areas and stockpiles to minimize sediment transport in stormwater runoff. During soil and thoriated slag handling activities, dust control measures such as water or other dust suppression sprays will be used to minimize the transport of airborne particles. Temporary drainage ditches and/or berms may also be constructed if needed to divert stormwater runoff from excavation areas. All temporary erosion and sediment control measures will be removed following excavation and subsequent backfilling and stabilization activities.

Postremediation

After completion of the excavation involved with the off-site management alternative, the open areas will be backfilled to original grade and all disturbed areas will be repaved or revegetated. Revegetation or repaving activities will begin immediately following completion of backfilling activities. These actions are not anticipated to alter watershed drainage areas. The presence of a healthy vegetative base following revegetation activities will reduce stormwater runoff volumes by increasing the effects of evapotranspiration, which will also minimize erosion of the revegetated areas.

4.3.1.3 No Action Alternative

No temporary or permanent stormwater control measures will be implemented with the no action alternative.

4.3.2 Groundwater

Potential groundwater and surface water impacts were analyzed for each of the proposed alternatives based on the nature of the waste material and the current knowledge of the site geology and hydrogeology. The following paragraphs discuss the migration and transport of a hypothetical release. However, an assessment of information gathered to date indicates that such a release is highly unlikely for any of the options. This is based on the vitrified nature of the slag (Foster Wheeler, 1995c), the negligible amounts of thorium identified in the leachate tests as presented in Appendix K, and the design of the proposed double lined, containment structure with leachate collection and leak detection systems. Additionally, the proposed containment structure will be constructed with a low permeability cap designed to inhibit infiltration and promote diversion of precipitation.

The impermeable cap and double liner system being utilized in each of the proposed storage cell options provides for protection of groundwater via the following ways:

1) *Impermeable Cap.* Use of the impermeable cap layer prevents infiltration of precipitation to the thoriated material. The reduced infiltration results in increased surface water runoff which will flow off the cap in sheet flow and be collected in perimeter drainage ditches which direct the flow to Sugar Run or Chartiers Creek.

2) *Double Liner Cell.* All liquid generated in the storage cell due to separation of liquid from saturated soil will be collected in the leachate collection system. Generated leachate will be sampled and analyzed for concentration of radionuclides. Leachate will be disposed based on analysis results. Based on previous leachate analysis as presented in Appendix K, no radioactive materials are anticipated to be detected in the leachate. If there is a breach of the impermeable primary liner, the leachate would be detected by the leak detection system constructed between the primary and secondary liners.

Groundwater monitoring wells will be installed both upgradient and downgradient of the management cell. Locations of the wells will be determined once final design of the management cell has been completed. Semi-annual sampling and analysis of the groundwater monitoring wells will be performed.

Alternative 1, Option 1 - Hill Area

The potential transport routes via groundwater from a hypothetical break-through of the proposed double-lined containment system is believed to be vertically downward until an aquitard (low permeability rock bed) is encountered. From this point, horizontal flow is preferential. Further downward migration is possible through fractures. However, multiple layers of perched water indicate that the primary migration route would be horizontal. There are no known potable water wells located in the immediate vicinity of the site.

The hypothetical release may impact surface water through seeps and/or baseflow to Sugar Run, Chartiers Creek, or the wetland area. Seeps from the Sandstone outcrop along the CSX railroad located south of the proposed Hill Area were impacted by drilling operations during the hill area investigation, indicating a potential migration pathway from the Hill area site. Groundwater monitoring wells will be installed upgradient and downgradient of the management cell. Monitoring wells will be sampled semi-annually to monitor groundwater characteristics.

Alternative 1, Option 2 - Open Storage Area.

A hypothetical release is expected to migrate vertically downward until water is encountered and is then expected to move with groundwater, eventually discharging to Chartiers Creek. There are no known potable water wells completed in the vicinity of the site and there are no known surface water intakes along Chartiers Creek downstream of the facility. Groundwater monitoring wells will be installed upgradient and downgradient of the storage cell. Monitoring wells will be sampled semi-annually to monitor groundwater characteristics.

Alternative 1, Option 3 - Abandoned Railroad Area

A release from this site would be expected to migrate vertically downward until an aquitard is encountered. Once this barrier to flow is encountered, horizontal flow is expected to be dominant, potentially discharging as seeps and/or baseflow to Sugar Run or Chartiers Creek. As noted above, groundwater and surface water are not used as a potable water source in the immediate vicinity of the site.

Groundwater monitoring wells will be installed upgradient and downgradient of the management cell. Monitoring wells will be sampled semi-annually to monitor groundwater characteristics.

Alternative 2 - Off-site Disposal

If the off-site disposal option is chosen, all residual material left at the site is expected to be within acceptable levels. Due to its vitrified nature, the remaining thoriated slag would not be expected to impact surface or groundwater. Monitoring of groundwater will continue using the existing monitoring program.

Alternative 3 - No Action

Based on the leachate tests and the site radiological survey, there is no significant impact to groundwater or surface water attributable to the slag. A hypothetical release from this material would be expected to move vertically until groundwater is encountered. The hypothetical release would then be expected to move with the groundwater toward Chartiers Creek. These materials have been shown to have no significant impact on either groundwater or surface water (Foster Wheeler, 1995). Monitoring of groundwater will continue using the existing monitoring program.

4.4 AIR QUALITY, VISIBILITY, AND NOISE

Air quality, visibility, and noise impacts at the off-site borrow sources will be evaluated once the facilities have been selected and prior to implementation of any remedial action. Only sources where impacts are anticipated to be minimal or insignificant will be utilized.

4.4.1 <u>On-Site Management Alternative</u>

<u>Remediation</u>

Air Quality. Implementation of any of the on-site options would increase traffic on-site by 50 vehicles per day, maximum. Interstate-70, which is located in close proximity to the facility has high volumes of daily traffic 39,300 vehicles per 24 hours (PennDot, 1997). The increase in pollutants associated with the increase in vehicular traffic will be less than one percent and therefore will not result in significant impact. During soil handling activities, dust control measures such as water or other dust suppression sprays will be used to minimize transport of airborne particles. Dust control measures will also be utilized on stockpiles and on the final graded area until vegetation is established. Air quality impacts from dust are therefore anticipated to be insignificant.

Air Quality Modeling. Air quality modeling was performed to estimate the impact of particulate matter (PM) emissions from the management of thoriated material only on worker and residential receptors. Decommissioning on-site options 1, 2, and 3 involve excavating and loading of thoriated material, transporting to a storage cell, unloading, and spreading of material. Each of these operations are similar, however, the location of the storage cell, and thus the location of the unloading and spreading of material differs.

Industrial Source Complex 3 (ISC3), Version 96113 (*Guideline on Air Quality Models (Revised)*, EPA-450/2-78-027R) was chosen to perform the air quality modeling. ISC3 was chosen because it can estimate air concentrations resulting from the PM emissions from multiple area sources. It also allows for the temporal variation of the emission rate. That is, it can account for soil-handling operations being performed only from 8:00 AM until 5:00 PM each day. The model also accounts for the difference in terrain height between sources and receptors.

Both surface and upper air meteorological data from the Pittsburgh International Airport was used for the modeling. Pittsburgh International Airport is the closest National Weather Service 24-hour reporting station. Five full years (1984-88) of data were used. Only those hours corresponding to the planned period of daily work, 8:00 AM until 5:00 PM, were used in the modeling.

AP-42 (*Compilation of Air Pollutant Emission Factors, Volume 1, Fifth Edition*, AP-42) emission factors were used to estimate the uncontrolled emission rate of PM from the truck loading and unloading and the grader spreading. Copies of applicable sections of AP-42 are provided in Appendix L. The truck loading and unloading was modeled as an elevated area source corresponding to the back of the truck. The grader spreading was modeled as a ground-level area source corresponding to a layer one foot deep. A maximum and minimum emission rate was estimated based on the estimated range of the soil-handling rate, 100 to 200 yd^3 per day. The soil-handling rate corresponds to the loading, unloading, and spreading of material from five to ten trucks per day.

Each source was modeled using a polar array of receptors spaced at 15° increments around the source. The maximum and minimum distance for this polar array was chosen to correspond to the maximum and minimum source-receptor distance for each of the three on-site options. Receptor rings were placed at 25 meter intervals within these maximum and minimum distances. The highest value within this polar array was chosen to represent the maximum fence-line concentration. (The fence-line is the proposed perimeter fence that will be located approximately thirty feet from the outer edge of the berm.) Receptors to represent the workers were placed in a ring 10 meters from the source. They also were spaced on 15° intervals. In addition, receptors were placed at the location of the nearest neighbors.

Rural dispersion coefficients were used for the modeling due to the nature of the surrounding area. Sensitivity analyses were performed by varying source and receptor elevations. Results showed that, for this application, results were insensitive to terrain heights, thus the modeling was performed with flat terrain.

Modeling results are presented in Appendix L. Modeled air concentrations were found to drop off rapidly with distance from the emission source; therefore, the maximum concentration was generally found in the first receptor ring (25 meters). These findings were common to all three on-site remediation options under consideration. Only the maximum distance varied among the three options. Consequently, this analysis applies to all three remediation options under consideration.

Two different measures of PM emissions were estimated: PM_{10} annual averages were calculated for comparison with the National Ambient Air Quality Standard (NAAQS), which is 50 $\mu g/m^3$ (based on an annual average), and $PM_{2.5}$ one-hour averages were also calculated for use in radiological dose calculations. The maximum fence-line PM_{10} concentrations due to thoriated material operations were found to be 22.0 $\mu g/m^3$. Background PM_{10} concentrations are on the order of 30 $\mu g/m^3$ (Charleroi and Monesson, approximately 20 miles east, reported 26 and 32 $\mu g/m^3$, respectively, as their 1995 annual PM_{10} concentration). The sum of the modeled PM_{10} maximum concentration and the background (52 $\mu g/m^3$) are barely over the NAAQS (50 $\mu g/m^3$).

These results should be considered very conservative for two reasons.

1. The emission rates used in the model are uncontrolled (assume no dust suppression). Simple dust suppression techniques (e.g., water spray) which will be utilized can yield control efficiencies greater than 50%, sometimes as high as 80% or more.

2. The majority of the modeled dust generated was from the grading operation. The emission rate from the grader is strongly dependent on the silt content of the material. It was conservatively assumed that all the silt in the soil/slag mixture was derived from the thoriated slag. Thoriated slag when crushed or milled forms primarily sand-sized particles and does not weather appreciably; therefore this assumption was extremely conservative.

Visibility. Excavation of thoriated slag in the open storage area and construction of any of the three on-site storage cell options will be visible to traffic traveling west on I-70 and by traffic on Caldwell Avenue. Construction of storage cell Option 1 on top of the hill will also be visible to residents of The Circle (residential street). Construction of the storage cell Option 3 in the railroad area will also be visible to residents along Weirich Avenue.

Noise. An analysis of noise impacts due to construction activities was performed. Based on calculations, it was determined that at distances of 500 ft. from the construction equipment there will be no increase to the sound pressure levels due to construction equipment over ambient conditions. Noises from construction equipment (such as engines and back up alarms) will be distinctly audible, however, they will not increase sound pressure levels at distances of 500 ft. away. Calculations of noise impact are provided in Appendix M. All of the construction activities (with the exception of emergencies) will be performed between the hours of 8:00 AM and 5:00 PM Eastern Standard or Daylight Time and limited to weekdays. Workers will be required to utilize hearing protection, as specified in the facility Health and Safety Plan (HASP).

All construction activities will be performed between the hours of 8:00 AM and 5:00 PM Eastern Standard Time and limited to weekdays. In case of an emergency, it may be necessary to perform construction activities outside these hours. Emergencies may include a major precipitation event or other natural phenomenas which require immediate response to minimize damage both on-site and off-site.

Postremediation

Air Quality. The current levels of fugitive dust emissions containing thoriated slag are minor since the majority of the thoriated slag is covered with soil and because the thoriated slag is not in a form which decomposes to produce an airborne dust. The glass-like structure of the thoriated slag severely inhibits the potential for the material to be transported from the facility as airborne dust. Therefore, no significant impact to air quality is anticipated compared to existing facility conditions.

Visibility. Following remediation, the selected on-site storage option will be vegetated with trees planted around the perimeter. Each of the options will result in permanent changes to the existing area topography.

Option 1 in the hill area will increase the height of the hill by approximately 29 feet and will appear as a natural hill top. Option 2, the open storage area will, at its maximum height, be 1072 ft-msl or approximately 8 feet below the level of I-70. This will be an obvious change in the existing ground surface which will not appear as natural in regards to other topographic features. The railroad area option, Option 3, will for the most part blend into the existing topography. Maintenance of upstream ditches or channels will be critical to maintenance of slope stability in Option 3 and will be performed at recommended intervals.

Noise. Maintenance activities to be conducted in association with a storage cell include mowing and possibly pumping of the leachate collection and leak detection systems. These activities will not significantly impact the area since they will be performed only periodically in accordance with a maintenance plan.

4.4.2 Off-Site Management Alternative

Remediation

Air Quality Modeling. Excavation of the thoriated material would increase traffic on-site by approximately 50 vehicles per day. Due to the proximity of I-70 to the facility and the high volumes of traffic along I-70 (39300 vehicles per 24 hours), the increase in pollutants associated with these vehicles will not result in significant impact.

Dust control measures such as water or other dust suppression sprays will be used to minimize transport of airborne particles during soil handling activities. Dust control measures will also be utilized on stockpiles and on the final graded area until vegetation is established. Air quality impacts from excavation and transportation of the thoriated material are anticipated to be minimal. Air quality modeling as described in Section 4.4.1 was also performed for this alternative and the calculations are presented in Appendix L. Two different measures of PM emissions were estimated: PM_{10} annual averages were calculated for comparison with the National Ambient Air Quality Standard (NAAQS), which is 50 $\mu g/m^3$ (based on an annual average), and $PM_{2.5}$ one-hour averages were also calculated for use in radiological dose calculations. The maximum fence-line PM_{10} concentrations due to thoriated material operations were found to be 22.0 $\mu g/m^3$. Background PM_{10} concentrations are on the order of 30 $\mu g/m^3$ (Charleroi and Monesson, approximately 20 miles east, reported 26 and 32 μg/m³, respectively, as their 1995 annual PM_{10} concentration). The sum of the modeled PM_{10} maximum concentration and the background (52 μg/m³) are barely over the NAAQS (50 μg/m³).

Decommissioning alteractive 3, off-site management, includes only the excavating and loading of material. The air quality modeling was performed assuming no dust suppression techniques are utilized.

These results should be considered very conservative for two reasons.

1. The emission rates used in the model are uncontrolled (assume no dust suppression). Simple dust suppression techniques (e.g., water spray) which will be utilized can yield control efficiencies greater than 50%, sometimes as high as 80% or more.

2. The majority of the modeled dust generated was from the grading operation. The emission rate from the grader is strongly dependent on the silt content of the material. It was conservatively assumed that all the silt in the soil/slag mixture was derived from the thoriated slag. Thoriated slag when crushed or milled forms primarily sand-sized particles and does not weather appreciably, therefore this assumption is extremely conservative.

Visibility. Excavation activities associated with removal of the thoriated material and subsequent backfilling of the excavated areas will be visible to travelers along I-70 west and Caldwell Avenue.

Noise. An analysis of noise impacts due to construction activities was performed. Based on calculations, it was determined that at distances of 500 ft. from the construction equipment there will be no increase to the sound pressure levels due to construction equipment over ambient conditions. Noises from construction equipment (such as engines and back up alarms) will be distinctly audible, however, they will not increase sound pressure levels at distances of 500 ft. away. Calculations of noise impact are provided in Appendix M. All of the construction activities (with the exception of emergencies) will be performed between the hours of 8:00 AM and 5:00 PM Eastern Standard Time and limited to weekdays. Workers will be required to utilize hearing protection as specified in the HASP.

Postremediation

Air Quality. The current levels of fugitive dust emissions containing thoriated slag are minor since the majority of the thoriated slag is covered with soil. Moreover, the thoriated slag is not in a form to decompose to produce an airborne dust. The glass-like structure of the thoriated slag provides for containment of the material to the facility. Therefore no significant impact to air quality is anticipated compared to existing facility conditions.

Visibility. There will be no change to the existing facility conditions because grades will be restored to pre-excavation grades following thoriated slag removal.

Noise. There will be no maintenance or other activities performed during the postremediation phase which are anticipated to result in any noise impact.

4.4.3 No Action Alternative

Under the no action alternative, no remediation activity would be performed therefore no impacts would result.

4.5 RISK ASSESSMENT

References utilized in the Risk Assessment Include:

- 10 CFR 71;
- 10 CFR 20.302;
- SECY 81-576;
- USNRC, 1997;
- USEPA, 1993;
- and USEPA, 1988.

A risk assessment was conducted to aid in the evaluation and selection of alternatives for the thoriated material at the Washington facility. Risk assessment is a scientific process for evaluating potential risks associated with substances and agents, such as radiation, that have the potential to cause adverse health effects if people are exposed to the materials. There is a degree of uncertainty associated with estimating potential risks associated with exposure to relatively low levels of environmental agents, such as the thorium present in material at the Molycorp facility. Consequently, the practice of risk assessment, as it is currently required by Federal agencies such as the NRC, employs a number of conservative assumptions to ensure that the potential risks are not underestimated. Therefore, the numerical estimates of potential risks presented in this (and any other) risk assessment should be considered estimates to be used as a tool for comparing among various situations, such as the storage alternatives being considered at Molycorp. They do not represent actual risks to people at the facility now or in the future.

This section of the report presents a summary of the technical approach, major assumptions, and primary findings of the risk assessment for the Molycorp facility. The technical details of the risk assessment are presented in Appendix N.

As previously discussed, this report evaluates three alternatives for management of the thoriated materials at the Washington facility:

1) On-site storage in an engineered storage cell (three location options)
2) Off-site management at an NRC licensed commerical disposal facility
3) No-Action

This risk assessment evaluated potential radiation doses and risks associated with the implementation of each alternative. The risk assessment was conducted in accordance with applicable NRC regulations and policies. Calculations were performed using three NRC accepted models: the RESRAD code developed by the U.S. Department of Energy (DOE), the Microshield code published by Grove Engineering, and the radiation transportation code RADTRAN-4 developed by Sandia National Laboratory to assess potential transportation risks. The following sections present the various components of the risk assessment.

4.5.1 Source Characterization

The first step in the risk assessment process was the characterization of the nature and extent of potential radioactive sources throughout the facility. The next step was to determine the potential impact on site personnel, contract workers. and the neighboring and surrounding populace as a result of the implementation of the three remediation alternatives. Compliant with a recommendation by the NRC, the assessment of potential risks posed at the site was accomplished by modeling the site as a series of area sectors:

- Northern Sector - area adjacent to the Findlay property and area west of the cooling tower and the impoundment area;
- Southern Sector - areas south of Caldwell Avenue, excluding the slag pile;
- Slag Pile; and
- Area Beneath the Slag Pile.

Within each area, the site characterization data were reviewed to determine the depth and extent of thoriated material present above natural background concentrations (1 to 2 pCi/g) and also above the 30 pCi/g proposed cleanup level (areas with a concentration greater than 30 pCi/g will be excavated for storage).

The approaches for estimating doses from the Slag Pile are different than for the other areas because it is an above-ground area source. Therefore, the Microshield model was used for the Slag Pile and the RESRAD model was used for the other areas. The following subsections describe the source characterization that is specific to each of the three alternatives.

4.5.1.1 On-Site Storage Alternative (three location options)

Under the On-Site Storage Alternative, all thoriated material above 30 pCi/g is assumed to be removed and placed in the on-site storage unit. As part of this overall strategy, approximately 3,300 yd^3 of material from Molycorp's York, PA facility (containing lower concentrations of radioactive material) would also be placed in the storage cell. Excavated areas would be returned to original grade with clean soil that is then seeded and mulched to control erosion. The storage cell will be capped with synthetic liners, biotic material to discourage burrowing animals, and three feet of clean soil.

Under this alternative, potential radiation doses may occur from the thoriated material (containing less than 30 pCi/g) left in place after the removal action, as well as the thoriated material (containing greater than 30 pCi/g) placed in the storage cell. Radiation doses for the areas where material was removed were estimated based on the assumption that the concentration of residual material less than 30 pCi/g is covered by clean fill. For the storage cell, the material is contained beneath three feet of soil and other capping material. Doses were estimated taking this into account.

4.5.1.2 Off-Site Management Alternative

Under the Off-Site Management Alternative, material above 30 pCi/g would be removed, packaged and transported to an NRC approved, licensed commercial disposal facility. The York material as well as the material contained in rolloffs from previous removal actions are included. Excavated areas would be returned to their original grade with clean soil, and paved or seeded and mulched.

Under this alternative, potential radiation doses may occur from the thoriated material left in place after the removal action. Potential exposure also may occur during the removal of the material containing greater than 30 pCi/g.

4.5.1.3 No-Action Alternative

The No-Action Alternative is evaluated based on the assumption that thoriated material at the facility remains in its current condition without any further action. Existing site characterization data were used to estimate radiation doses from all areas containing thoriated material.

4.5.2 Exposure Assessment

Based on the nature and location of the thoriated material being evaluated at the Washington facility, there are three potential receptors that could receive radiation doses under all of the alternatives: workers involved in implementing the remedial action, workers at the facility, and off-site residents.

The receptor population with the greatest potential for exposure consists of the workers involved in the implementation of the on-site or off-site storage alternative (such a worker would not be required for the No-Action Alternative). These individuals would be involved in excavating, packaging, transporting, hauling and placing, and grading activities. However, these tasks will be performed by specially-trained workers who will be equipped with the appropriate personal protection equipment. As required under the site health and safety plan (HASP), precautions will be taken to ensure that worker exposure is kept to a minimum by strict adherence to NRC's As Low As Reasonably Achievable (ALARA) procedures.

To estimate the impact to this potential receptor, referred to as "Remediation Worker," three activities were evaluated: excavating, hauling, and grading. It was assumed that the same individual would not be involved in each activity. The dose impacts associated with the performance of the three different remediation activities were evaluated. The total volume of material being removed from the Washington facility subsurface was assumed to be 45,000 yd^3, with an average concentration of 80 pCi/g. The specific details of the exposure situation are described in Appendix N.

Workers employed at the facility could be exposed to either residual or stored material during the course of routine activities following completion of each of the three alternatives. For this assessment, the potential receptor is referred to as the "Industrial Worker" receptor.

Potentially, an off-site resident could be exposed to radiation emitted from residual or stored material. Theoretically, exposure could occur at a place of residence or during travels past the facility. For the subject risk assessment, the receptor is referred to as the "Off-Site Resident." This "Off-Site Resident" is either the casual observer at the current fence line or the nearest resident.

A fourth receptor, called the "Resident Farmer," was also evaluated in this risk assessment. This is a purely hypothetical receptor required by the NRC. This receptor is defined as someone who moves on to the site and constructs a home after the remediation. This individual grows crops on site for personal consumption, uses an on-site well for drinking and irrigation purposes, raises livestock on site for personal consumption, and catches and eats fish from a nearby stream. Clearly this situation is extremely unlikely to occur at the Molycorp facility with its long history of industrial use. Although potential risks are required to be calculated for this receptor, they should be considered "worst-case" and not directly relevent to the analysis of potential remedial alternatives.

Figure 4-1 presents a graphical depiction of the location of these potential receptors relative to the source areas at the site.

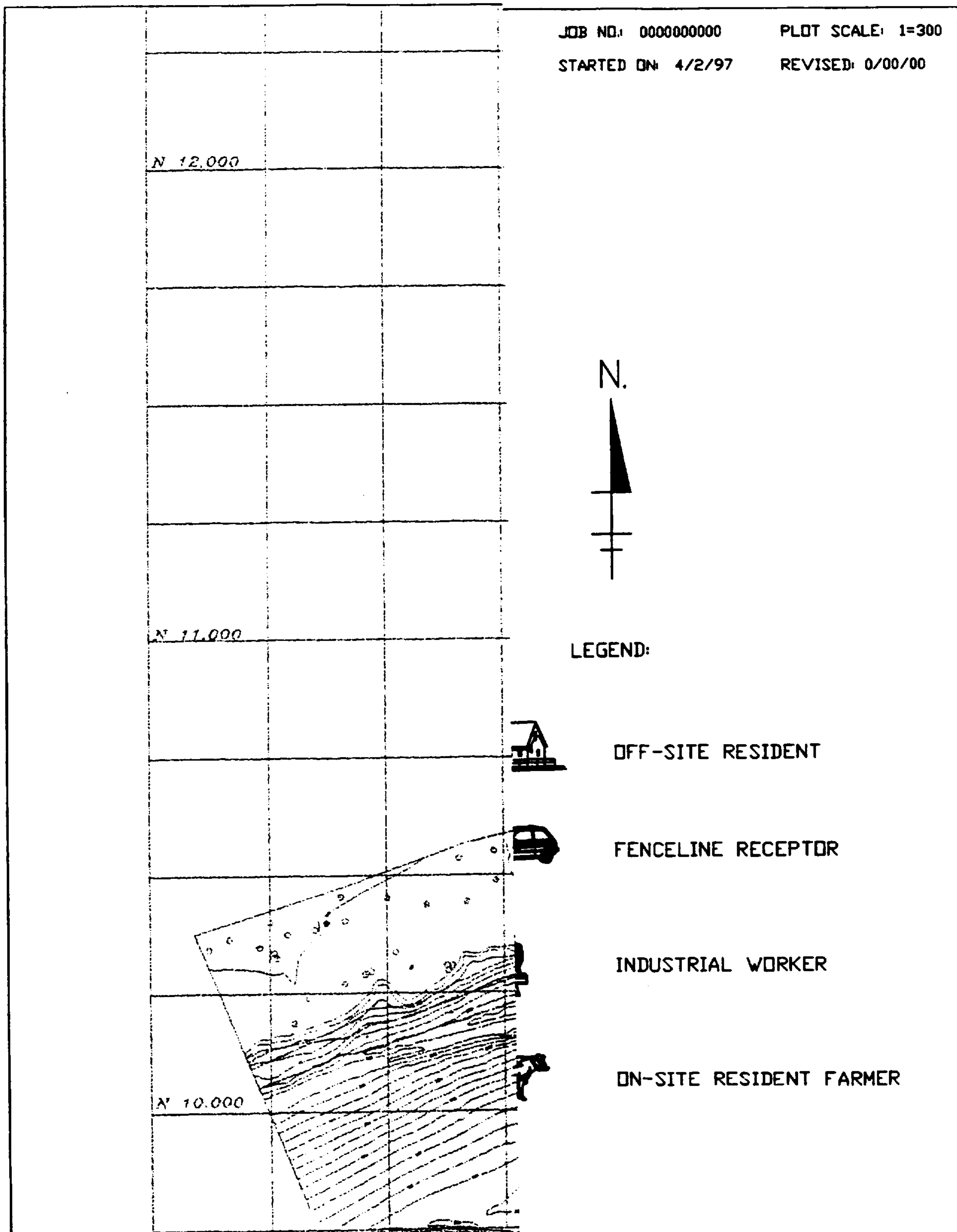


FIGURE 4-1

LOCATION OF RISK RECEPTORS

: 4/2/97	DR.: M. WILLIAMS
E: 1"=300'	DWG. NO. 20155001

As indicated previously, the slag pile was evaluated using a different model (the Microshield code) than was used for the other areas (the RESRAD model). For the slag pile, exposure doses were estimated for potential receptors located at various distances from the pile. These distances ranged from ten feet to five thousand feet. This set of receptors is only applicable to the No-Action Alternative, as the pile would be removed in the On-Site or Off-Site Management Alternative.

For all of the above receptors, potential radiation doses are calculated on a yearly basis for 1,000 years. NRC requires these calculations out to a period of 1,000 years to model the ingrowth of thorium daughters and to model the impact upon the resident farmer and the industrial worker.

4.5.3 Results

The results of the risk assessment are presented in terms of estimated radiation dose, expressed in units of mrem/yr. To help put these estimated doses in perspective, it is useful to compare them to the estimated radiation doses received from natural background radiation and other common sources of radiation. These are presented in Table 4-2.

The NRC has also established exposure limits for the amount of radiation above background level an individual may receive. The occupational limit is 5,000 mrem maximum in any one year and 10,000 mrem total over any five year period. The current limit for the general public is 100 mrem/yr.

4.5.3.1 No-Action Management Alternative

Under the No-Action Alternative, potential radiation doses were estimated for the Industrial Worker, and the hypothetical on-site Resident Farmer. The estimated doses are summarized in Table 4-3.

The estimated doses associated with the slag pile are presented in Table 4-4.

As indicated by these estimates, potential doses to an industrial worker under the No-Action Alternative do not exceed either the occupational limit of 5,000 mrem/yr. or 10,000 mrem over five years. In addition, the contribution of the slag pile to the total estimated dose is minor on-site and inconsequential off-site. Over the last three years the maximum yearly dosage recorded for an employee at Molycorp's site was 35 mrem.

TABLE 4-2

{PRIVATE }Radiation Doses from Common Sources	
Source	Dose
One Airline Flight - Six Hours Roundtrip	3 mrem
Diagnostic X-rays	40 mrem/yr
Average National Background	300-360 mrem/yr

TABLE 4-3

{PRIVATE }Estimated Maximum Potential Doses for On-site Receptors Under No-Action Alternative				
Sector	Industrial Worker		Hypothetical On-Site Resident Farmer	
	Maximum Potential Dose (mrem/yr)	Year	Maximum Potential Dose (mrem/yr)	Year
Northern	508	100	1156	100
Southern	537	97.5	1221	96.9
Beneath Slag Pile	532	97.3	1216	95.6

TABLE 4-4

Doses Associated With the Slag Pile	
Location	Dose (mrem/yr)
20 ft (current fence line)	0.013
200 ft	0.0045
Nearest Residence (500 ft)	0.0003

4.5.3.2 On-Site Storage Alternative

Potential radiation doses were also estimated for the Remediation (Occupational) Worker, the Industrial Worker, the hypothetical on-site Resident Farmer under the On-site Storage Alternative and are presented in Tables 4-5 and 4-6. Doses were also calculated for the receptor standing on the surface of the storage unit following construction. The dose to this receptor is the same for each of the storage unit options.

As indicated, the estimated doses to the remediation worker are below the occupational limit of 5,000 mrem/yr. Potential doses to the industrial worker receptor are also below the occupational limit.

Soil acts as a shield against radiation. Soil with throiated material on the surface of the pile would act as a shield against radiation coming from deeper thoriated material. Calculations show that a person standing on the bare thoriated material would be exposed only to the radiation from the first foot or two of thoriated material. The same calculations indicate that two feet of "clean" soil would shield against almost one hundred percent of the radiation from the thoriated material it covers. A person standing on this cover (two or more feet of clean soil) would get no more radiation than standing on any other open grassy area in Washington County. Therefore, a person standing on the top of any of the proposed on-site storage cells would also get no more radiation than standing on any open grassy area in Washington County.

During all remediation activities (excavating, loading, hauling, etc.) the soil will be kept in a slightly wetted condition to eliminate potential fugitive dust generation and soil ingestion. In light of this, remediation workers expect some limited dose impacts (see Table 4-5 for potential occupational doses). Maximum potential dose impacts to the casual observer at the fence line (about 20 feet away) and the nearest resident (about 500 feet away) are expected to be small.

For the observer at the fence line and for the closest resident, the only component of exposure of any potential concern is from direct gamma. At 20 feet from the extended source, the dose from gamma exposure is reduced by 1/r where r is the distance in meters from the source. Table 8 (Appendix N) indicated an occupational gamma dose (for an excavator) of 1366 mrem for the anticipated two years of the project or about 0.34 mrem/hr (1366 mrem divided by 2 years divided by 2000 hours/year of remediation time). The 1/r factor reduces this to 0.056 mrem/hr. Assuming an observer, standing at the

TABLE 4-5

Estimated Maximum Potential Doses for Remediation Workers During the Clean-up Period	
Activity	Total Dose (mrem)
Excavator	1,425.7
Hauler	713.0
Grader	385.0

TABLE 4-6

Estimated Maximum Potential Doses for On-site Receptors to Residual Material Under On-Site StorageAlternative				
Sector	Industrial Worker		Hypothetical On-site Resident Farmer	
	Maximum Potential Dose (mrem/yr)	Year	Maximum Potential Dose (mrem/yr)	Year
Northern	2.56	1000	250	1000
Southern	2.52	1000	242	1000
Beneath Slag Pile	2.52	1000	242	1000

fence, watches for one hour per day for 250 days, the resulting maximum potential dose is 14 mrem per year. The national average background dose is 300-360 mrem/yr.

For the resident, the maximum potential dose drops off as $1/r^2$. The maximum potential dose at the resident's site (for 152 meters or 500 feet) is 15E-06 mR/hr. Assuming a remediation time of 2,000 hrs/yr, the resident's maximum potential dose would be 0.03 mrem. This also assumes the resident is at home and outside for the full time the remediation takes place, which is a very conservative assumption.

4.5.3.3 Off-Site Management Alternative

The estimated radiation doses for the Remediation Worker, Industrial Worker and hypothetical on-site Resident Farmer under the Off-site Storage Alternative are the same as were presented above for the On-Site Storage Alternative. This observation is the result of the fact that the only source of radioactive material under either set of alternatives is the thoriated material (that being removed and that which remains), assumed to be identical under either situation. The dose from the material stored in the cell is minimal (see Appendix N, Section 3.3).

4.5.4 Discussion

Based on the above analysis, there is a clear distinction between the No-Action Alternative and the On-site and Off-Site Management Alternatives in terms of their potential radiation impacts. While under the No-Action Alternative, potential doses to an Industrial Worker are estimated to be greater than 500 mrem/yr, these are still well below the present occupational limit of 5,000 mrem/yr for any one year and a 5-year maximum of 10,000 mrem. Under the On- and Off-Site Management Alternatives, potential doses to this receptor are estimated to be about 2.5 mrem/yr, approximately 200 times lower. The present occupational limit is 5,000 mrem/yr for any one year and a 5 year maximum of 10,000 mrem.

The vast majority of the estimated dose to the Industrial Worker receptor is from external gamma radiation. Under the No-Action Alternative, greater than 87% of the total dose to this receptor is from external gamma, with approximately 10% from inhalation excluding radon, approximately 2% from radon, and about 1% from soil ingestion. Upon completion of the On-Site and Off-Site Management Alternatives, 100% of the total dose is from external gamma radiation. This is due to the fact that the thoriated material will be covered and inaccessible for other potential exposures (e.g., inhalation and soil ingestion). This cover will also prevent the release of radon.

The relative contribution from the different pathways to the total dose was similar for the Remediation Worker. The dose from external gamma radiation contributed greater than 97% of the total, inhalation (excluding radon) contributed about 2%, and soil ingestion 1.0%.

As part of the risk assessment, the NRC required that Molycorp evaluate the potential effect on the estimated radiation dose associated with the mobility of thorium in the on-site material. The leachability testing of the thorium bearing slag at the Molycorp facility following ANSI (American National Standard Institute) standard 16.1 show the material to be "non-leachable" by definition (see Appendix K for details). However, it was assumed for this evaluation, that some small amount of thorium bearing leachate could be generated. The analysis was completed by performing a sensitivity evaluation of the distribution coefficient (K_d) for thorium in soil. This approach evaluates the migration rate of thorium bearing leachate. The K_d value (a retardation coefficient) for thorium is high. As stated in the sensitivity analysis, the most likely K_d value for the thorium material on-site is 60,000 cm^3/g. The dose associated with the K_d value for the various pathways and scenarios is similar to that for natural background values.

4.6 MONITORING PROGRAMS

Monitoring programs that will be utilized include the following.

4.6.1 Remediation

Exposure of workers to radiation will be monitored to ensure the exposure is kept within the regulatory limits. Additionally, the site specific HASP will ensure worker exposures are kept ALARA.

Baseline data for surface water, groundwater, soil and air have been collected and will be augmented with additional samples prior to implementing the chosen alternative. Data collection will continue throughout implementation to evaluate the effectiveness of the protective measures being utilized and corrective measures implemented, if necessary.

A facility Health and Safety Plan which includes monitoring activities will be developed and implemented.

4.6.2 Confirmation

The limits of excavation of the thoriated slag were determined during the facility characterization. These limits are considered to be the minimum limits of removal. Confirmation surveys will be performed to ensure that all thoriated slag with a radiation concentration greater than 30 pCi/g has been removed.

4.6.3 Long-Term Monitoring Phase

Long-term monitoring of any of the on-site management options will include inspection of the leachate collection system and periodic removal and management of the leachate which drains from the encapsulated soils. Inspection of the leak detection system will also be required to ensure liner integrity has not been compromised.

Long-term monitoring of the facility will also be required if the thoriated material is transported off-site.

4.7 MITIGATING ACTIONS

Some construction activities have potential adverse effects on upland, wetland, and aquatic ecosystems. The following measures will be used to mitigate adverse impacts which may occur.

- Provide personnel training for and implement a Spill Prevention and Response Plan to be utilized during remediation and postremediation monitoring.
- Develop and implement an Erosion and Sediment Control Plan in accordance with Pennsylvania Department of Environmental Protection (PADEP).
- Develop a construction management plan which details limits of construction which minimizes clearing and grubbing and construction activities in wetlands.
- Comply with all Federal, State, and local permit requirements.

In addition, if any of the on-site management options are chosen, institutional controls will be required to ensure appropriate care is provided for the facility. Institutional controls include deed restrictions and creation of financial assurance mechanisms to provide long-term monitoring and maintenance.

4.8 RELATIONSHIP BETWEEN SHORT TERM SITE IMPACTS AND LONG TERM PRODUCTIVITY

All of the on-site management alternatives would involve some minimal disturbance of the Washington facility in the short-term. During remediation there will be no significant impact on air quality and some minor impacts to noise and traffic. Once remediation is complete, environmental impacts would consist of restricted access to the storage cell area and any areas which contain residual thoriated slag and a small reduction in precipitation infiltration in the immediate cap area. In addition, the storage cell area will be dedicated only to thoriated material management, with new uses being restricted due to the construction of the cap.

Implementation of the off-site management alternative would also involve some minimal disturbance of the Washington facility in the short-term. During remediation there will be no significant impact on air quality and some minor impacts due to noise. Once remediation is complete, access to the site will once again be restricted to site personnel. The storage cell and remaining site areas will continue to be monitored and maintained.

5.0 COSTS AND BENEFITS ASSOCIATED WITH DECOMMISSIONING

This section presents an analysis of the costs and benefits of each of the five alternatives considered. It should be noted that the costs are in addition to any sums already spent by Molycorp on decommissioning at the Washington, Pennsylvania facility. The main focus of the analysis is on quantifiable, monetary values; i.e. capital costs (e.g. construction, material, labor) and operation and maintenance (O&M) costs (e.g. periodic inspections, monitoring). Other significant qualitative costs and benefits are identified. The direct costs of the alternatives are considered to be the capital investment and the O&M costs. Capital investments are short-term costs, whereas O&M costs are long-term. Long-term costs are characterized by present value - that is, a discount rate is applied to long-term costs in order to compare costs that occur at different points in time. Because the choice of the appropriate discount rate over long time periods is a controversial issue, the O&M costs will be evaluated using three different discount rates, 5%, 7%, and 10%. Operation and maintenance costs are only associated with the three on-site alternatives.

Capital and O&M costs for each alternative are discussed below, the exception being the no action alternative for which no costs are projected. Capital costs included mainly the material, equipment, and labor costs. A majority of these costs are from the *R.S. Means Heavy Construction Cost Data, 11th Edition* (R.S. Means, 1997) and copies of the referenced pages are provided in Appendix N. However, some of the costs included are from vendor quotes for similar services. All costs presented include the cost of equipment and labor. Because most of the cost items for the alternatives are the same, the unit costs are presented in Table 5-1, with the source for each. The specific costs for each alternative are described in greater detail in the following subsections. Activities associated with capital costs will be performed over a relatively short time period (three years or less), therefore, all capital costs are assumed at present value in 1997 dollars utilizing no discount rate.

5.1 On-Site Management Alternatives

The capital costs for the on-site containment cell alternatives include facility preparation and deed restrictions for the area of the cell, cell construction and closure, thoriated material excavation and placement, and facility refurbishing in the area of the thoriated material excavation and any other disturbed areas. A contingency of 20% has been added to account for miscellaneous equipment and material costs

Table 5-1

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Unit Costs

Item	Unit Cost		Source (Assumptions)
Site Prep			
Clearing and Grubbing	$ 10,910.00	Lump Sum	R.S. Means 021 104 0300 + 0350 + 0400
Build Haul Road	$ 85.88	per LF	Recent construction at Molycorp
Relocate Force Main Sewer	$ 80.00	per LF	R.S. Means 027-166-5040 & ICF Kasier Engineers' experience
Build Rail Spur	$ 88.50	per LF	R.S. Means 024 524 0820 (100 lb. rail on wood ties)
#8 Switch Turnout	$ 22,600.00	Each	R.S. Means 024 524 2200
Railroad car bumpers	$ 3,650.00	Each	R.S. Means 024 524 0100
Materials			
HPDE Drainage Net w/ Geotextile	$ 0.44	per SF	Vendor Quote
HDPE Geomembrane	$ 0.44	per SF	Vendor Quote
HPDE Drainage Net	$ 0.40	per SF	Vendor Quote
GCL (Claymax)	$ 0.64	per SF	Vendor Quote
Non-woven Geotextile	$ 0.88	per SY	Vendor Quote
Textured HDPE Geomembrane	$ 0.44	per SF	Vendor Quote
Clean Fill	$ 4.25	per CY	Vendor Quote
Topsoil	$ 8.00	per CY	Vendor Quote
Rock/Aggregate "Biotic" Layer	$ 17.70	per CY	R.S. Means 033 100 0850
Fencing - Gate	$ 1,000.00	per gate	R.S. Means 028 308 5070 (6'H, aluminized steel)
Fencing - Fence	$ 18.90	per LF	R.S. Means 028 308 0300 (6'H, aluminized steel)
Material Handling			
Excavation	$ 2.31	per CY	R.S. Means 022 238 0300 (Hydraulic backhoe)
Overburden Removal	$ 9.24	per CY	R.S. Means 022 238 0300 (+300% "surgical removal")
Thoriated Material Removal	$ 9.24	per CY	R.S. Means 022 238 0300 (+300% "surgical removal")
Backfilling	$ 2.21	per CY	R.S. Means 022 208 3320 (Front end loader)
Soil Placement	$ 2.21	per CY	R.S. Means 022 208 3320 (Front end loader)
Thoriated Material Placement	$ 2.21	per CY	R.S. Means 022 208 3320 (Front end loader)
Compaction	$ 0.83	per CY	R.S. Means 022 226 8700
Loading Rail Cars	$ 2.31	per CY	R.S. Means 022 238 0300 (Hydraulic backhoe)
Transportation to NRC licensed commercial disposal facility	$ 5.38	per CF	Shieldalloy EIS
Hauling, On-Site	$ 2.10	per CY	R.S. Means 022 266 1150 (1 mile round trip)
Hauling, Off-Site	$ 6,20	per CY	R.S. Means 022 266 1250 (10 mile round trip)
Miscellaneous			
Berm Construction	$ 3.04	per CY	R.S. Means 022 208 3320 (+ Compaction)
Radiological Surveys	$ 85.00	per Hour	Includes Labor and Equipment
Railcar switcher	$ 2,000.00	per Day	
Tipping Fee	$ 15.00	per CF	Vendor Quote
Hydroseeding	$ 1,308.12	per Acre	Vendor Quote
Groundwater Monitoring Wells	$ 10,000.00	Each	Vendor Quote

Notes:

CF = Cubic Foot
CY = Cubic Yard
LF = Linear Foot
SF = Square Foot
SY = Square Yard

(e.g., dust control measures), miscellaneous services (e.g., surveying), periodic progress reviews, and other miscellaneous expenses. The itemized costs are presented in Table 5-2.

The O&M costs for each of the on-site containment cell alternatives would be the same. These costs include periodic inspections and monitoring to assure that the cell is in good repair and that the liner system is not leaking. Table 5-3 summarizes the O&M costs over a thirty year period and provides the costs in terms of present value (1997 dollars) by applying the discount rates described above (5%, 7%, and 10%).

5.2 Off-Site Management Alternative

The capital costs for the off-site management alternative include facility preparation, thoriated material excavation, railcar loading, transportation, tipping fees, and facility refurbishing in the area of the thoriated material excavation and any other disturbed areas. A contingency of 20% has been added to account for miscellaneous equipment and material costs (e.g., dust control measures), miscellaneous services (e.g., surveying), periodic progress reviews, fluctuations in tipping fees, and other miscellaneous expenses. The itemized costs are presented in Table 5-2. The existing groundwater monitoring program will be continued. Costs associated for O & M would therefore include semi-annual sampling and analysis. This report assumes that the off-site commercial disposal facility to be utilized will be Envirocare in Clive, Utah in order to generate order of magnitude cost estimates for transportation and disposal.

5.3 No-Action Alternative

The No Action Alternative assumes that the existing monitoring program will continue. Costs associated with the no action alternative would therefore include semi-annual sampling and analysis.

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Cost Estimate

Item		Unit Cost		Option 1 Hill Qty	Option 1 Hill Cost	Option 2 Open Storage Area Qty	Option 2 Open Storage Area Cost	Option 3 Railroad Qty	Option 3 Railroad Cost	Option 4 Off-Site Disposal Qty	Option 4 Off-Site Disposal Cost	No Action Qty	No Action Cost
Site Prep													
Mobilization/Site Preparation		$ 30,000.00	Lump Sum	1	$ 30,000	1	$ 30,000	1	$ 30,000	1	$ 30,000	not applicable	
Deed Restrictions		$ 10,000.00	Lump Sum	1	$ 10,000	1	$ 10,000	1	$ 10,000	not required		not applicable	
Clearing and Grubbing		$ 10,910.00	per acre	4	$ 43,600	1	$ 10,900	6	$ 65,500	not applicable		not applicable	
Build Haul Road		$ 85.88	per LF	existing haul road		not applicable		200	$ 17,200	not applicable		not applicable	
Relocate Force Main Sewer		$ 80.00	per LF	not applicable		500	$ 40,000	not applicable		not applicable		not applicable	
Cell Construction													
Excavation (total cut)		$ 2.31	per CY	33,000	$ 76,200	6,900	$ 15,900	68,300	$ 157,800	not applicable		not applicable	
Berm Construction	(1)	$ 3.04	per CY	13,800	$ 42,000	24,900	$ 75,700	5,400	$ 16,400	not applicable		not applicable	
Cell Liner													
HDPE Drainage Net w/ Non-Woven Geotextile (one side)		$ 0.44	per SF	105,700	$ 46,500	101,400	$ 44,600	143,200	$ 63,000	not applicable		not applicable	
HDPE Geomembrane	(2)	$ 0.44	per SF	211,400	$ 93,000	202,900	$ 89,300	286,300	$ 126,000	not applicable		not applicable	
HDPE Geonet		$ 0.40	per SF	105,700	$ 42,300	101,400	$ 40,600	143,200	$ 57,300	not applicable		not applicable	
GCL Claymax		$ 0.64	per SF	105,700	$ 67,600	101,400	$ 64,900	143,200	$ 91,600	not applicable		not applicable	
Removal & On-Site Disposal													
Overburden Removal		$ 9.24	per CY	17,500	$ 161,700	17,500	$ 161,700	17,500	$ 161,700	17,500	$ 161,700	not applicable	
Thoriated Material Removal	(3)	$ 9.24	per CY	58,600	$ 541,500	58,600	$ 541,500	58,600	$ 541,500	58,600	$ 541,500	not applicable	
Radiological Surveys		$ 85.00	per Hour	2,080	$ 176,800	2,080	$ 176,800	2,080	$ 176,800	2,080	$ 176,800	not applicable	
Hauling, On-Site		$ 2.10	per CY	62,000	$ 130,200	62,000	$ 130,200	62,000	$ 130,200	62,000	$ 130,200	not applicable	
Thoriated Material Placement and Compaction	(1)	$ 3.04	per CY	62,000	$ 188,500	62,000	$ 188,500	62,000	$ 188,500	0	$ -	not applicable	
Cap Construction													
GCL (Claymax)		$ 0.64	per SF	130,000	$ 83,200	123,200	$ 78,800	167,300	$ 107,100	not applicable		not applicable	
Textured HDPE Geomembrane		$ 0.44	per SF	130,000	$ 57,200	123,200	$ 54,200	167,300	$ 73,600	not applicable		not applicable	
HDPE Drainage Net w/ Non-Woven Geotextile (both sides)		$ 0.44	per SF	130,000	$ 57,200	123,200	$ 54,200	167,300	$ 73,600	not applicable		not applicable	
Rock/Aggregate "Biotic" Layer	(1)	$ 3.04	per CY	4,500	$ 13,700	4,300	$ 13,100	5,800	$ 17,600	not applicable		not applicable	
Non-woven Geotextile (one layer)		$ 0.88	per SY	14,400	$ 12,700	13,700	$ 12,100	18,600	$ 16,400	not applicable		not applicable	
Cover Soil (clean fill)	(1)	$ 3.04	per CY	6,800	$ 20,700	6,400	$ 19,500	8,700	$ 26,400	not applicable		not applicable	
Topsoil	(1)	$ 3.04	per CY	2,300	$ 7,000	2,100	$ 6,400	2,900	$ 8,800	not applicable		not applicable	
Hyroseeding		$ 1,308.12	per Acre	4	$ 5,200	4	$ 5,200	6	$ 7,800	not applicable		not applicable	
Fencing - Gate		$ 1,000.00	per gate	1	$ 1,000	1	$ 1,000	1	$ 1,000	not applicable		not applicable	
Fencing - Fence		$ 18.90	per LF	1,500	$ 28,400	1,500	$ 28,400	1,800	$ 34,000	not applicable		not applicable	
Site Refurbishing													
Backfill	(1)(4)	$ 3.04	per CY	62,800	$ 190,900	62,800	$ 190,900	62,800	$ 190,900	62,800	$ 190,900	not applicable	
Hydroseeding		$ 1,308.12	per Acre	4	$ 5,200	4	$ 5,200	4	$ 5,200	4	$ 5,200	not applicable	
Off-Site Soils													
Clean Fill	(5)(6)(7)	$ 10.45	per CY	26,100	$ 272,700	63,300	$ 661,500	0	$ -	45,300	$ 473,400	not applicable	
Rock/Aggregate "Biotic" Layer	(5)	$ 23.90	per CY	4,500	$ 107,600	4,300	$ 102,800	5,800	$ 138,600	not applicable		not applicable	
Cover Soil	(5)(7)	$ 10.45	per CY	6,800	$ 71,100	6,400	$ 66,900	0	$ -	not applicable		not applicable	
Topsoil	(5)	$ 14.20	per CY	2,300	$ 32,700	2,100	$ 29,800	2,900	$ 41,200	not applicable		not applicable	

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Cost Estimate

Item	Unit Cost	Option 1 Hill		Option 2 Open Storage Area		Option 3 Railroad		Option 4 Off-Site Disposal		No Action	
		Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost	Qty	Cost
Off-Site Disposal											
#8 Switch Turnout	$ 22,600.00 Each	not applicable		not applicable		not applicable		1	$ 22,600	not applicable	
Build Rail Spur	$ 88.50 per LF	not applicable		not applicable		not applicable		500	$ 44,300	not applicable	
Railroad Car bumpers	$ 3,650.00 Each	not applicable		not applicable		not applicable		1	$ 3,700	not applicable	
Loading Rail Cars	$ 2.31 per CY	not applicable		not applicable		not applicable		62,000	$ 143,200	not applicable	
Railcar Switcher	$ 2,000.00 per Day	not applicable		not applicable		not applicable		100	$ 200,000	not applicable	
Transportation to Utah (Rail)	$ 5.38 per CF	not applicable		not applicable		not applicable		1,674,000	$ 9,006,100	not applicable	
Tipping Fee	$ 15.00 per CF	not applicable		not applicable		not applicable		1,674,000	$ 25,110,000	not applicable	
Groundwater Monitoring Wells	$ 10,000.00 Each	5	$ 50,000	5	$ 50,000	5	$ 50,000	0	$ -		$ -
Construction Cost Subtotal			$ 2,666,400		$ 3,000,600		$ 2,625,700		$ 36,239,600		$ -
Overhead and Profit	5%		$ 133,320		$ 150,030		$ 131,285		$ 1,811,980		$ -
Subtotal			$ 2,799,720		$ 3,150,630		$ 2,756,985		$ 38,051,580		$ -
Contingencies	20%		$ 559,944		$ 630,126		$ 551,397		$ 7,610,316		$ -
Construction Cost Total			$ 3,359,664		$ 3,780,756		$ 3,308,382		$ 45,661,896		$ -
Other Costs											
O&M Costs (@5% - see Table 5-3)			$ 307,500		$ 307,500		$ 307,500		$ 276,700		$ 276,700
Administrative Costs	2%		$ 67,193		$ 75,615		$ 66,168		$ 913,238		$ -
Engineering Oversight	4%		$ 134,387		$ 151,230		$ 132,335		$ 1,826,476		$ -
Permits and Legal	2%		$ 67,193		$ 75,615		$ 66,168		$ 913,238		$ -
Implementation Cost Total			$ 3,935,937		$ 4,390,716		$ 3,880,553		$ 49,591,548		$ 276,700
Engineering Design Cost		5%	$ 196,797	5%	$ 219,536	5%	$ 194,028	1%	$ 495,915	0%	$ -
Total Capital Cost			$ 4,132,734		$ 4,610,252		$ 4,074,580		$ 50,087,463		$ 276,700

Notes

CF = Cubic Foot
CY = Cubic Yard
LF = Linear Foot
SF = Square Foot
SY = Square Yard

(1) Unit cost includes material placement ($2.21/CY) and compaction ($0.83/CY)
(2) 2 layers
(3) Quantity includes total thoriated slag (62,000 CY) - that which has already been excavated into roll-off boxes (4,000 CY)
(4) Quantity needed for backfilling of excavated areas. Quantity equals total thoriated slag (62,000 CY) + overburden (17,500 CY) - thoriated soil (3,300 CY) - roll-off box slag (4,000 CY) - stockpile slag (10,000 CY)
(5) Unit cost includes material cost and the cost of hauling it to the site ($6.20)
(6) Off-site fill needed to backfill excavated soil areas and to construct cell berms
(7) No off-site soil will be needed for backfill material, berm construction, or cover soil for Option 3 due to the excess cut material available

Table 5-3

Molycorp, Inc.
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O&M Costs

Item	Annual Cost	Present Worth (1) 5%	7%	10%
Quarterly Inspections Includes: inspection and pumping of leachate collection system, leak detection system, sampling and analysis.	$18,000	$276,700	$223,400	$169,700
Semiannual Maintenance Inspections Includes: maintenance inspections, mowing, fence repair, soil and vegetation replacement.	$1,000	$ 15,400	$ 12,400	$ 9,400
Annual Visual and Ambient Radiological Surveys	$1,000	$ 15,400	$ 12,400	$ 9,400
Total O&M Costs	$20,000	$307,500	$248,200	$188,500

(1) Present worth is based on a 30-year time period. Three different discount factors are shown.

6.0 ENVIRONMENTAL AND ECONOMIC IMPACT SUMMARY

A matrix summarizing the environmental and economic impacts as presented in Sections 4.0 and 5.0 are presented in Table 6-1.

TABLE 6-1

Summary of Anticipated Environmental and Economic Impacts Due to Implementation of Decommissioning Options

		On-Site Disposal Options			Off Site Disposal
		Option 1 Hill Area	Option 2 Open Storage Area	Option 3 Railroad Area	
Land Use	Remediation	Assumes change to current zoning is performed	No conflict with current land use and zoning	Assumes change to current zoning is performed	No conflict with current land use and zoning
	Postremediation	Dedication of 4 acres for storage cell, restricted access and land use	Dedication of 4 acres for storage cell, restricted access and land use	Dedication of 5.25 acres for storage cell, restricted access and land use	Restricted access and land use
Socioeconomic Resources	Remediation	Minor increase in jobs, payroll, and taxes (< 1 percent)	Minor increase in jobs, payroll, and taxes (< 1 percent)	Minor increase in jobs, payroll, and taxes (< 1 percent)	Minor increase in jobs, payroll, and taxes (< 1 percent)
	Postremediation	No significant impact to socio-economic resources	No significant impact to socio-economic resources	No significant impact to socio-economic resources	Potential impact based on use of current storage area
Cultural Resources	Remediation	No adverse impacts to cultural resources	No adverse impacts to cultural resources	No adverse impacts to cultural resources	No adverse impacts to cultural resources
	Postremediation	No adverse impacts to cultural resources	No adverse impacts to cultural resources	No adverse impacts to cultural resources	No adverse impacts to cultural resources
Surface water	Remediation	Excavation within the 100 yr. flood plain. Erosion and sediment controls utilized	Located within the 100 yr. floodplain. Erosion and sediment controls utilized	Excavation within the 100 yr. flood plain. Erosion and sediment controls utilized	Excavation within the 100 yr. flood plain. Erosion and sediment controls utilized
	Postremediation	No impact to surface water quality, minor increase in surface water quantity	Relocation of 100 yr. floodplain. No impact to surface water quality, minor increase in surface water quantity	No impact to surface water quality, minor increase in surface water quantity	No impact to surface water quantity or quality

TABLE 6-1

Summary of Anticipated Environmental and Economic Impacts
Due to Implementation of Decommissioning Options

		On-Site Disposal Options			Off Site Disposal
		Option 1 Hill Area	Option 2 Open Storage Area	Option 3 Railroad Area	
Groundwater	Remediation	No groundwater effects outside the limits of excavation and construction.	No groundwater effects outside the limits of excavation and construction.	No groundwater effects outside the limits of excavation and construction.	No groundwater effects outside the limits of excavation.
	Postremediation	Infiltration of precipitation prohibited by impermeable cap layers. Semi-annual monitoring and analysis of leachate collection, leak detection and groundwater monitoring wells.	Infiltration of precipitation prohibited by impermeable cap layers. Semi-annual monitoring and analysis of leachate collection, leak detection and groundwater monitoring wells.	Infiltration of precipitation prohibited by impermeable cap layers. Semi-annual monitoring and analysis of leachate collection, leak detection and groundwater monitoring wells.	Semi-annual groundwater monitoring well analysis using existing wells.
Air Quality	Remediation	No significant impact to air quality during remediation.	No significant impact to air quality during remediation.	No significant impact to air quality during remediation.	No significant impact to air quality during remediation.
	Postremediation	No change to existing conditions	No change to existing conditions	No change to existing conditions	No change to existing conditions

TABLE 6-1

Summary of Anticipated Environmental and Economic Impacts Due to Implementation of Decommissioning Options

		On-Site Disposal Options			Off Site Disposal
		Option 1 Hill Area	Option 2 Open Storage Area	Option 3 Railroad Area	
Visibility	Remediation	Construction activities visible from I-70, The Circle, Caldwell Avenue and Weirich Ave.	Construction activities visible from I-70 and Caldwell Ave.	Construction activities visible from I-70, Caldwell Avenue and Weirich Ave.	Construction activities visible from I-70 and Caldwell Road
	Postremedation	Change in landscape will blend into surrounding topography	Visible change in landscape that does not conform with surrounding topography	Change in landscape will blend into surrounding topography	Minimal change to existing topographic configuration. (Pile removed)
Noise Sound Pressure Level	Remediation	No significant impact to sound pressure level	No significant impact to sound pressure level	No significant impact to sound pressure level	No significant impact to sound pressure level
	Postremediation	No change to existing sound pressure level	No change to existing sound pressure level	No change to existing sound pressure level	No change to existing sound pressure level
Human Health	Remediation	ALARA procedures implemented to minimize impact	ALARA procedures implemented to minimize impact	ALARA procedures implemented to minimize impact	ALARA procedures implemented to minimize impact
	Postremediation	Less exposure following remediation	Less exposure following remediation	Less exposure following remediation	Less exposure following remediation
Terrestrial Ecology	Remediation	No impact to terrestrial ecology	No impact to terrestrial ecology	No impact to terrestrial ecology	No impact to terrestrial ecology
	Postremediation	No impact to terrestrial ecology	No impact to terrestrial ecology	No impact to terrestrial ecology	No impact to terrestrial ecology

TABLE 6-1

Summary of Anticipated Environmental and Economic Impacts
Due to Implementation of Decommissioning Options

		On-Site Disposal Options			Off Site Disposal
		Option 1 Hill Area	Option 2 Open Storage Area	Option 3 Railroad Area	
Aquatic Ecology	Remediation	No impact to aquatic ecology	No impact to aquatic ecology	No impact to aquatic ecology	No impact to aquatic ecology
	Postremediation	No impact to aquatic ecology	No impact to aquatic ecology	No impact to aquatic ecology	No impact to aquatic ecology
Estimated Costs*		$4,100,000	$4,600,000	$4,000,000	$50,000,000

* Includes 30 years of Operation and Maintenance at 5%.

7.0 REFERENCES

Copies of personal communications are provided in Appendix O.

Applied Health Physics, Inc. Summary of Actions Taken During 1972-1974 to Comply with Requirements of the Nuclear Regulatory Commission. May 22, 1975(rev.).

Berryhill, H.L., Schweinfurth, S.P., and B.H. Kent, 1971. Coal-Bearing Upper Pennsylvanian and Lower Permian Rocks, Washington Area, Pennsylvania. U.S. Geological Survey Professional Paper 621.

Brooks, Mrs. of Trinity High School. Personal communication with Dan Rembert of ICF Kaiser Engineers. February 14, 1997.

Burick, Don of Pennsylvania Department of Transportation. Personal communication with Rachel Skerritt of ICF Kaiser Engineers. March 7, 1997.

Copp, Patti of Fish and Boat Commission in Harrisburg. Personal communication with Rachel Skerritt of ICF Kaiser Engineers. February 21, 1997.

57 FR 13389. Issued April 16, 1992. Site Decommissioning Management Plan Action Plan.

59 FR 7629. Issued February 11, 1994. Executive Order 12898. Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations.

Federal Emergency Management Agency. Flood Insurance Rate Map. Effective date November, 1986.

Foster Wheeler Environmental Corporation, 1995a. Decommissioning Plan for the Washington, Pennsylvania Facility. July, 1995.

Foster Wheeler Environmental Corporation, 1995b. Decommissioning Plan for the York, Pennsylvania Facility. August, 1995

Foster Wheeler Environmental Corporation, 1995c. Site Characterization Report for License Termination of the Washington, Pennsylvania Facility. January, 1995.

Foster Wheeler Environmental Corporation, 1995d. Supplemental Site Characterization Report of the York, Pennsylvania Facility. May, 1995.

Franks, Karen of Washington County Planning Commission. Personal communication with Rachel Skerritt of ICF Kaiser Engineers. March 5, 1997.

Harter, Debbie of St. Hilary School. Personal communication with Dan Rembert of ICF Kaiser Engineers. February 14, 1997.

HMT & Associates, Inc. Subdivision and Land Development Ordinance for Canton Township, Washington County, PA. May 28, 1996.

ICF Kaiser, 1996. Final Design Report Temporary Storage Structure. October, 1996.

IT Corporation, 1996, Ecological Risk Assessment and Permitting Support for Unocal/Molycorp, Inc. Washington, Pennsylvania. December, 1996.

John F. Kennedy School. Personal communication between secretary and Dan Rembert of ICF Kaiser Engineers. February 14, 1997.

Kendree and Shepherd Planning Consultants. Zoning Ordinance for Canton Township, Washington, County. Amended January, 1977.

McDonald, M.G. and A.W. Harbaugh, 1983. A Modular Three-Dimensional Finite Difference Groundwater Flow Model, U.S. Geological Survey Open-File Report 83-875.

Means, R.S. 1997. Heavy Construction Cost Data, 11th Edition. Pages 41, 46-49, 54, 55, 66, 67, 99, 100, 107, 108, 140.

National Climatic Data Center. 1994. Pittsburgh Local Climatological Data (LCD) summaries for normals, means, and extremes, 1961-1990.

Newport, T.G., 1973, Summary of Ground-Water Resources of Washington County, Pennsylvania. Pennsylvania Department of Environmental Resources, Water Resources Report No. 38, page 23.

PHR, Environmental Consultants Inc., 1996. Operational History and Corporate Succession. Washington Molycorp Facility, Washington, Pennsylvania.

Pennsylvania American Water Company, 1997a. Sam Taylor. Personal communication with Rachel Skerritt of ICF Kaiser Engineers. February 27, 1997.

Pennsylvania American Water Company, 1997b. William Kudaroski. Personal communication with Dan Rembert of ICF Kaiser Engineers. March 3, 1997.

Pennsylvania American Water Company, 1997c. William Kudaroski. Personal communication with Dan Rembert of ICF Kaiser Engineers. March 6, 1997.

Pennsylvania Department of Environmental Protection, Gene Wolbert. Personal communication with Dan Rembert of ICF Kaiser Engineers. February 24, 1997.

Pennsylvania Department of Environmental Resources. 1990. Erosion and Sediment Pollution Control Program Manual. Bureau of Soil and Water Conservation, April 1990.

Post, Jim, Arden Landfill. Personal communication with Dan Rembert of ICF Kaiser Engineers. March 6, 1997.

Skema, V., 1987. Coal Resources of Washington County, Pennsylvania: Part 1 Coal Crop Lines, Mined Out Areas, and Structure Contours, Penna. Dept. of Environmental Resources, Bureau of Topographic and Geologic Survey, Mineral Resource Report 93.

Sproull, Steven, Deputy Game Warden for the Pennsylvania Game Commission. Personal communication with Jeanette Duvall of ICF Kaiser Engineers. February 22, 1997.

Stevens, Mrs. of Washington High School. Personal communication with Dan Rembert of ICF Kaiser Engineers. February 14, 1997.

Stewart, B.A., et al. 1975. Control of Water Pollution from Cropland: Volume 1-A Manual for Guideline Development. USDA Report No. ARS-H-5-1. U.S. Department of Agriculture, Hyattsville, MD.

Trinity Middle School. Personal communication between secretary and Dan Rembert of ICF Kaiser Engineers. February 13, 1997.

Trinity West Elementary School. Personal communication between secretary and Dan Rembert of ICF Kaiser Engineers. February 14, 1997.

United States Environmental Protection Agency. 1995. AP-42 (Compilation of Air Pollutant Emission Factors, Volume 1, Fifth Edition, AP-42). Pages 11.9-1 through 11.9-14, 13.2.3-1 through 13.2.4-7, and 13.2.4-1 through 13.2.4-6.

United States Environmental Protection Agency. 1996. Industrial Source Complex 3 (ISC3), Version 96113 (Guideline on Air Quality Models, Revised, EPA-450/2-78-027R).

United States Environmental Protection Agency, Federal Guidance Report No. 12. External Exposure to Radionuclides In Air, Water, and Soil, September 1993.

United States Evironmental Protection Agency, Federal Guidance Report No. 11. Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, September 1988.

United States Geological Survey, 1997, National Earthquake Information Center, Map and Data from USGS Earthquake Data Database.

United States Nuclear Regulatory Commission. Code of Federal Regulations, 10 CFR 71, Energy, Packaging of Radioactive Material for Transportation of Radioactive Material Under Certain Conditions.

United States Nuclear Regulatory Commission. Code of Federal Regulations, 10 CFR 20.302, Energy, Method for Obtaining Approval of Proposed Disposal Procedures.

United States Nuclear Regulatory Commission. NRC Branch Technical Position for the Disposition of On-site Storage of Thorium or Uranium Wastes from Past Operations, October 1981. SECY 81-576.

United States Nuclear Regulatory Commission. NRC Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses by By-product, Source, or Special Nuclear Material. August 1987.

Washington and Jefferson College. Personal communication between secretary at public information office and Dan Rembert of ICF Kaiser Engineers. February 14, 1997.

Washington County Planning Commission. 1996. Washington County Profile.

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Washington Facility Environmental Report

VOLUME 2 OF 2

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Worldwide Excellence in Meeting Client Needs

April 1997

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WETLANDS DELINEATION REPORT

MOLYCORP SITE
28.8 ACRES

WASHINGTON, PENNSYLVANIA

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APPENDIX A

WETLANDS REPORT

1.0 Introduction

This document provides permitting information to support Molycorp's filing of a temporary stream crossing permit with the Pennsylvania Department of Environmental Protection (PADEP) and presents an ecological risk assessment for the Washington, Pennsylvania Molycorp site.

The wetlands delineation documented 3.25 acres of jurisdiction wetlands on site. Based on the results of the ecoradiological risk assessment, terrestrial and aquatic species are not expected to be at risk.

Wetlands delineation (Section 2.0), environmental assessment (Section 3.0), and ecoradiological risk assessment (Section 4.0) follow the scope of work as outlined in IT Corporation's (IT) letter proposal dated July 16, 1996.

This information was assembled to assist Unocal/Molycorp, Inc. in providing the Nuclear Regulatory Commission (NRC) with information necessary for the completion of the environmental impact statement (EIS). Information in Sections 2.0 and 3.0 may be utilized in the permitting process for the proposed stream crossing over Chartiers Creek.

List of Figures

2.0 Wetlands Delineation

A wetlands delineation was performed at the Washington, Pennsylvania site to determine the extent and type of jurisdictional wetlands that may be on site. This information is necessary for any stream crossing permits that may be required, as part of the EIS biologic resources information requirement, and to support the ecological risk assessment by identifying important habitat types that currently exist on site.

As a result of the survey, a total of 3.25 acres of jurisdictional wetlands were identified at the site, located within eight distinct areas. Wetland types included wet meadows, scrub/shrub wetlands, and lowland floodplain wooded areas. Delineated wetlands are depicted in Attachment I of Appendix A. Other information presented in Appendix A includes a summary of the site ecology, a discussion of the methodology utilized for the survey, a discussion of disturbed sites, the results and conclusions of the survey, and supporting figures, reference material, and photographs of the site.

3.0 Environmental Assessment

This section on the environmental assessment contains information regarding natural landmarks, state and national historic places, and archaeological sites in the vicinity of the Molycorp facility. Drinking water intakes on Chartiers Creek are discussed, as well as threatened and endangered species, and the stream classification for the creek under Pennsylvania Title 25, Chapter 93, designated water uses and water quality criteria.

3.1 Natural Landmarks and State and National Historic Places Survey

To support the permit for the stream crossing over Chartiers Creek, natural landmarks and state and national historic places were identified in areas near the site. These include historic, cultural, and archaeological sites identified by the Pennsylvania Inventory of Historical Places or the National Register of Historic Places and sites identified in the latest published version of the National Registry of Natural Landmarks. To ensure that sites listed on these lists are not present near the site, the Pennsylvania Historical and Museum Commission Bureau of Historic Preservation was contacted. The Bureau provided a copy of the National Register of Individual Properties and Historical Districts in Pennsylvania (Appendix B). This list also includes identified archaeological sites. Sites on this list are referenced according to the county and municipality where each is located.

After review of the list, no historic places are expected to be impacted by the proposed stream crossing due to the fact that there are no such listed sites in the immediate vicinity of the proposed stream crossing.

3.2 Drinking Water Intake - Chartiers Creek

To identify drinking water intakes for public supplies within five miles downstream of the site, Mr. Clark Harris of the PADEP (McMurray, Pennsylvania), was contacted. According to Mr. Harris, no public drinking water intakes are located within the stretch of Chartiers Creek five miles downstream of the site (personal communication).

3.3 Threatened and Endangered Species Survey

The Bureau of Wildlife Management, Pennsylvania Game Commission, was contacted to provide information regarding the documentation of state and federal threatened or endangered species in the area. In a letter dated October 2, 1996 from the Pennsylvania Game

Commission, it was documented that no records of threatened or endangered species exist for the area near the site (Appendix C).

Additionally, the PADEP was contacted to conduct a Pennsylvania Natural Diversity Inventory Search. PADEP's search also reported the finding of no known records for species of special concern at the site (Appendix C).

The Pennsylvania Fish and Wildlife data base did identify 34 endangered, threatened, or special concern species within Washington County (one fish species, one reptile species, one mammal species, one mollusk species, and 30 bird species, Appendix C). Although some of the land use and cover types associated with these species exist on site (i.e., deciduous forest, stream, wetland), none of these 34 species found in Washington County have been documented on or near the project site (Appendix C).

3.4 Chapter 93 Protected Water Uses

Chartiers Creek is classified as a warm water fishery (WWF), per Title 25 of the Pennsylvania Code, Chapter 93 (1996). This protected use is for maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

4.0 Ecological Risk Assessment

This section contains the ecological risk assessment for the proposed permanent low-level thorium storage cell in Washington, Pennsylvania. The intent of this effort is to produce a screening-level ecological risk assessment that can be used to support the EIS that will be prepared on a later date by the NRC. This assessment will focus on naturally occurring radioactive thorium (thorium-232), the most prevalent radionuclide contained within the slag.

The assessment follows the general guidance of several U.S. Environmental Protection Agency (EPA) documents on the subject. Although greater emphasis is placed on the *Framework for Ecological Risk Assessment* (EPA, 1992), more recent documents in review draft form (EPA, 1996, and EPA, 1995) were also consulted. In keeping with the general format of the "Framework," an area description is presented in the assessment that briefly discusses the history and physical features of the area. The problem formulation phase of the assessment involves the review of available information in order to provide an understanding of the current extent of potential problems at the site. Information presented includes the identification of the constituent of concern, the conceptual site model, exposure pathways, and ecological endpoints. The ecological exposure characterization identifies contaminant transport and flow phenomena, identifies specific ecological receptors, and quantifies exposure-point concentrations from both primary and secondary exposure pathways. The ecological effects characterization section discusses quantitative links between contaminant concentrations and effects on receptors. Literature reviews are the primary source of such dose-response information. Finally, the risk characterization portion of the assessment describes potential risks to ecological receptors and populations of interest. Uncertainties associated with the estimation of risk are also included in this section. Calculation briefs are presented in Appendix D.

4.1 Facility Description

The site of interest is a proposed long-term storage cell that will be used to contain slag with low levels of radioactivity. The long-term storage cell proposed by Molycorp will contain the thorium-bearing slags currently present at the Washington site. Also, Molycorp has proposed to relocate a small portion of thorium-bearing soils from the York, Pennsylvania site to Washington, Pennsylvania for inclusion in the permanent storage cell. The site will be located at the existing Molycorp facility in Washington, Pennsylvania. The facility is located approximately 35 miles southwest of Pittsburgh. The facility is situated on the outskirts of the city of Washington with Interstate 70 separating the facility from the city. The topography of the area consists of relatively flat-topped ridges and hilltops with steep-side valleys resulting from erosion by streams. The facility is located along the east bank of Chartiers Creek. Groundwater within the underlying alluvium of the Washington, Pennsylvania facility ranges from 8 to 15 feet below ground surface. Average monthly temperatures range from 30 to 69 degrees Fahrenheit (°F) with an average rainfall within the county of 38 inches (Foster Wheeler Environmental Corporation, 1995).

The area potentially impacted by the long-term storage facility includes approximately 30 acres of the 59-acre parcel owned by Molycorp, Inc. A plant exists at the facility that was used for ferroalloy manufacturing operations in the 1920s. Ferromolybdenum manufacturing at the site extended from the 1920s through 1991 when the plant entered extended standby mode. In August 1996, the plant resumed ferromolybdenum production. A small active area within the plant is also leased to another company. Current activities also include: the purchasing and reselling of ferroalloys, maintenance, and decommissioning of the site. Heavy industrial use is proposed as a potential future use for the facility (Foster Wheeler Environmental Corporation, 1995).

Over the years, slags from ferroalloy operations have been maintained on site. Some of the slag contained naturally occurring thorium that has either been disposed of at the West Valley, New York site, or stored in a capped pile containing about 10,000 cubic yards of segregated and stabilized slag/soil or used as fill on site. In order to comply with the regulatory requirements of the NRC, numerous investigations and studies have been conducted from 1970 to the present to address issues related to the thorium radioisotopes and their decay products present in the slag (Foster Wheeler Environmental Corporation, 1995). A permanent storage cell for thorium-containing slag is currently being proposed at the Washington, Pennsylvania facility.

4.2 Problem Formulation

Problem formulation is the first step of the ecological risk assessment process. It can be defined as a systematic planning step that identifies the major factors to be considered in a particular assessment (EPA, 1992). In short, it establishes the goals, breadth, and focus of the assessment and is linked to the regulatory and policy context of the assessment. The problem formulation process begins with the initial stages of characterizing exposure and ecological effects expected and observed. Problem formulation describes the relationships among assessment and measurement endpoints, data required, and methodology that will be used to analyze the data.

The purpose of this ecological risk assessment is to evaluate the potential for adverse ecological impacts to occur as a result of exposure to thorium-232 associated with the proposed low-level permanent thorium cell at the Washington, Pennsylvania facility. Environmental media will be evaluated for the potential to present risk to the ecosystems associated with the facility.

4.2.1 Study Site Identification

The physical characteristics of the Washington, Pennsylvania facility are briefly summarized in Section 1.1 and are described in detail in the Site Characterization Report (Foster Wheeler Environmental Corporation, 1995). Specific information related to the proposed site is in the process of being collected and will be presented in future reports.

4.2.1.1 Conceptual Site Model

A Conceptual Site Model (Figure 1) was developed describing sources of the thorium-232 present, thorium release and transport mechanisms, potential routes of migration, and potential ecological receptors. Soil/slag was assessed as a media of concern for terrestrial receptors. Transport of thorium-232 to the adjacent Chartiers Creek could occur via runoff from the slag pile or from leaching of the thorium from the pile to groundwater with subsequent discharge into surface water. However, the Site Characterization Report (Foster Wheeler, 1995) has shown that the thorium contaminated slags are not leachable. Both transport mechanisms could potentially result in the exposure of aquatic and semiaquatic species to the thorium.

4.2.1.2 Study Site Description

The study site considered is the proposed future low-level thorium permanent storage cell at the Washington, Pennsylvania facility. The land containing the slag/soil and the adjacent Chartiers Creek were considered locations of greatest thorium-232 content for all subsequent exposure scenarios.

4.2.2 Constituent of Potential Ecological Concern

The constituent of potential ecological concern being considered in this assessment is the radionuclide thorium-232. The thorium found in the slag pile at the on-site temporary storage thorium pile and at the York, Pennsylvania site is naturally occurring thorium. The thorium-containing soils at the York, Pennsylvania site resulted from the processing of ores from Molycorp's Mt. Pass, California facility. The materials at the York, Pennsylvania facility are considered because of their proposed storage in the permanent cell. The slag materials at the Washington site originated from ores obtained from a mine in Brazil where background

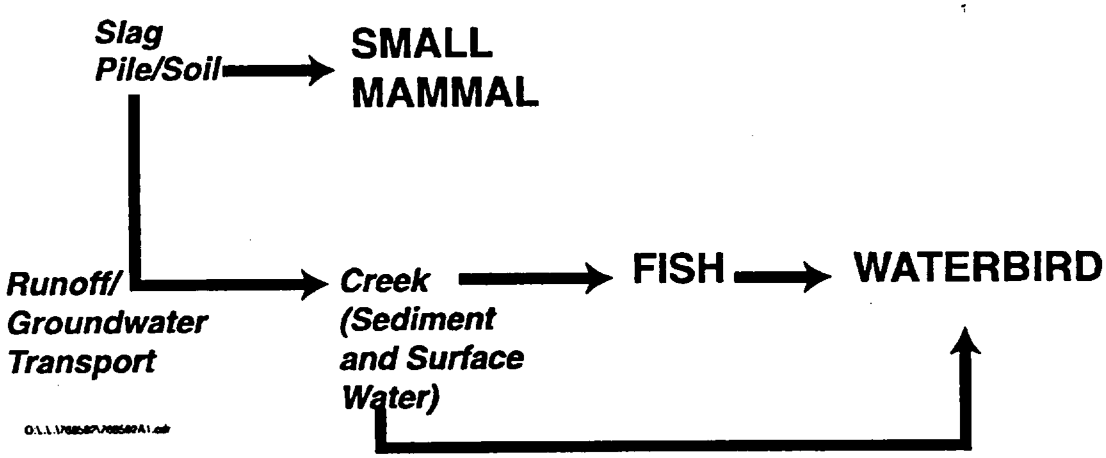

Figure 1
Conceptual Site Model for the Washington, Pennsylvania Permanent Storage Site Ecological Risk Assessment

concentrations of thorium in the ore are naturally elevated. Greater than 99.99 percent of natural thorium exists as thorium-232 with the remaining 0.01 percent comprised of thorium-230 and thorium-228 (ASTDR, 1989). As a consequence, this risk assessment will focus on potential ecological impacts that may occur as a result of exposure to thorium-232.

4.2.3 Exposure Pathway Identification

Complete exposure pathways must exist for exposure to occur. A complete exposure pathway requires:

- A source and mechanism for constituent release
- A transport medium
- A point of environmental contact
- An exposure route at the exposure point (EPA, 1989).

If any of these four components is absent, a pathway is generally considered to be incomplete.

The source of the constituent of interest, thorium-232, is the proposed permanent low-level thorium storage cell. Material from the cell could reach Chartiers Creek via surface water runoff or through the leaching of thorium from the pile to groundwater that subsequently discharges into surface water. However, the more probable source for material reaching Chartiers Creek is through runoff since the thorium slags are highly insoluable and not likely to leach to the water table (Foster Wheeler, 1995). Points of ecological contact with thorium-232 and its daughters are direct contact with the soil/slag, surface water, or sediment, or through indirect exposure routes related to food chain uptake. The exposure pathways that will be addressed are as follows:

- External exposure of a small mammal to the thorium-232 and its daughters
- Internal exposure of a small mammal to the radionuclide via ingestion of thorium-contaminated vegetation and soil
- External exposure of a fish to thorium-232 and its daughters in sediment and surface water
- Internal exposure of a fish to thorium-232 and its daughters via bioaccumulation
- External exposure of a waterbird to thorium-232 and its daughters in sediment
- Internal exposure of a waterbird to thorium-232 and its daughters in the fish.

Dermal exposure of the waterbird to surface water and inhalation by the waterbird and the small mammal were considered minor pathways and were, therefore, not evaluated.

4.2.4 Ecological Receptor Identification

An ecosystem is a combination of the abiotic (nonliving) physicochemical environment and the assemblage of biotic (living) organisms that combine to form an interrelated and independent system. The environment at the Washington, Pennsylvania facility supports numerous plant and animal species. Each of these can be considered a potential receptor to thorium-232 in soil, surface water, and/or sediment. The exposure evaluation within this ecological risk assessment will, however, focus on a few representative species with a reasonable potential of being exposed to thorium-232.

4.2.5 Potential Ecological Effects

For a given set of environmental conditions, species have characteristic attributes such as birth rates, age and gender distributions, migration patterns, and mortality rates. A species' habitat preferences, food preferences, and other behavioral characteristics (e.g., nesting, foraging, rearing young) may also determine population size and distribution in an area and may also significantly affect the potential for exposure.

A contaminant entering the environment will cause adverse affects if the following conditions exist:

- It exists in a form and concentration sufficient to cause harm.
- It comes into contact with organisms or environmental media with which it can interact.
- The interaction that takes place is detrimental to life functions.

Adverse effects may also occur if a contaminant interacts with other chemicals present in a synergistic manner that could raise the overall toxicity of the contaminated environment. The likelihood of ecological harm is, thus, a combined function of chemical, physical, and biological factors, depending on the nature of the contaminant and the environment into which it is released.

A chemical or radionuclide may enter the environment or move among environmental compartments on several possible time scales. The hypothetical type of release predicted to occur in association with the permanent storage cell is expected to be chronic in nature, representing a continuous release from the source until eventual total dissipation. The most significant effect associated with chronic exposure from an ecological standpoint are adverse effects on reproduction and mortality.

There are two basic approaches to expressing ecological effects: (1) contaminant-related effects observed in site organisms, populations, or communities, and an interpretation of associated ecological implications in relation to appropriate endpoints; or (2) comparison of on-site measured concentrations in abiotic media to established benchmarks (such as water quality standards or toxicity values). Where thorium-232 is the stressor of concern, a modification of the second approach was used where environmental monitoring data were used to estimate a radiation dose to selected receptors that were then compared to benchmark values. Because chronic exposure scenarios are of greatest significance to this assessment, acute exposure scenarios will not be addressed.

4.2.6 Ecological Endpoints

Assessment and measurement endpoints are used in an ecological risk assessment to help guide the evaluation process along the lines of what should be examined and how it can be detected. Some individual organisms may be more sensitive to thorium-232 than others; therefore protection of individuals would not be a practical goal unless a protected species were of special concern. Because no endangered, threatened, or otherwise protected species are thought to occur at the Washington, Pennsylvania facility, the level of ecological protection set for this assessment will be at the population level. In other words, the overall assessment endpoint for this risk assessment is the protection of aquatic and semiaquatic populations that may utilize Chartiers Creek, and terrestrial populations that may use the area of the permanent storage cell as habitat.

Adverse effects to biota were assessed through the use of environmental monitoring data from the "Site Characterization Report for the License Termination of the Washington, Pennsylvania facility" (Foster Wheeler Environmental Corporation, 1995), radiation dose models, and toxicity-based benchmark values. Maximum concentrations reported in soil/slag, surface water or groundwater, and sediment from the existing on-site temporary storage facility were used to estimate potential exposure concentrations. Radioecological benchmarks have been established for terrestrial animal and plant populations by the International Atomic Energy Agency (IAEA) (IAEA, 1991, as cited in Kahn, 1992) and for aquatic populations by the National Council on Radiation Protection and Measurements (NCRP) (NCRP, 1991, as cited in Kahn, 1992). Estimated dose to selected receptors was compared to the benchmark values and adverse impacts were predicted to occur when benchmarks were exceeded.

4.3 Exposure Assessment

This section identifies the exposure point concentrations, the ecological receptors, and exposure models that were used in the estimation of ecological risks that may be associated with the proposed site.

4.3.1 Exposure Point Concentrations

Exposure point concentrations used in this risk assessment were the maximum concentrations detected in soil/slag material, surface water/groundwater, and sediment as reported by Foster Wheeler Environmental Corporation (1995). Because groundwater can discharge into surface water, both environmental media were considered when estimating concentrations of thorium-232 and its associated daughters within the creek. Whenever possible, concentrations of thorium-232 daughters detected in the same sample as the maximum thorium-232 value were also used in the evaluation of ecological risk. In almost all cases, however, the daughter compounds were not detected. The concentrations used in the dose models are listed in Table 1.

Table 1
Concentrations of Thorium-232 and Decay Products Used in the Exposure Model

Media	Sample Location	Radionuclide	Concentration[a]
Slag/soil	TP4-01	Th-232	1,530 ±80 pCi/g
Surface water/ groundwater	MW25 MW25	Th-232 Th-228	1.38 ±0.39 pCi/L 1.04 ±0.5 pCi/L
Sediment	SS7A	Th-232	0.86 ±0.18 pCi/g

[a]Data are maximum concentrations reported in Foster Wheeler Environmental Corporation, 1995.
pCi/g = Picocuries per gram.
pCi/L = Picocuries per liter.

It should be noted that background concentrations of Th-232 in groundwater have been found to be less than the median quantitation limit of 1 pCi/L (based on 127 samples collected and reported in *Characterization of Background Water Quality for Streams and Groundwater,* Fernald Environmental Management Project, U.S. Department of Energy [DOE], 1993). Background concentrations of Th-232 in surface water have also been found to be less than the median quantitation limit of 1 pCi/L (5 samples; DOE, 1993). The highest background concentration of Th-228 in groundwater from the DOE (1993) report was 2.9 pCi/L (142 samples), while Th-228 in surface water was found to be less than the median quantitation limit of 1 pCi/L (5 samples; DOE, 1993). These results demonstrate that the maximum concentrations of Th-232 and Th-228 in groundwater at the Washington site (including the laboratory counting error) are generally within background levels reported upgradient from the Fernald, Ohio site located approximately 300 miles away (DOE, 1993).

4.3.2 Selected Ecological Receptors

As stated in Section 1.2.4, this ecological risk assessment will focus on a few species that represent key exposure pathways. The receptors selected for this risk assessment were a house mouse (*Mus musculus*), a channel catfish (*Ictalurus punctatus*), and a great blue heron (*Ardea herodias*). Natural history data for these organisms is summarized below.

4.3.2.1 House Mouse

House mice are small mammals common to disturbed areas across the continent. Although no surveys have been conducted to confirm the existence of this species at the site, it is very likely that they exist there. House mice are omnivorous, eating both seed and vegetative parts of plants as well as invertebrates (Jameson and Peeters, 1988); however, because of the high degree of uncertainty associated with the fraction of nonplant material in their diet, the mice were assumed to be herbivorous in this risk assessment.

House mice range in weight from 12 to 24 grams (g) (Jameson and Peeters, 1988). DeLong (1967) used the body weight of the house mouse to classify individuals into age groups, with animals weighing less than 12 g considered juveniles, animals weighing from 12 to 16 g considered subadults, and animals weighing more than 16 g considered adults. For exposure modeling purposes, 0.016 kilograms (kg) was used.

House mouse populations fluctuate widely and are prone to occasional outbreaks. Hall (1927 as cited in Mohr 1943) reported densities as high as 5,180 mice per hectare during one such outbreak in the 1920s. More typically, peak population densities reach 500 to 700 mice per hectare before collapsing (Pearson, 1963; DeLong, 1967). In Pearson's study, the monitored population entered the breeding season at about 120 mice per hectare. Although all study sites showed increasing densities, some local areas reached 700 mice per hectare before collapsing to less than 12 mice per hectare. DeLong observed a collapse from about 500 mice per hectare to about 60 mice per hectare in the course of one month. The cause(s) of these population collapses (e.g., disease, predation, and dispersal) have generally not been determined.

The range of values reported in the literature for the size of the house mouse home range is relatively small. DeLong (1967) notes that house mice tend to establish a home range as juveniles or subadults and rarely shift from this area unless they leave the population. The maximum diameters of these home ranges ranged from less than 11 meters (m) in the nonbreeding season to less than 24 m in the breeding season. These home range sizes remained constant through cycles in population density. Pearson (1963) noted a home range diameter for house mice at about 9 m. In a study of house mice in an enclosure, Mikesic and Drickamer (1992) found an average adult home range size of 306 m^2, which, if circular, would have a diameter of 20 m. Finally, Lidicker (1966), working in a California grassland, noted that 50 percent of recaptures were within 8.8 m of previous captures of the same animal and that 95 percent of the recaptures were less than 19 m of the previous captures. From this data, the mean home range diameter of house mice in this habitat is 13.2 m, which, if circular, gives an average home range size of 0.0138 hectares.

4.3.2.2 Channel Catfish

No aquatic survey has been conducted for Chartiers Creek adjacent to the site. As a consequence, a fish expected to occur in the creek, specifically the channel catfish, was used as a receptor for the evaluation of risk to aquatic biota in the creek. Because the catfish is a bottom feeder, it is representative of a species exposed to thorium-232 in both sediment and surface water.

The channel catfish is a slender catfish found in a wide range of habitats from large rivers to ponds. Adults may reach a length of 76 centimeters (cm) and a weight of 11 kg. Individual fish do not usually exceed 4.5 kg. Channel catfish feed at night. Their diet is varied and may include insects, crustaceans, fish, algae, fruits, seeds, and refuse (Eddy and Underhill, 1976). Spawning occurs in the late spring or early summer when water temperatures are about 21 to 29 degrees Celsius (°C), with upper preference temperatures of 30°C and 31°C for juveniles and adults from South Carolina and Pennsylvania (Talmage and Opresko, 1981).

4.3.2.3 Great Blue Heron

The great blue heron was selected to represent a top predator of the aquatic habitat at the Washington site. Although this species is known to reside near streams and rivers, no field surveys have been conducted to verify the presence of this species at the site. Great blue herons are large birds weighing about 2.39 kg (Dunning). For the purpose of this risk assessment, the heron was assumed to be a strict predator. They typically hunt along shorelines of rivers, streams, ponds, and lakes, although Dowd and Flake (1985) reported up to 25 percent of observed foraging birds in terrestrial habitats (pastures and cropland) and six cases of herons eating ground squirrels have been reported. The typical diet of the heron is a diverse mix of aquatic and terrestrial species including fish, crayfish, insects, mice, frogs, snakes, turtles, and so on (Martin et al., 1951). For exposure modeling purposes, the great blue heron was assumed to consume only fish from Chartiers Creek.

Great blue herons are colonial in nesting habit. The adult birds will fly considerable distances from the heronry to foraging areas. Based on observations made on the James River, South Dakota, Dowd and Flake (1985) report an average travel distance of 3.1 kilometers (km) is made from the heronry to a feeding area, with the maximum distance exceeding 24 km. On the Mississippi River, Thompson (1978) reported a mean travel distance of 6.5 km, with a maximum of 20 km.

4.3.3 Exposure Models

Published radiation dose models created by Pacific Northwest Laboratory were used to estimate the dose to ecological receptors exposed to thorium-232 and its daughters in the environment. Both external and internal dose were estimated. The discussion below summarizes the models that were used and the assumptions associated with them.

4.3.3.1 Dose Model for the House Mouse

The radiation dose model used for the house mouse is based on that developed for the Hanford Site (DOE, 1994) and uses radiological parameters presented in Baes, et al. (1984), and Baker and Soldat (1992). A detailed description of the methodology used to compute the internal and external radiation doses can be found in DOE (1994). Major assumptions incorporated into the Hanford dose model and the house mouse calculations are as follows:

- The geometry of the mouse was assumed to approximate a sphere.
- The entire activity of the radionuclide was assumed to be present at the center of the mouse.

- The effective absorbed energy for the mouse was constant.

- All of the alpha particle's energy was absorbed within the organism.

- The mouse received its internal exposure through its diet of plants and ingestion of soil.

- Inhalation and dermal exposure were considered insignificant.

- The house mouse will not receive any external dose from thorium-232 due to the low penetrability of the alpha radiation associated with the radionuclide.

- The mouse was assumed to weigh 0.016 kg and reside exclusively within the boundaries of the highest thorium-232 concentrations.

The different methodologies used to calculate external and internal radiation dose as presented below.

Internal Total-body Dose Rate. The following equation defines the internal dose rate to the house mouse in rad/day:

$$R_{internal} = \sum_{i}^{N} \frac{(CS_i \cdot PS_i \cdot WW \cdot Qv \cdot FI \cdot EF \cdot ED \cdot FR \cdot B_i \cdot E_i)}{(BW \cdot AT)}$$

where:

R_i	=	The internal total-body dose rate (rad/day) (DOE, 1994)
CS	=	The radionuclide concentration in the soil (curies (Ci)/kg)
PS	=	The soil-to-plant conversion factor specific to a given radionuclide and chemical form in the soil (Baes et al., 1984; DOE, 1994)
WW	=	The conversion from plant dry weight to wet weight, equal to 0.32 (DOE, 1994)
Qv	=	The ingestion rate of soil into the mouse (kg/day), given as 0.0067 (DOE, 1994)
FI	=	The fraction ingested form contaminated source (unitless), given as 1.0 (DOE, 1994)

EF = The exposure frequency (day/year), equal to 365 (DOE, 1994)

ED = The exposure duration (years), equal to 1.0 (DOE, 1994)

FR = The fraction of the radionuclide retained in the mouse (unitless), which is radioisotope specific (Baker and Soldat, 1992)

B_i = The sum of removal factor for nuclide i (day), equal to:

$$B_i = \frac{(1 - \exp(-\lambda_i \cdot T_e))}{\lambda_i}$$

where:

$$\lambda_i = \lambda_b + \lambda_r$$

λ_i = The effective decay constant for radioisotope i (day^{-1}).

λ_r = The radiological decay constant (day^{-1}) defined as $\ln(2)/T_r$ where T_r is the half-life of the radioisotope in days (Baker and Soldat, 1992). For thorium-232, T_r=5.11 x 10^{12} day.

λ_b = The biological removal constant (day^{-1}) defined as $\ln(2)/T_b$ where T_b is the biological half-life of a radioisotope in days (Baker and Soldat, 1992).

Te = Time that an organism is exposed to radionuclide i; assumed to be 365 days.

E_i = The effective energy absorbed constant for radionuclide i (kg-rad-Ci^{-1}-day^{-1}) (DOE, 1994), which is defined as:

$$E_i = 5.12 \cdot 10^4 \cdot \varepsilon_i$$

where:

ε_i = The radionuclide energy for a particular diameter of mouse (million electron volts per disintegration [MeV/dis]) (Baker and Soldat, 1992). For thorium, ε_i = 4.1 MeV/Dis.

BW = The body weight of the mouse (kg) equal to 0.016.

AT = The averaging time equal to 365 days (DOE, 1994).

4.3.3.2 Aquatic Dose Models

The estimation of dose to the fish and the heron were determined using a method outlined in Baker and Soldat (1992). The model considered both internal and external exposure to thorium. The fish was assumed to be the primary organism and the heron the secondary organism. Concentrations used in the model were as discussed in Section 4.3.1 and Table 1.

Major assumptions incorporated into the Baker and Soldat (1992) model and the aquatic dose model calculations for the catfish and great blue heron are as follows:

- All of the alpha radiation is internally absorbed within the organism.
- The radionuclides are uniformly distributed throughout the organism's interior.
- The geometry of the fish and heron are assumed to approximate a sphere.
- The dose rate calculated is assumed to be only from exposure to thorium.
- The fish was assumed to have an effective radius of 2 centimeters (cm), be immersed in the water 100 percent of the time, and be in contact with the sediment 50 percent of the time.
- The great blue heron was assumed to have a mass of 2.39 kg, an effective radius of 10 cm, consume only the primary organism, and be in direct contact with sediment 50 percent of the time.

The methodologies presented below were used to assess exposure to thorium-232 and its daughters.

Aquatic Internal Dose. The total daily dose to a primary organism are estimated as the sum of doses (based on a weighted gamma energy from radioactive decay for specific radionuclides) received from internal and external exposure sources.

The internal total-body dose rate (rad/day) to an organism exposed to a given radionuclide is given by the equation below:

$$R_c = \sum_{i=1}^{N} b_{ic} \cdot E_{ic}$$

where:

R_c = Internal total-body dose rate of organism c (rad/day)

$b_{i,c}$ = Specific body burden of nuclide i in organism c (Ci/kg), which is defined as:

$$b_{i,c} = C_{i,c} \times BF_{i,c} \times CF_{i,c}$$

where:

R_c = Internal total-body dose rate of organism c (rad/day)

$b_{i,c}$ = Specific body burden of nuclide i in organism c (Ci/kg)

$C_{i,c}$ = Concentration of radionuclide i in water to which organism c is exposed (Ci/liter [L])

BF_i = Bioaccumulation factor for nuclide i and organism c (m^3/kg)

CF = Conversion factor (0.001 L/m^3)

$E_{i,c}$ = Effective energy absorbed for radionuclide i per unit activity in organism c (kg-rad/Ci-day), which is defined as:

$$E_{i,c} = \varepsilon_{i,c} \text{ (MeV/dis)} \times 5.12 \times 10^4$$

where:

$\varepsilon_{i,c}$ = The effective radionuclide energy for the diameter of the aquatic organism for nuclide i in organism c. The proportionality constant, 5.14×10^4, is defined in Baker and Soldat (1992).

The equation can be rewritten as:

$$R_c = \sum_{i=1}^{N} E_{ic} \cdot C_{ic} \cdot BF_{ic} \cdot CF_{ic} .$$

The heron, as the secondary organism, consumes the fish and thus receives an exposure internally due to the uptake of radionuclides in fish. The internal dose rate received by the heron is given by the equation below:

$$R_c = \frac{\sum_{i=1}^{N} b_i \cdot U_c \cdot f_{1_i} \cdot E_{ic} \cdot B_{ic}}{M_c}$$

where:

R_c	=	Internal total-body dose rate of secondary organism c (rad/day)
U_c	=	Intake rate of primary organism by secondary organism c (kg/d)
M_c	=	Mass of secondary organism c (kg)
b_i	=	Body burden of primary organism (Ci/kg)
$f_{i,c}$	=	Fraction of radionuclide initially retained in total body of secondary organism (unitless)
$E_{i,c}$	=	Effective energy absorbed for radionuclide i per unit activity in organism c (kg-rad/Ci-day), which is defined as:

$$E_{i,c} = \varepsilon_{i,c}\ (\text{MeV/dis}) \times 5.12 \times 10^4$$

where:

$\varepsilon_{i,c}$	=	The effective radionuclide energy for the diameter of the aquatic organism for nuclide i in organism c. The proportionality constant, 5.14×10^4, is defined in Baker and Soldat (1992).
$B_{i,c}$	=	Effective decay constant of radionuclide i in the secondary organism (day) defined as:

$$B_{ic} = \frac{(1 - \exp(-\lambda_{ic} \cdot T_c))}{\lambda_{ic}}$$

where the equation below defines the effective decay constant in the secondary organism:

$$\lambda_{ic} = (\lambda_b + \lambda_r)\, day^{-1}$$

where:

λ_i = The effective decay constant for radioisotope i (day^{-1}).

λ_b = Biological decay constant of radionuclide defined as λ_b=ln(2)/T_b, where T_b = the biological half-life of the radionuclide in the organism, and

λ_r = Radiological decay constant of radionuclide defined as λ_r = ln(2)/T_r, where T_e = the radiological half-life of the radionuclide in the organism. The variable T_e is defined as the exposure time or period of exposure, which is assumed to be 365 days (Baker and Soldat, 1992).

Aquatic External Dose. The primary organism is assumed to reside in the water. The catfish can be exposed externally to the radionuclide(s) from immersion in water contaminated with radionuclides and from contaminated river bottom sediments. As stated earlier, it is assumed that fish have a water immersion fraction of 1.0 and a sediment exposure fraction of 0.5. Secondary organisms can be exposed externally from immersion in the water, and/or exposure to river bottom or shoreline sediments. Therefore, external exposure for the secondary organism is weighted by the fraction of the time it is exposed to these pathways. For the heron, the water immersion exposure fraction was assumed to be zero and the sediment exposure fraction was assumed to be 0.5. Water immersion and sediment dose rate factors are used to calculate external dose rates. The following equation was used to calculate the dose rate from immersion in water:

$$R_c = \sum_{i=1}^{N} C_{ic} \cdot DF_{im,i} \cdot F_{exp} \cdot CF$$

where:

R_c = Dose rate (rad/day) from immersion in the water

$C_{i,c}$ = Concentration of radionuclide i in water to which the organism c is exposed (Ci/L)

$DF_{im,i}$ = Immersion dose rate factor for radionuclide i (rad-m^3/Ci-day)

F_{exp} = Exposure fraction (unitless)

CF = Conversion factor (0.001 in units of L/m^3).

The following equation defines the external dose rate due to sediment exposure.

$$R_c = F_{sed} \bullet F_{ruf} \bullet F_{exp} \bullet \sum_{i=1}^{N} C_{ic} \bullet DF_{gnd} \bullet \frac{(1 - \exp(-\lambda_r \bullet T_s))}{\lambda_r}$$

where:

R_c = Dose rate (rad/day) from sediment exposure in water

F_{sed} = Sediment deposition transfer factor (0.07 Ci m^{-2} day^{-1} Ci^{-1} m^3)

F_{ruf} = Geometry roughness factor (unitless)

DF_{gnd} = Ground irradiation dose factor for nuclide (rad day^{-1} Ci^{-1} m)

T_s = Time sediment is exposed to contaminated water (day)

C_{ic} = Concentration of radionuclide i in water to which the organism c is exposed (Ci/L)

λ = Radiological decay constant (day)

F_{exp} = Exposure fraction (unitless).

The external dose due to direct contact with sediment and surface water are simply multiplied by their associated water immersion or sediment exposure fraction to determine an external dose rate associated with each exposure route. Summing up each component will estimate the total external dose to the fish and heron.

Total Dose Rate. The total dose rate received by either the fish or heron is the sum of the external and internal components. For example, if a fish receives 0.1 rad/day via internal exposure and 0.05 rad/day via external exposure, the total dose rate to the fish would be 0.1 + 0.05 = 0.15 rad/day.

4.4 Effects Characterization

As stated in Section 4.2.2, the thorium found in the slag piles at the on-site temporary storage thorium cell is naturally occurring thorium, of which greater than 99.99 percent exists as thorium-232 with the remaining 0.01 percent comprised of thorium-230 and thorium-228

(ASTDR, 1989). As a consequence, this risk assessment will focus on potential ecological impacts that may occur as a result of exposure to thorium-232.

Thorium-232 is a radionuclide with a relatively long half-life of 14 billion years. The radionuclide decays through the emission of a series of alpha and beta particles, gamma radiation, and the formation of daughter products, ultimately yielding the stable lead-208 (Figure 2). Thorium-232 emits a low level of alpha radiation and a much lower level of gamma radiation. Alpha particles can only penetrate tissues by a few micrometers, whereas gamma rays can deeply penetrate tissues.

The primary concern associated with exposure to thorium is its potential to induce radiological effects. Biological effects associated with exposure to radiation can range from no observable effect to death. The effect is dependent upon the total dose, dose rate, type of radiation, exposure period, exposure route, species sensitivity, age, and general health of the organism. In the environment, the dose received from thorium-232 and its daughters is due to external and internal exposure that may occur from direct exposure to external radiation sources or through inhalation, ingestion, or dermal exposure. Adverse effects that have been associated with exposure to thorium include: liver and splenic tumors, lung, pancreatic, and hematopoietic cancers, cirrhosis of the liver, lungs and spleen, histopathological effects on liver and kidney tissues, chromosomal aberrations, and alterations in liver enzyme levels. It has been shown that thorium entering the body primarily partitions to bone (ASTDR, 1989).

Substantial information exists on natural populations of biota exposed to radionuclides in the environment. As summarized by Talmage and Meyers-Schöne (1995), these studies have not shown adverse impacts on terrestrial or aquatic populations exposed to fallout radiation or radionuclides associated with radioactive waste management activities. A dose rate of 1 rad/day has been recommended by the NCRP Science Committee on the Effects of Ionizing Radiation on Aquatic Organisms (NCRP, 1991, as cited in Kahn, 1992) and is expected to provide sufficient protection to aquatic populations. This dose rate was used as the benchmark for protection of fish and other aquatic biota within Chartiers Creek. The IAEA Committee on the Effects of Ionizing Radiation on Plants and Animals recommends a dose of 0.1 rad/day for the protection of terrestrial populations (IAEA, 1992, as cited in Kahn, 1992). This value was used for the house mouse. Because the great blue heron is a semiaquatic, semiterrestrial species, the value of 0.1 rad/day was conservatively used for the protection of the heron.

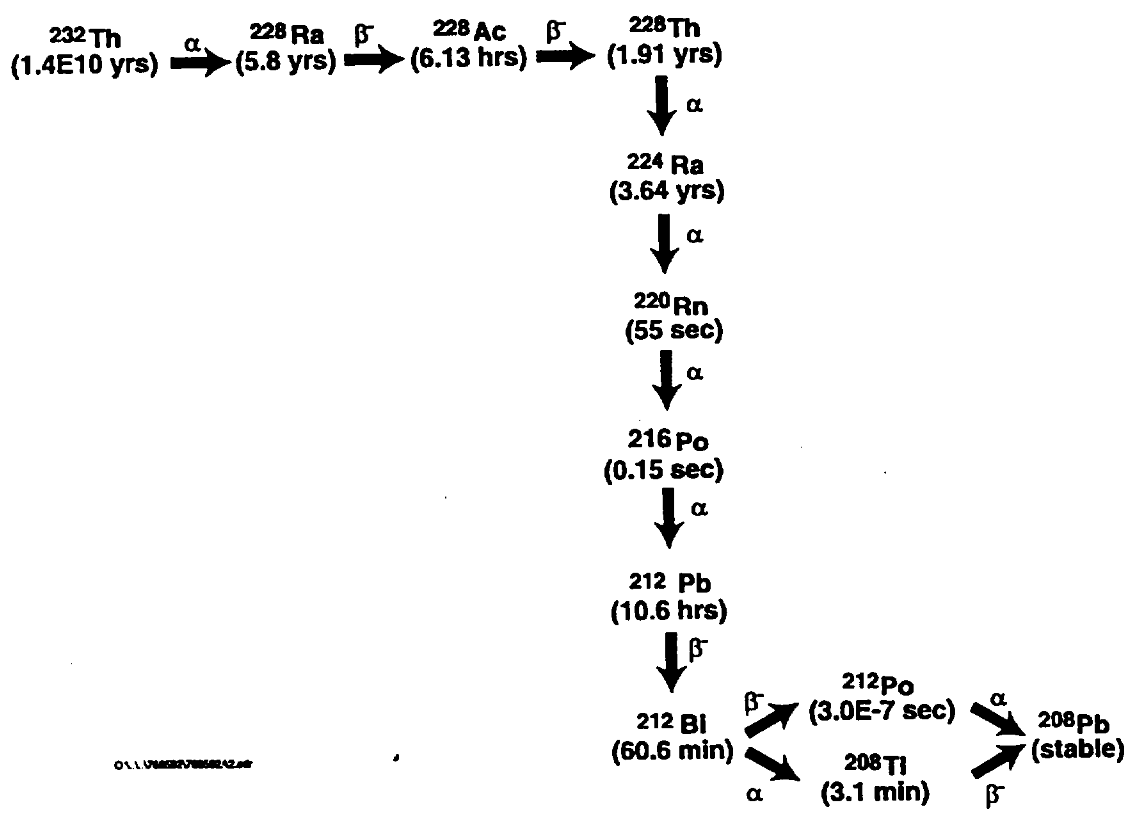

Figure 2
Thorium-232 Decay Series

4.5 Risk Characterization

Risks to the aquatic and terrestrial receptors were estimated by approximating the maximum radiation dose received by the receptor from exposure to thorium-232 and its daughters. It was assumed that maximum concentrations of these radioisotopes detected near the Washington on-site temporary storage pile would approximate concentrations expected at the proposed low-level thorium storage cell. Dose rates were then compared to acceptable benchmark dose values presented in Section 4.4. These values are 1 rad/day for the fish and 0.1 rad/day for the great blue heron and mouse. Predicted dose rates greater than these benchmark values were used as an indication of potential risk to the specific receptor. Estimated total dose rates to the mouse, fish, and heron are presented in Table 2.

4.5.1 Terrestrial Environment

A house mouse was selected as a terrestrial receptor with greatest exposure to the thorium within the storage pile. External and internal radiation dose to the mouse was estimated using the maximum thorium-232 and associated daughter concentrations detected in the Washington on-site temporary storage thorium pile. Using a concentration of 1,530 pCi/g, the total dose to the mouse was estimated to be 2.66×10^{-6} rad/day. As with the aquatic receptors, this dose is much less than the established benchmark of 0.1 rad/day. Based on available information, terrestrial receptors are not expected to be at risk to the radionuclides of concern.

Table 2

Estimated Radiation Dose Rates for Ecological Receptors Exposed to Thorium-232 and its Daughters from the Washington, Pennsylvania On-site Permanent Storage Cell[a]

Receptor	Dose (rad/day)		
	Internal	External	Total
House mouse	2.66E-06	—[b]	2.66E-06
Catfish	5.88E-05	8.09E-07	5.96E-05
Great blue heron	5.30E-07	8.09E-07	1.34E-06

[a]It is assumed that concentrations in the on-site proposed permanent storage cell will be similar to the on-site temporary storage pile concentrations.
[b]Assumed to be insignificant.

4.5.2 *Aquatic Environment*

A generic fish was used to represent a receptor exposed to contaminated sediment and surface water from Chartiers Creek. Fish within Chartiers Creek were estimated to be exposed to thorium-232 and its daughters via external and internal means. Using the maximum sediment and surface water concentrations reported from the quarterly sampling associated with the Washington on-site temporary storage thorium pile, fish were estimated to receive a maximum total dose of 5.96×10^{-5} rad/day. Because this value does not exceed the benchmark value of 1 rad/day, aquatic receptors are not expected to be exposed to hazardous concentrations of thorium-232 and its daughters at the temporary storage site or at the proposed site once it is constructed.

The great blue heron, selected to represent an upper trophic level riparian species, was assumed to exclusively ingest fish exposed to the radionuclides of interest in Chartiers Creek. Exposure to the fish used in the model above and external exposure of the heron to sediment resulted in a total dose of 1.34×10^{-6} rad/day to the heron. This dose is several orders of magnitude less than 0.1 rad/day. The great blue heron is, therefore, not expected to be at risk from exposure to thorium-232 or its associated daughters that may reach the creek from the permanent storage cell.

4.6 *Uncertainty*

Uncertainty associated with this ecological risk assessment is largely attributed to the uncertainty of the source term. In other words, because the low-level permanent storage cell does not exist, assumptions were made as to the maximum concentration of thorium in the material to be stored. These assumptions were based on the concentrations of thorium-232 measured in the slag/soil from the on-site temporary storage thorium pile at the Washington site. In order to err on the side of conservatism, the maximum detected concentration was used as the source term for the house mouse exposure scenario. Likewise, concentrations of thorium-232 that may occur in Chartiers Creek as a result of runoff or groundwater transport were also estimated using existing surface water, groundwater, and sediment data. Because groundwater may contribute to surface water contamination, the maximum thorium-232 concentration detected in any groundwater or surface water sample from the Washington, Pennsylvania site was used as a source term for exposure of aquatic and semiaquatic receptors. It should be noted that concentrations measured in surface water and groundwater were generally within background concentrations (Section 4.3.1). The maximum detected thorium-232 concentration measured in sediment from Chartiers Creek was also used as an exposure point concentration for these receptors. Because the permanent storage site is not expected to have thorium-232 concentrations higher than those detected in the temporary cell, the use of maximum concentrations may overestimate the exposure and risk to terrestrial, semiaquatic, and aquatic species that may utilize the future site.

The ecological receptors selected for this assessment are thought to be representative of different ecological habitats and niches, and are believed to be common to the general area. Each of the exposure models assumes that the receptor's home range is restricted to the area of maximum contamination. This assumes maximum exposure of the mouse, fish, and heron to thorium-232 and its daughter. Consequently, it was assumed that if these receptors were not found to be at risk, all other potential receptors with less exposure to the radionuclide and its daughter were also assumed to be protected. With reference to the radiation dose models, the assumptions associated with the models are considered to be realistic to conservative in nature. Each of these assumptions contributes to the conservatism of the assessment. The fact that exposure through inhalation or dermal contact were not evaluated may underestimate exposure for the mouse and heron. These were, however, considered minor exposure pathways and are not expected to significantly impact the ecological evaluation.

There is also some uncertainty associated with the toxicological benchmarks used to protect the terrestrial and aquatic populations. These benchmarks are based on reproductive indices and are designed to protect populations and not individual organisms. If protected species were found to occur in the area, the use of lower radiation dose values may be deemed necessary. Unfortunately, no comprehensive ecological surveys have been completed for the site. Such information would also serve to validate the prediction that no ecological risks currently occur at the Washington, Pennsylvania site.

4.7 Summary

The intent of this screening level ecological risk assessment was to predict potential risks to ecological receptors that may be associated with a future low-level storage cell for thorium-232 containing slag. Risk predictions were based on estimated doses to the house mouse (terrestrial receptor), a channel catfish (aquatic receptor), and a great blue heron (aquatic predator) using published dose models and toxicity-based benchmark values. Exposure point concentrations used were maximum thorium-232 concentrations detected in soil/slag from the temporary on-site thorium storage pile, maximum sediment concentrations reported in Chartiers Creek, and maximum concentrations detected in either surface water or groundwater samples from the area. Based on the information at hand, no ecological risks were predicted for the terrestrial and aquatic biota associated with the Washington, Pennsylvania site as a result of exposure to thorium-232 and its daughters. Because the permanent storage site is not expected to have thorium-232 at concentrations higher than those associated with the temporary cell, terrestrial, semiaquatic, and aquatic species that may utilize the future site are also not expected to be at risk.

5.0 References

Agency for Toxic Substances and Disease Registry, 1989, *Toxicological Profile for Thorium*, Agency for Toxic Substances and Disease Registry, U.S. Public Health Service.

ASTDR, see Agency for Toxic Substances and Disease Registry.

Baes, III, C.F., R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984, "A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture," *ORNL-5786*, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Baker, D. A., and J. K. Soldat, 1992, "Methods for Estimating Doses to Organisms from Radioactive Materials Released into the Aquatic Environment," *PNL-8150*, Pacific Northwest Laboratory, Richland, Washington.

DeLong, K. T., 1967, "Population Ecology of Feral House Mice," *Ecology*, Vol. 48, pp. 611-634.

DOE, see U.S. Department of Energy.

Dowd, E. M., and L. D. Flake, 1985, "Foraging Habitats and Movements of Nesting Great Blue Herons in a Prairie River Ecosystem, South Dakota," *Journal of Field Ornithology*, Vol. 56, pp. 379-387.

Dunning, J. B., Jr., 1993, *CRC Handbook of Avian Body Masses*, CRC Press, Boca Raton, Florida.

Eddy, S., and J. C. Underhill, 1976, "Northern Fishes, University of Minnesota Press, Minneapolis, pp. 299-301.

EPA, see U.S. Environmental Protection Agency.

Foster Wheeler Environmental Corporation, 1995, "Site Characterization Report for License Termination of the Washington, PA Facility," Molycorp, Inc.

Hall, E. R., 1927, "An Outbreak of Mice in Kern County, California," *University of California Publications in Zoology*, Vol. 30, pp. 189-203.

IAEA, see International Atomic Energy Agency.

International Atomic Energy Agency (IAEA), 1992, "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," *Technical Report Series 332*, International Atomic Energy Agency, Vienna, Austria.

Jameson, E. W., Jr., and H. J. Peeters, 1988, "California Mammals," *California Natural History Guides No. 52*, University of California Press, Berkeley, California.

Kahn, B., 1992, "Ecological Risks Associated with Radioactive Materials," pp. 289-326, In J. Cairns, Jr., B. R. Niederlehner, and D. R. Orvis, *Predicting Ecosystem Risk*, Princeton Scientific Publishing Co., Inc., Princeton, New Jersey.

Lidicker, W. Z., Jr., 1966, "Ecological Observations on a Feral House Mouse Population Declining to Extinction," *Ecological Monographs*, Vol. 36, pp. 27-50.

Martin, A. C., H. S. Zim, and A. L. Nelson, 1951, *American Wildlife and Plants: A guide to Wildlife Food Habits*, McGraw-Hill Book Company, Inc., reprinted (1961) by Dover Publications, Inc., New York.

Mikesic, D. G., and L. C. Drickamer, 1992, "Factors Affecting Home-Range Size in House Mice (*Mus Musculus domesticus*) Living in Outdoor Enclosures," *The American Midland Naturalist*, Vol. 127, pp. 31-40.

Mohr, C. O., 1943, "A Comparison of North American Small-Mammal Censuses," *The American Midland Naturalist*, Vol. 29, pp. 545-587.

National Council on Radiation Protection and Measurements (NCRP), 1991, "Effects of Ionizing Radiation on Aquatic Organisms," *Report Number 109*, National Council on Radiation Protection and Measurements, Bethesda, Maryland.

NCRP, see National Council on Radiation Protection and Measurements.

Pearson, O. P., 1963, "History of Two Local Outbreaks of Feral House Mice," *Ecology*, Vol. 44, pp. 540-549.

Talmage, S.S., and D.M. Opresko, 1981, "Literature Review: Responses of Fish to Thermal Discharges," EA-1840, Research Project 877, ORNL/EIS-193, Oak Ridge National Laboratory.

Talmage, S. S., and L. Meyers-Schöne, 1995, "Nuclear and Thermal", pp. 469-491 In D. J. Hoffman, B. A. Rattner, G. A. Burton, Jr., and J. Cairns, Jr., eds., *Handbook of Ecotoxicology*, Lewis Publishers, Boca Raton, Florida.

Thompson, D. H., 1978, "Feeding Areas of Great Blue Herons and Great Egrets Nesting within the Floodplain of the Upper Mississippi River," *Proceedings of the Colonial Waterbird Group*, Vol. 2, pp. 202-213.

U.S. Department of Energy, 1993, "Characterization of Background Water Quality for Streams and Groundwater," Fernald Environmental Management Project, RI/FS Draft Report, Fernald, Ohio, prepared by IT Corporation.

U.S. Department of Energy, 1994, Hanford Site Risk Assessment Methodology (HSRAM), "Ecological Dose and Exposure Calculations", *DOE/RL-91-45, Review Draft*, U.S. Department of Energy.

U.S. Environmental Protection Agency, 1995, "Draft Proposed Guidelines for Ecological Risk Assessment," *EPA/6630/R-95/002 External Review Draft*, Risk Assessment Forum, U.S. Environmental protection Agency, Washington, D.C.

U.S. Environmental Protection Agency, 1994, "Draft Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments," *September 26, 1994 Review Draft*, Risk Assessment Forum, U.S. Environmental protection Agency, Washington, D.C.

U.S. Environmental Protection Agency, 1992, "Framework for Ecological Risk Assessment," *EPA/630/R-92/001*, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency, 1989, "Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual," *EPA/540/1-89/001*, U.S. Environmental Protection Agency, Washington, D.C.

INTERNATIONAL TECHNOLOGY CORPORATION

Project No. 768592
December 1996

Final Report

Ecological Risk Assessment and Permitting Support for Unocal/Molycorp, Inc. Washington, Pennsylvania

Prepared for:
Molycorp, Inc.
A Unocal Company
Washington, Pennsylvania

Prepared by:
IT Corporation
Monroeville, Pennsylvania

RESPONSIVE TO THE NEEDS OF ENVIRONMENTAL MANAGEMENT

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APPENDIX A

ECOLOGICAL RISK ASSESSMENT AND PERMITTING SUPPORT FOR UNOCAL/MOLYCORP, INC. WASHINGTON, PA

Appendices

Statement of Certification

The analyses, opinions, and conclusions in this report are limited only by the reported assumptions and are based entirely on ACRT's unbiased, professional judgment. ACRT's compensation is not in any way contingent on any action or event resulting from this study. Neither ACRT nor any ACRT employee has any vested interest in the property examined in this study.

Expiration Dates for Wetlands Delineation Reports

This wetlands delineation report is valid for a period of five years from the time it is issued. Refer to U.S. Army Corps of Engineers Regulatory Guidance Letter # 94-1 (May 23, 1994).

Determination of Wetlands Jurisdiction

Final determination of wetlands jurisdiction in the State of Pennsylvania is made by the U.S. Army Corps of Engineers. Wetlands delineations and related wetlands studies are not considered officially valid until approved by this agency. ACRT, Inc. is not responsible for any decisions made based on wetlands delineations or assessments that have not been validated by this agency.

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1. INTRODUCTION

A. *Project Location*

The 28.8-acre site is located in Washington County near Caldwell Avenue and Interstate 70 in Washington, Pennsylvania (Attachments A and B).

B. *Extent to which work will involve fill or disturbance to any jurisdictional wetland(s) based on client's plans*

Wetlands fill requirements have not yet been determined. When this information is known, the Pennsylvania Department of Environmental Protection will be notified regarding permitting.

C. *Location of site on USGS quadrangle map*

The site is shown on the West Washington quadrangle of the United States Geological Survey (USGS) 7.5-minute series (topographic) map (Attachment C).

2. SITE DESCRIPTION

A. *General topographic relief of the project site and surrounding landscape*

The landscape is gently rolling to steep, with elevations ranging from near 1,015 feet along Chartiers Creek and Sugar Run to 1,128 feet on a hilltop in the southwest corner of the site.

B. *Description of any floodplain, streams, or water bodies located on or near the site*

Chartiers Creek and Sugar Run flow through the site. Sugar Run flows into Chartiers Creek which flows north and east after it leaves the site, eventually entering the Ohio River just west of Pittsburgh.

C. *Description of any pre-project artificial alterations such as impoundments, erosion outwash areas, drainage works, or other similar features*

Molycorp, Incorporated owns and operates a ferroalloys plant in Washington, Pennsylvania. This facility is comprised of approximately 55 acres of land, of which the manufacturing operations occur on approximately 20 acres. The wetlands delineation survey focuses on approximately 30 acres of the site, and is not inclusive of the area where manufacturing operations occur. This 30-acre portion of the site was acquired by Molycorp in 1975 from Brockway Glass Company (BGC) and Tylerdale Connecting Railroad Company (TCRC). BGC and TCRC were responsible for most of the current site conditions in the 30-acre area. Ownership of these parcels changed hands several times prior to Molycorp's acquisition of the property.

An impoundment containing tar is located in the southeastern corner of the site. The impoundment was constructed in 1985, for management of the tars in a controlled and centralized environment. The impoundment was later covered with soil and vegetated. Currently, the tar impoundment area is a mixture of upland old field and successional wetlands. In some areas of the impoundment, tar is visible at the surface.

Areas of fill and an existing roadbed are found near Chartiers Creek and Sugar Run. This has likely restricted the drainage for Wetland B, causing water to pond during wet periods.

3. Agency Resource Information

A. *National Wetlands Inventory (NWI) Map*

The NWI map (West Washington quadrangle) showing the area is found in Attachment D. The tar impoundment area is classified as a palustrine, unconsolidated bottom, semipermanently flooded, diked/impounded wetlands system (code PUBFh). Just north of the tar pit is a palustrine, emergent, persistent, seasonally flooded wetlands system (code PEM1C). A palustrine, unconsolidated bottom, permanently flooded, diked/impounded wetlands system (code PUBHh) is located at the top of the hill in the southwest property corner. Chartiers Creek is classified as a riverine, lower perennial, unconsolidated bottom, permanently flooded wetlands system (code R2UBH).

B. *Description of any or all ecological classification information available for the site*

The original vegetation on the property was probably a mixture of upland and lowland woods, depending on local soil and drainage conditions.

C. *Washington County soils map*

The site is on sheet 52 of the Soil Survey of Greene and Washington Counties, Pennsylvania (Seibert, *et al.*, 1983). See Attachment E. The soil types mapped for the property are:

CaD	-	Culleoka silt loam, 15 to 25 percent slopes
DoB	-	Dormont silt loam, 3 to 8 percent slopes*
DoC	-	Dormont silt loam, 8 to 15 percent slopes*
DtD	-	Dormont-Culleoka silt loams, 15 to 25 percent slopes
DtF	-	Dormont-Culleoka silt loams, 25 to 50 percent slopes
Nw	-	Newark silt loam*
Us	-	Urban land
*	-	Non-hydric soil with hydric inclusions

The soil descriptions by Seibert, *et al.* (1983) for these types are found in Attachment F. [Note: *This site was surveyed carefully for hydric soils during the wetlands delineation and a detailed soil map was prepared. This is discussed in paragraph 4B.*]

D. *Hydric soils or non-hydric soils with hydric inclusions (according to National Technical Committee for Hydric Soils (1991))*
A list of hydric soils and a supplemental list of non-hydric map units with hydric components for Washington County, Pennsylvania are found in Attachments G and H. Seven soils are mapped for the site.

E. *Any wetlands that is already regulated by a state or local government*
Not applicable.

4. SITE ECOLOGY

A. *Brief description of all major plant communities located on and adjacent to the site with simple description map*
General plant communities on the site are shown in Attachment I. Plant species identifications were based on Gleason and Cronquist (1991), Newcomb (1977) and Wherry, *et al.* (1979). Vegetational cover on the parcel is comprised of upland old fields, successional woods, wet meadows, scrub/shrub wetlands, and lowland floodplain woods.

Upland Old Fields. Upland old fields cover the more recently disturbed areas of the site (Photograph 6, Attachment Q). The soils in most of these areas consist of fill or have been disturbed. Common species include *Solidago canadensis* (Canada goldenrod, FACU[1]), *S. rugosa* (early goldenrod, UPL), *Oenothera biennis* (evening primrose, FACU), *Dactylis glomerata* (orchard grass, FACU), *Phleum pratense* (timothy, FACU), *Verbascum blattaria* (moth mullein, UPL), *Taraxacum officinale* (dandelion, FACU), *Cichorium intybus* (chickory, FACU), *Rosa multiflora* (multiflora rose, FACU), and *Rubus allegheniensis* (Allegheny blackberry, FACU-).

Successional Woods. The steep hillsides are covered by a successional woods containing small trees, saplings, and shrubs. Common species include *Prunus serotina* (black cherry, FACU), *Catalpa speciosa* (catalpa, FAC), *Robinia pseudoacacia* (black locust, FACU-), *Acer rubrum* (red maple, FAC), *Fraxinus* spp. (ashes), *Rubus allegheniensis* (Allegheny blackberry, FACU-), *R. occidentalis* (black raspberry, UPL), *Rosa multiflora* (multiflora rose, FACU), *Lonicera tatarica* (Tartarian honeysuckle, FACU), *Impatiens capensis* (jewelweed, FACW), *Polygonum virginianum* (Virginia knotweed, FAC), *Circaea lutetiana* (southern broad-leaved enchanter's nightshade, FACU), *Parthenocissus quinquefolia* (Virginia creeper, FACU), and *Geum* sp. (avens).

[1] The U.S. Fish and Wildlife Service has assigned indicator symbols to all plant species that occur in wetlands. See Attachment O for an explanation of these symbols.

Wet Meadows. Wetlands D, E, F, G, and H can be classified as wet meadow (Photographs 3, 4, and 5, Attachment Q). These are small, isolated wetlands created or enhanced by excavation, soil compaction, and/or rutting. Common species include *Asclepias incarnata* (swamp milkweed, OBL), *Juncus effusus* (soft rush, FACW+), *Scirpus validus* (soft stem bulrush, OBL), *S. atrovirens* (green bulrush, OBL), *S. cyperinus* (wool grass, FACW+), *Typha* sp. (cattail, OBL), and *Alisma plantago-aquatica* (water plantain, OBL).

Scrub/shrub Wetlands. Wetlands A and B are scrub/shrub wetlands (Photograph 2, Attachment Q). Common shrubby species include *Cornus amomum* (silky dogwood, FACW), *Viburnum recognitum* (northern arrow-wood, FACW-), and *Spiraea* sp. (meadowsweet). Herbaceous species are present and similar to what occurs in the marshes and wet meadows, but are more scattered due to the dense shrub cover.

Lowland Floodplain Woods. Wetland C is a lowland woods located on the floodplain of Sugar Run and Chartiers Creek (Photograph 2, Attachment Q). Frequent, but brief inundation occurs here. Common species are limited to *Acer negundo* (box elder, FAC+), *Acer saccharinum* (silver maple, FACW), *Cornus amomum* (silky dogwood, FACW), and *Lysimachia nummularia* (moneywort, OBL).

B. *Description of hydric soils and their extent based on soils map and field data (shown on simple soil map)*

No hydric soils are identified on the soil survey map of the site. Newark silt loam can have hydric inclusions. Most areas of Newark silt loam on the site were found to meet hydric soils criteria. The extent of this hydric soil and the location of other soils are shown on the map in Attachment J and described in Attachment K.

C. *Description and explanation of any unusual plant assemblages, soil types, disturbed, modified, or filled areas*

As previously discussed, several companies owned portions of the site prior to Molycorp's acquisition. Subsequently, much of the site was disturbed through the placement of various fill materials and the construction of several access roads. Areas of fill and several access roads are found on the site. The portions of the site near Caldwell Avenue are primarily utilized for current plant activities and consist of industrial buildings surrounded by asphalt. As discussed, the tar impoundment near Interstate 70 has been covered with soil. The impoundment area currently contains a mixture of upland old field and wet meadow vegetation. Areas of fill, disturbed soils, and a former excavation site were also observed on the hill top in the southwestern corner of the site.

Wetlands at the site have either resulted from or been affected by previous disturbance. Fill materials form the southern boundary of Wetland A and have reduced the size of the Sugar Run floodplain. The placement of fill materials along the edges of Wetlands B and C has restricted drainage and caused these areas to expand hydrologically. Wetland D appears to be the remnant of a drainage ditch within a more recently disturbed area.

Wetland E is a wet meadow which has formed within the fill over the tar impoundment. Wetlands F, G, and H are wet meadow pockets resulting from disturbances associated with previous excavation activities.

5. METHODOLOGY

A. *Detailed description of sampling procedures used to evaluate the site*

ACRT performed this delineation using criteria and guidance in the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Delineation, 1989).

Soil, hydrology, and vegetation are used to identify jurisdictional wetlands. Field sampling took place on August 20, 1996. Preliminary planning and reconnaissance of maps were performed prior to starting field work. Quantitative samples of soils, hydrology, and vegetation were taken at 22 locations.

The soils on the site were sampled during the delineation. Conditions were deemed hydric when the criteria of the National Technical Committee for Hydric Soils (1991) were met.

The hydrology of the site was also characterized during this study. The degree of soil saturation and inundation was recorded for each general plant community and soil type. Field indicators were examined at specific sample stations. Wetlands designations were assigned based on depth of water table, soil type, and hydrologic indicators as described by the 1989 Manual.

Vegetation was quantitatively sampled to document the wetlands delineation. At each sample location, the percent cover of trees and shrubs was visually estimated within a 5 meter by 5 meter quadrat. Percent cover of herbaceous plants was visually estimated in a 1 meter by 1 meter area. Percent dominance of each species in each stratum was recorded in the field. Data were entered into a computer and a total dominance measure calculated for each stratum. Species that comprised 20 percent of the total dominance measure for the stratum were classified as dominant. The number of dominant species from all strata combined that were obligate (OBL), facultative-wet (FACW), or facultative (FAC) was determined for each sample. This number was divided by the number of all dominant plants to determine the percentage of dominant wetlands plants. Wetlands criteria were met when the percentage of dominant wetlands plants exceeded 50 percent. Wetlands indicator status was assigned based on Reed (1988).

Attachment K shows all vegetation, soil, and hydrology sampling locations.

B. *Information submitted for each sample point in the field*

i. Quadrat size used to estimate the areal cover of all dominant species for each stratum of vegetation was as follows:

Herbaceous vegetation - 1 × 1 meter plot
Shrubs - 5 × 5 meter plot
Trees - 5 × 5 meter plot

The total dominance measure (TDM) per canopy and the dominant species were tabulated and calculated for each quadrat.

ii. Dominant plant species were identified to species (using scientific names) and their wetlands indicator status was listed according to Reed (1988).

iii. Soil samples were taken at 12 to 18 inches. The depth from the surface the soil sample was taken and the hue, value, and chroma of the sample were described. A soils map and descriptions of soils are in Attachments F and G. Soils data sheets for each sample site are in Attachment N.

C. *Explanation/justification of any deviations in methodology described by the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1989)*
Not applicable.

D. *Baseline map corresponding to the wetlands delineation including all field survey transects, labeled sampling point locations (corresponding with data sheets), location/direction of view of site photographs and derived wetlands boundary*
Attachment L shows all vegetation sampling locations in relation to all identified wetlands. A detailed summary sheet organized by sample number and all field data sheets are in Attachments N and P.

Photographs were taken during the field surveys to show the landscape and overall plant community composition. See Attachment Q for photographs and Attachment I for a map showing location and direction of view of the photographs.

E. *Description of adjacent parcels of wetlands or non-wetlands parcels to support wetlands determination*
The site is located in a portion of Canton Township, Washington County, Pennsylvania which is zoned for industrial activity. Surrounding land use in the immediate vicinity of the site is a mixture of industrial use and undeveloped land.

6. Disturbed Sites

A. Description of any of the three parameters (vegetation, soils, and hydrology) that were disturbed or modified on the site

As previously discussed, several companies owned portions of the site prior to Molycorp's acquisition. Subsequently, much of the site was disturbed through the placement of various fill materials and the construction of several access roads. Areas of fill and several access roads are found on the site. The portions of the site near Caldwell Avenue are primarily utilized for current plant activities and consist of industrial buildings surrounded by asphalt. As discussed, the tar impoundment near Interstate 70 has been covered with soil. The impoundment area currently contains a mixture of upland old field and wet meadow vegetation. Areas of fill, disturbed soils, and a former excavation site were also observed on the hill top in the southwestern corner of the site.

Wetlands at the site have either resulted from or been affected by previous disturbance. Fill materials form the southern boundary of Wetland A and have reduced the size of the Sugar Run floodplain. The placement of fill materials along the edges of Wetlands B and C has restricted drainage and caused these areas to expand hydrologically. Wetland D appears to be the remnant of a drainage ditch within a more recently disturbed area. Wetland E is a wet meadow which has formed within the fill over the tar impoundment. Wetlands F, G, and H are wet meadow pockets resulting from disturbances associated with previous excavation activities.

B. Description of any necessary techniques used to further study the site if any one or more of the wetlands indicator parameters is missing due to disturbance/modification

Not applicable.

7. Results and Conclusions

A. Notation of acreage of identified jurisdictional wetlands based upon the on-site delineation

Jurisdictional Wetlands

Wetlands	Acreage
A	0.503
B	1.315
C	0.869
D	0.059
E	0.377
F	0.090
G	0.034
H	0.006
Total	3.253

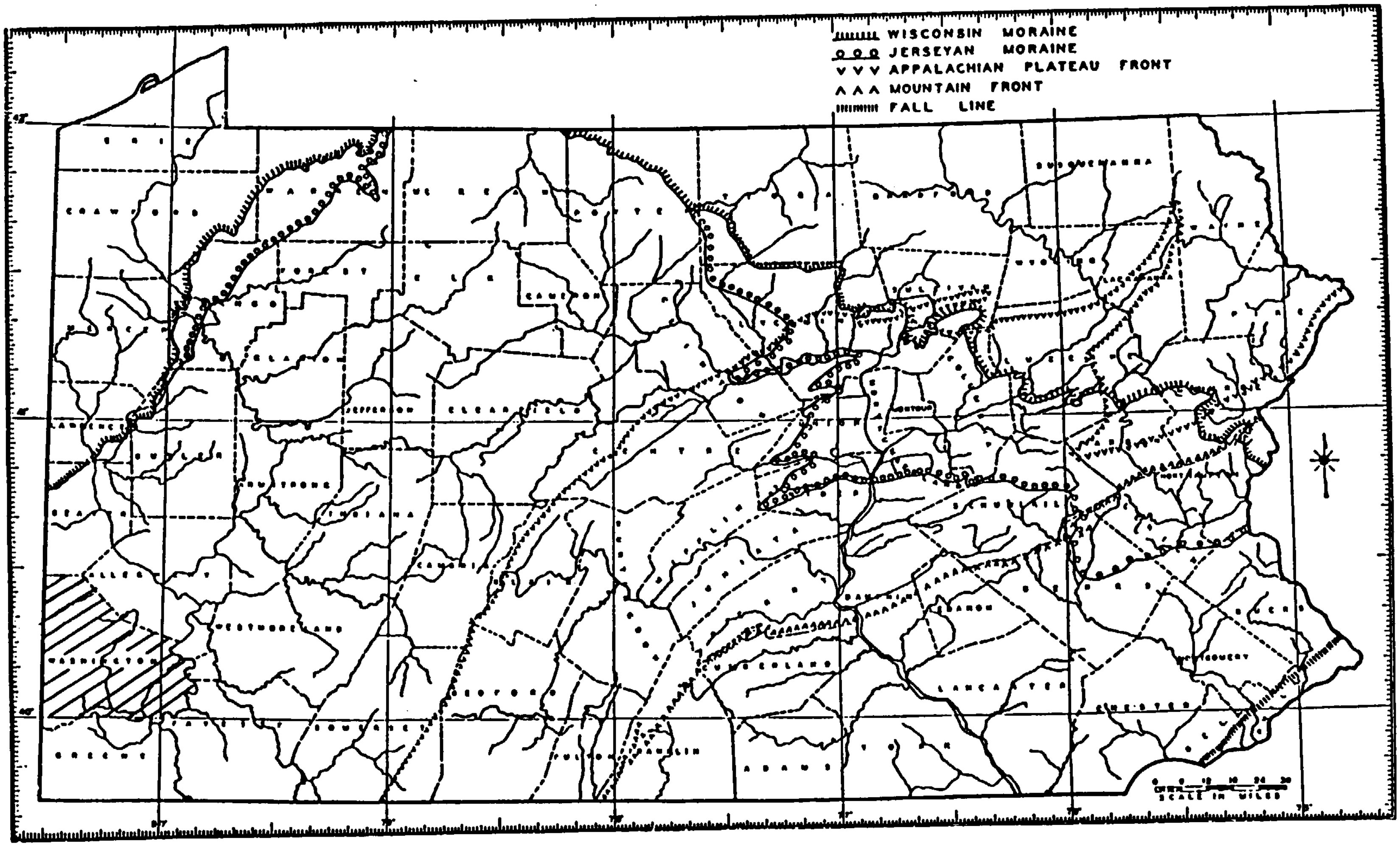
B. *Description of how acreage was calculated*
Wetlands areas were surveyed using a Trimble Pro XL global positioning system (GPS). Wetlands acreages were calculated using AutoCAD, a computer assisted design (CAD) program.

C. *Discussion of any unusual problems or difficulties encountered in the field which may have affected the wetlands boundary delineation*
Not applicable.

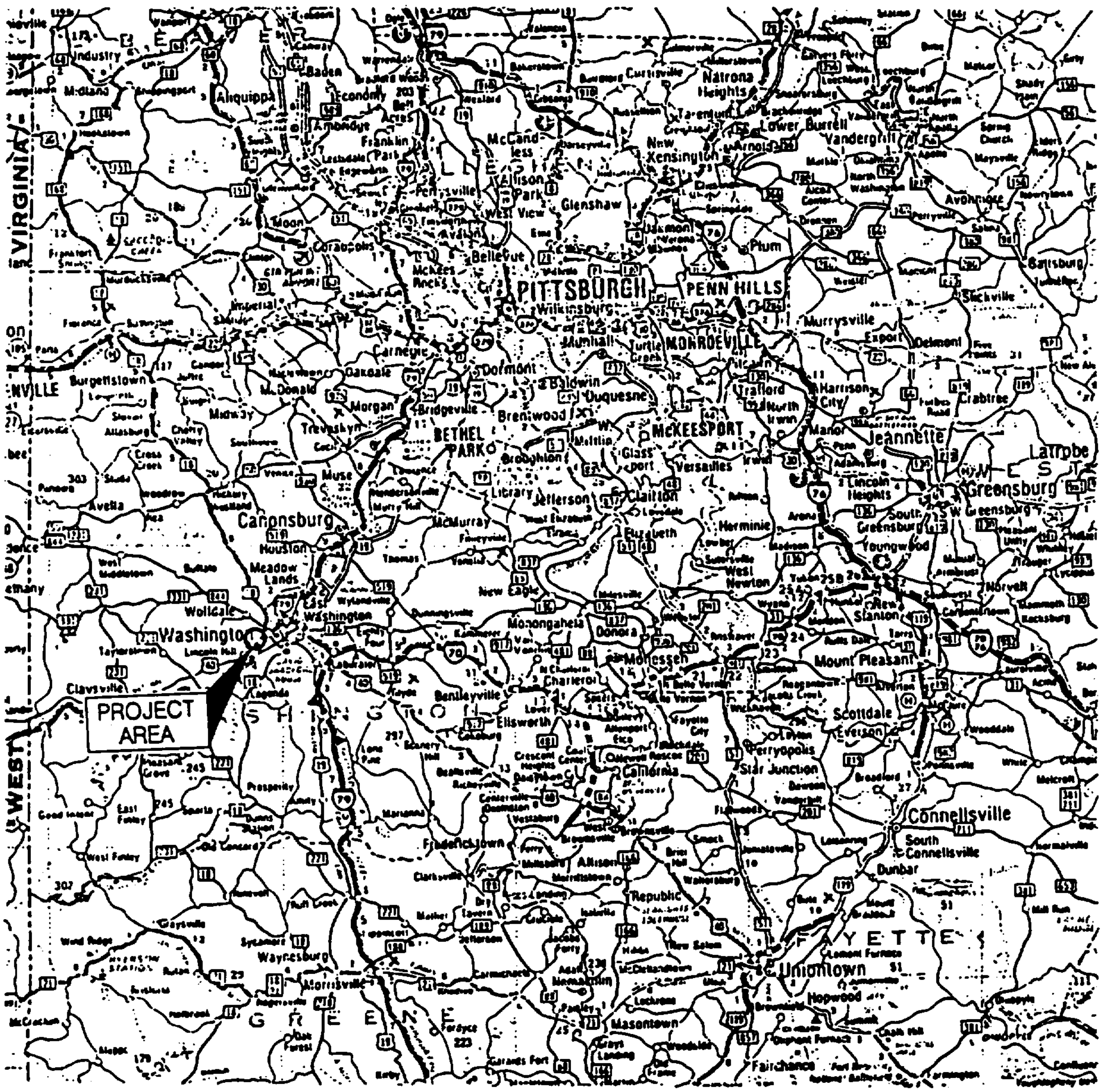
D. *Identification and explanation (or justification) for any impact any problem areas may have on the delineation result*
ACRT believes that all jurisdictional wetlands on this site were identified.

ATTACHMENTS

Attachment A. Location of Washington County, Pennsylvania

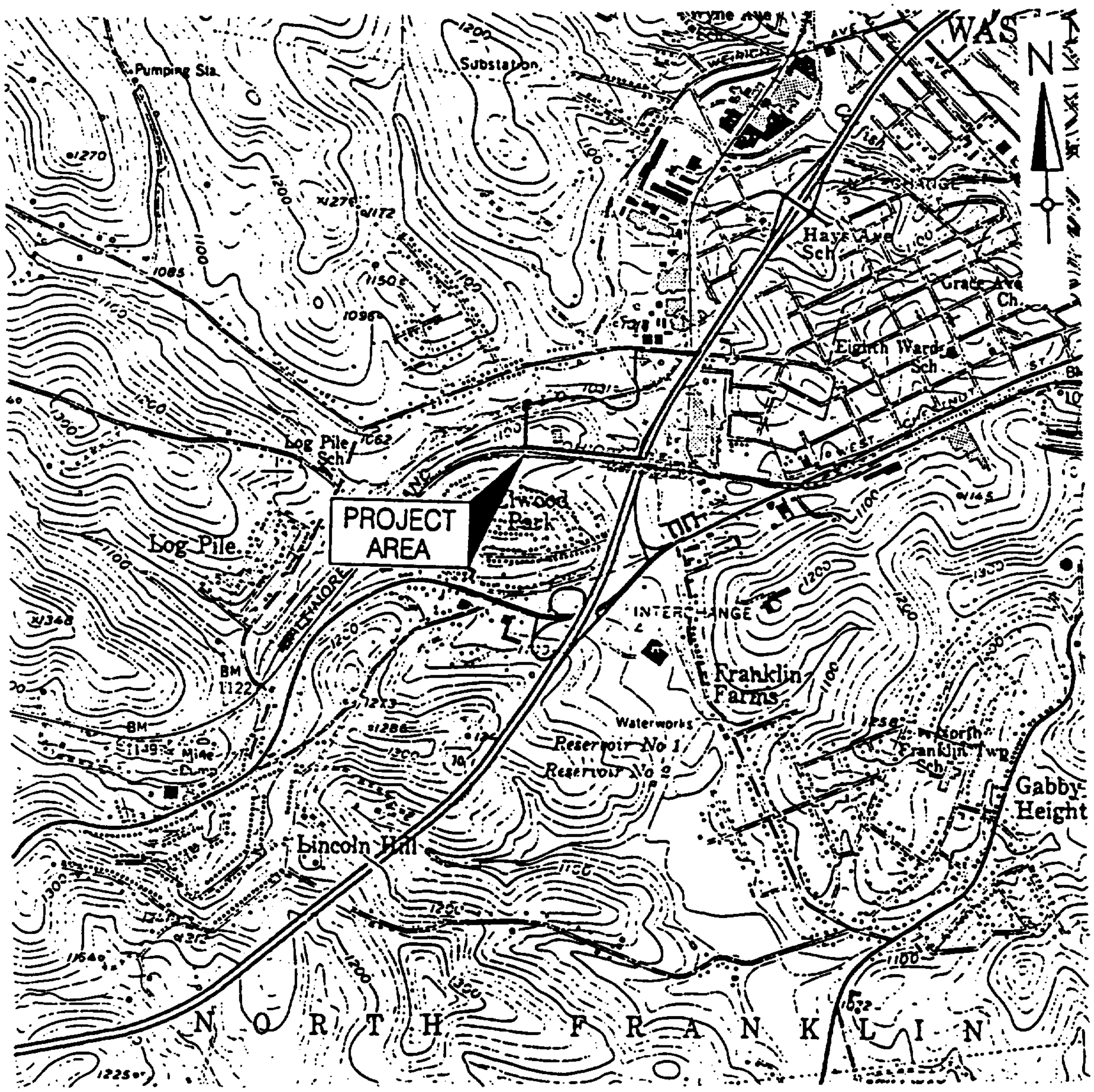


Attachment B. **Approximate Location of Site on Highway Map of Pennysivania**



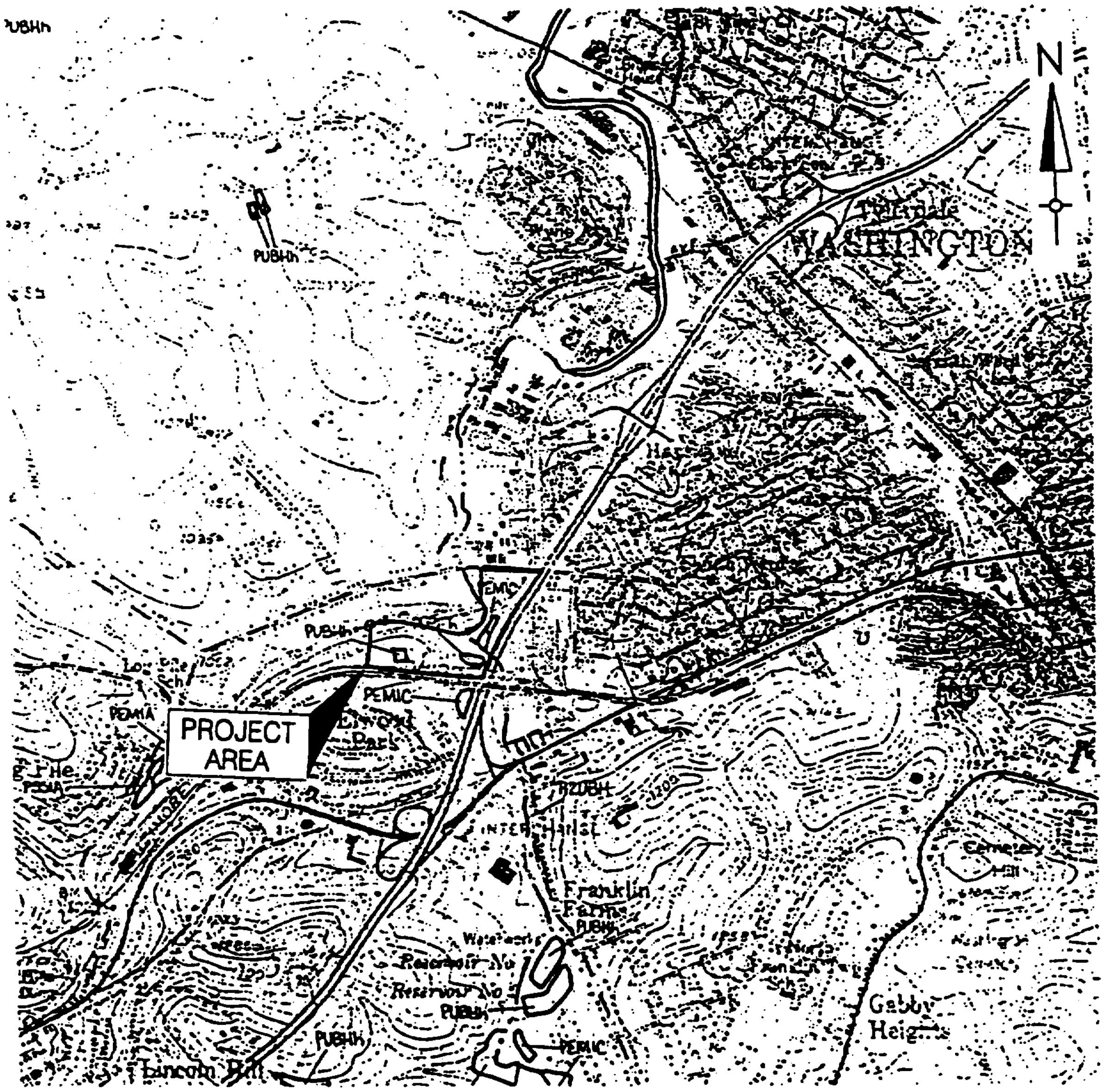
SCALE: 1 INCH = 10 MILES

Attachment C. Location of Site on USGS 7.5-minute (Topographic) Map (West Washington Quadrangle)



SCALE: 1 INCH = 2,000 FEET

Attachment D. Location of Site on NWI Map (West Washington Quadrangle)



SCALE: 1INCH = 2,000 FEET

Attachment E. Location of Site on Washington County Soil Survey Map

SCALE: 1 INCH = 1,320 FEET

Attachment F. Description of Soil Types Found on Site (from Seibert, *et al.* 1983)

CaB—Culleoka silt loam, 3 to 8 percent slopes.
CaC—Culleoka silt loam, 8 to 15 percent slopes.
CaD—Culleoka silt loam, 15 to 25 percent slopes.

These soils are moderately deep and well drained. The areas are on uplands and range from about 2 to 50 acres. Slopes range from 100 to 600 feet in length.

Typically, the surface layer of these soils is dark brown silt loam about 11 inches thick. The subsoil is yellowish brown and is about 14 inches thick. The upper 10 inches is light silty clay loam, and the lower 4 inches is shaly heavy silt loam. The substratum is yellowish brown very shaly silt loam about 3 inches thick. Shale bedrock is at a depth of 28 inches.

Included with these soils in mapping are a few small areas of Dormont, Guernsey, Brooke, Dekalb, and Weikert soils. Also included are small areas of a soil that is similar to these Culleoka soils but that is more than 40 inches deep to bedrock. Included soils make up about 25 percent of each unit.

The permeability of these Culleoka soils is moderately rapid, and the available water capacity is moderate. Runoff is medium on units CaB and CaC and rapid on unit CaD. Reaction in unlimed areas is medium acid or strongly acid in the surface layer and subsoil. The hazard of erosion is moderate on unit CaB, severe on unit CaC, and very severe on unit CaD.

Areas of these soils are used for cultivated crops, for hay and pasture, for woodland, and for community development. Most areas of units CaB and CaC are used for cultivated crops or hay. Most of unit CaD is used for hay and pasture.

All areas of these soils are generally suitable for cultivated crops, but those of units CaB and CaC are better suited. Contour stripcropping, minimum tillage, grassed waterways, diversions, and cover crops help to reduce runoff and control erosion. Growing cover crops, returning crop residue to the soil, and using grasses and legumes in the cropping system help maintain the organic matter content and tilth of the soils.

The soils are well suited to pasture. The prevention of overgrazing is a major pasture management concern. Proper stocking rates to maintain key plant species, rotating of pastures, and periodically applying nutrients are major pasture management practices.

The soils are suitable for trees, and the potential for woodland is high. Machine planting is practical in larger areas. Livestock graze many areas of woodland on these soils, hindering the establishment and growth of young trees. The hazard of erosion and the slope in unit CaD limit the use of equipment on these soils. Constructing roads on the contour of these more sloping areas helps to control erosion during timber harvesting.

CaB—Culleoka silt loam, 3 to 8 percent slopes.
CaC—Ceulleoka silt loam, 8 to 15 percent slopes.
CaD—Culleoka silt loam, 15 to 25 percent slopes. (continued)

The depth to bedrock limits the use of these soils for community development, especially for onsite waste disposal. Slope in the areas of units CaC and CaD is an additional limitation for community development.

The capability subclass is IIe for unit CaB, IIIe for unit CaC, and IVe for unit CaD; the woodland ordination symbol is 2o for units CaB and CaC, and 2r for unit CaD.

DoB—Dormont silt loam, 3 to 8 percent slopes.
DoC—Dormont silt loam, 8 to 15 percent slopes.
DoD—Dormont silt loam, 15 to 25 percent slopes.

These soils are deep and moderately well drained. Slopes are 100 to 500 feet long. The areas are on uplands and range from about 2 to 150 acres.

Typically, the surface and subsurface layers of these soils are dark brown silt loam and have a combined thickness of 12 inches. The subsoil is 42 inches thick. The upper 15 inches is yellowish brown silt loam and silty clay loam. The lower 27 inches is mottled, yellowish brown silty clay loam and channery silty clay loam. The substratum is mottled, brown silty clay to a depth of 78 inches.

Included with these soils in mapping are small areas of Culleoka, Guernsey, Library, and Weikert soils. Also included are soils that are similar to these Dormont soils but that are more poorly drained or shallower to bedrock. Included soils make up about 20 to 25 percent of each unit.

The permeability of these Dormont soils is slow to moderately slow, and the available water capacity is high. Runoff ranges from medium on unit DoB to rapid on units DoC and DoD. Reaction in unlimed areas is very strongly acid to medium acid to a depth of about 25 inches and is strongly acid to medium acid at a depth of more than 25 inches. A seasonal high water table is at a depth of 18 to 36 inches. The hazard of erosion is moderate on unit DoB and severe on units DoC and DoD.

These soils are used for cultivated crops, for hay and pasture, for woodland, and for community development. Many of the areas of unit DoB are used for crops; most of the acreage of units DoC and DoD is used for pasture or woodland.

Most areas of these soils are suited to cultivated crops, but the areas of unit DoB are better suited. Contour stripcropping and using minimum tillage, grassed waterways, cover crops and hay in the crop rotation help to reduce runoff and control erosion. Subsurface drains are needed in some areas to drain wet spots. Growing cover crops, returning crop residue to the soil, and using grasses and legumes in the cropping system help to maintain the organic matter content and tilth of the soils.

These soils are well suited to pasture. The prevention of overgrazing is a major pasture management concern.

DoB—Dormont silt loam, 3 to 8 percent slopes.
DoC—Dormont silt loam, 8 to 15 percent slopes.
DoD—Dormont silt loam, 15 to 25 percent slopes. (continued)

The use of proper stocking rates to maintain key plant species, pasture rotation, and periodic applications of nutrients are the main management practices. Restricted grazing and keeping equipment off the soils during the wet seasons help prevent compaction of the surface layer.

The soils are suitable for trees, and the potential for woodland is high. Machine planting is practical in larger areas, but slope limits the use of equipment on unit DoD. Constructing roads on the contour of such areas helps to control erosion during timber harvesting. Livestock graze many areas of woodland on these soils, hindering the establishment of young trees.

The seasonal high water table and slow to moderately slow permeability limit these soils for community development, especially for onsite waste disposal. Slope is an additional limitation on unit DoD, and low strength is a hazard for roads and foundations.

The capability subclass is IIe for unit DoB, IIIe for unit DoC, and IVe for unit DoD; the woodland ordination symbol is 2o for units DoB and DoC, and 2r for unit DoD.

DtD—Dormont-Culleoka silt loams, 15 to 25 percent slopes. This complex consists of moderately steep, deep and moderately deep, moderately well drained and well drained soils on uplands. Slopes are 100 to 600 feet long. The areas range from 5 to 400 acres. Dormont soils make up about 55 percent of this unit, Culleoka soils about 40 percent, other soils about 5 percent. The soils are so intermingled that it was not practical to map them separately.

Typically, the surface and subsurface layers of the Dormont soils are dark brown silt loam and have a combined thickness of about 12 inches. The subsoil is 42 inches thick. The upper 15 inches is yellowish brown silt loam and silty clay loam. The lower 27 inches is mottled, yellowish brown silty clay loam and channery silty clay loam. The substratum is mottled, brown silty clay to a depth of 78 inches.

Typically, the surface layer of the Culleoka soils is dark brown silt loam about 11 inches thick. The subsoil is yellowish and is about 14 inches thick. The upper 10 inches is light silty clay loam, and the lower 4 inches is shaly heavy silt loam. The substratum is yellowish brown very shaly silt loam about 3 inches thick. Shale bedrock is at a depth of 28 inches.

Included with these soils in mapping are small areas of Brooke, Weikert, Guernsey, and Library soils. Also included are soils similar to these Dormont soils but that are more poorly drained or shallower to bedrock.

DtD—Dormont-Culleoka silt loams, 15 to 25 percent slopes.(continued)

These Dormont soils have moderately slow permeability and high available water capacity. Runoff is rapid, and the hazard of erosion is very severe. Reaction in unlimed areas of the Dormont soils is very strongly acid to medium acid to a depth of about 25 inches and strongly acid or medium acid at a depth of more than 25 inches. A seasonal high water table is at a depth of 18 to 36 inches.

The Culleoka soils have moderately rapid permeability and moderate available water capacity. Runoff is rapid, and the hazard of erosion is very severe. Reaction in unlimed areas of the Culleoka soils is medium acid or strongly acid to a depth of about 25 inches.

Most areas of this unit are used for hay and pasture or are in woodland and brushland. A few areas are used for cultivated crops.

These soils are suited to cultivated crops. Contour stripcropping and using minimum tillage, grassed waterways, cover crops, and hay in the crop rotation help to reduce runoff and control erosion. Subsurface drains are needed in some areas of the Dormont soils to drain wet spots. Growing cover crops, returning crop residue to the soil, and using grasses and legumes in the cropping system help to maintain the organic matter content and tilth of the soils.

These soils are suited to pasture. The prevention of overgrazing is a pasture management concern. The main management practices are using proper stocking rates to maintain key plant species, pasture rotation, and using periodic applications of nutrients. Restricted grazing and keeping equipment off the soils during the wet season help to prevent compaction of the surface layer.

The soils are suitable for trees, and the potential for woodland is high. Machine planting is practical in larger areas. The hazard of erosion and the slope limit the use of equipment on these soils. Constructing roads on the contour helps to control erosion during timber harvesting. Livestock graze many areas of woodland on these soils, hindering the establishment and growth of young trees.

Slope, the seasonal high water table in the Dormont soils, and the depth to bedrock in the Culleoka soils are the main limitations for community development, especially for onsite waste disposal. Low strength in the Dormont soils is a hazard for roads and foundations.

The capability subclass is IVe; the woodland ordination sumbol is 2r.

DtF—Dormont-Culleoka silt loams, 25 to 50 percent slopes. This unit consists of steep and very steep, deep and moderately deep, well drained and moderately well drained soils on uplands. Slopes are 100 to 800 feet long. Dormont soils make up about 55 percent of this unit, Culleoka soils about 40 percent, and other soils about 5 percent. The areas range from about 5 to 800 acres. The soils are so intermingled that it was not practical to map them separately.

Typically, the surface and subsurface layers of the Dormont soils are dark brown silt loam and have a combined thickness of about 12 inches. The subsoil is 42 inches thick. The upper 15 inches is yellowish brown silt loam and silty clay loam. The lower 27 inches is mottled, yellowish brown silty clay loam and channery silty clay loam. The substratum is mottled, brown silty clay to a depth of 78 inches.

Typically, the surface layer of the Culleoka soils is dark brown silt loam about 11 inches thick. The subsoil is yellowish brown and is about 14 inches thick. The upper 10 inches is light silty clay loam, and the lower 4 inches is shaly heavy silt loam. The substratum is yellowish brown very shaly silt loam about 3 inches thick. Shale bedrock is at a depth of 28 inches.

Included with this soil in mapping are small areas of Guernsey, Weikert, and Upshur soils. Also included are areas of soils similar to these Dormont soils but that are more poorly drained and areas of soils that are similar to these Culleoka soils but that are deeper to bedrock. Some areas of the Dormont and Culleoka soils have slopes of more than 50 percent.

These Dormont soils have moderately slow permeability and high available water capacity. Runoff is rapid, and the hazard of erosion is very severe. Reaction in unlimed areas of the Dormont soils is very strongly acid to medium acid to a depth of about 25 inches and strongly acid or medium acid at a depth of more than 25 inches. A seasonal high water table is a depth of 18 to 36 inches.

The Culleoka soils have moderately rapid permeability and moderate available water capacity. Runoff is rapid, and the hazard of erosion is very severe. Reaction in unlimed areas of the Culleoka soils is medium acid or strongly acid to a depth of about 25 inches.

Most areas of these soils are used for pasture or are in woodland and brushland.

Slope and the hazard of erosion make these soils unsuitable for cultivated crops and poorly suited to pasture. The prevention of overgrazing is a major pasture management concern.

These soils are well suited to trees, and the potential for woodland is high. Slope limits the use of equipment, however, and makes machine planting impractical. Constructing roads on the contour helps to control erosion during timber harvesting. Livestock graze many areas of woodland on these soils, hindering the establishment and growth of young trees.

DtF—Dormont-Culleoka silt loams, 25 to 50 percent slopes.(continued)

Slope, the seasonal high water table in the Dormont soils, and the depth to bedrock in the Culleoka soils are the main limitations for community development, especially for onsite waste disposal. Low strength in the Dormont soils is a hazard for roads and foundations.

The capability subclass is VIIe; the woodland ordination symbol is 2r.

Nw—Newark silt loam. This soil is nearly level, deep, and somewhat poorly drained. Slopes are 50 to 300 feet long. The areas range from about 5 to 70 acres.

Typically, the surface layer is dark yellowish brown silt loam about 10 inches thick. The subsoil is yellowish brown and mottled, light brownish gray silty clay loam 29 inches thick. The substratum is mottled, light brownish gray and brown loam to a depth of 60 inches.

Included with this soil in mapping are areas of Huntington soils and Fluvaquents. Included soils make up about 25 percent of this unit.

The permeability of this Newark soil is moderate, and the available water capacity is high. Runoff is very slow. Reaction in unlimed areas is medium acid or slightly acid in the surface layer and subsoil. A seasonal high water table is at a depth of 6 to 18 inches. The hazard of erosion is slight.

Most areas of this soil are in hay, pasture, woodland, or brushland. A few areas are used for cultivated crops or community development.

This soil is suited to cultivated crops. Subsurface drains are needed in some areas to drain wet spots. Growing cover crops, returning crop residue to the soil, and using grasses and legumes in the cropping system help to maintain the organic matter content and tilth of the soil.

The soil is well suited to pasture. The prevention of overgrazing is a major pasture management concern. The suitable management practices include using proper stocking rates to maintain key plant species, rotating pastures, and periodically applying nutrients. Livestock need protection from occasional flooding of some areas of this soil.

The soil is well suited to trees, and the potential for woodland is very high. Machine planting is practical on larger areas, but the seasonal high water table limits the use of equipment.

The hazard of flooding and the seasonal high water table are the main limitations of the soil for community development.

The capability subclass is IIw; the woodland ordination symbol is 1w.

Us—Urban land. This unit consists of areas where more than 85 percent of the surface is covered by asphalt, concrete, buildings, and other impervious surfaces. Examples are parking lots, shopping centers, and industrial parks. These areas are mainly along the Monongahela River and near larger cities and towns. The areas range from 2 to 400 acres.

Examination and identification of soils or materials in this unit are impractical. Onsite investigation is needed to determine the suitabilities and potentials for any use.

This unit is not assigned a capability subclass or woodland ordination symbol.

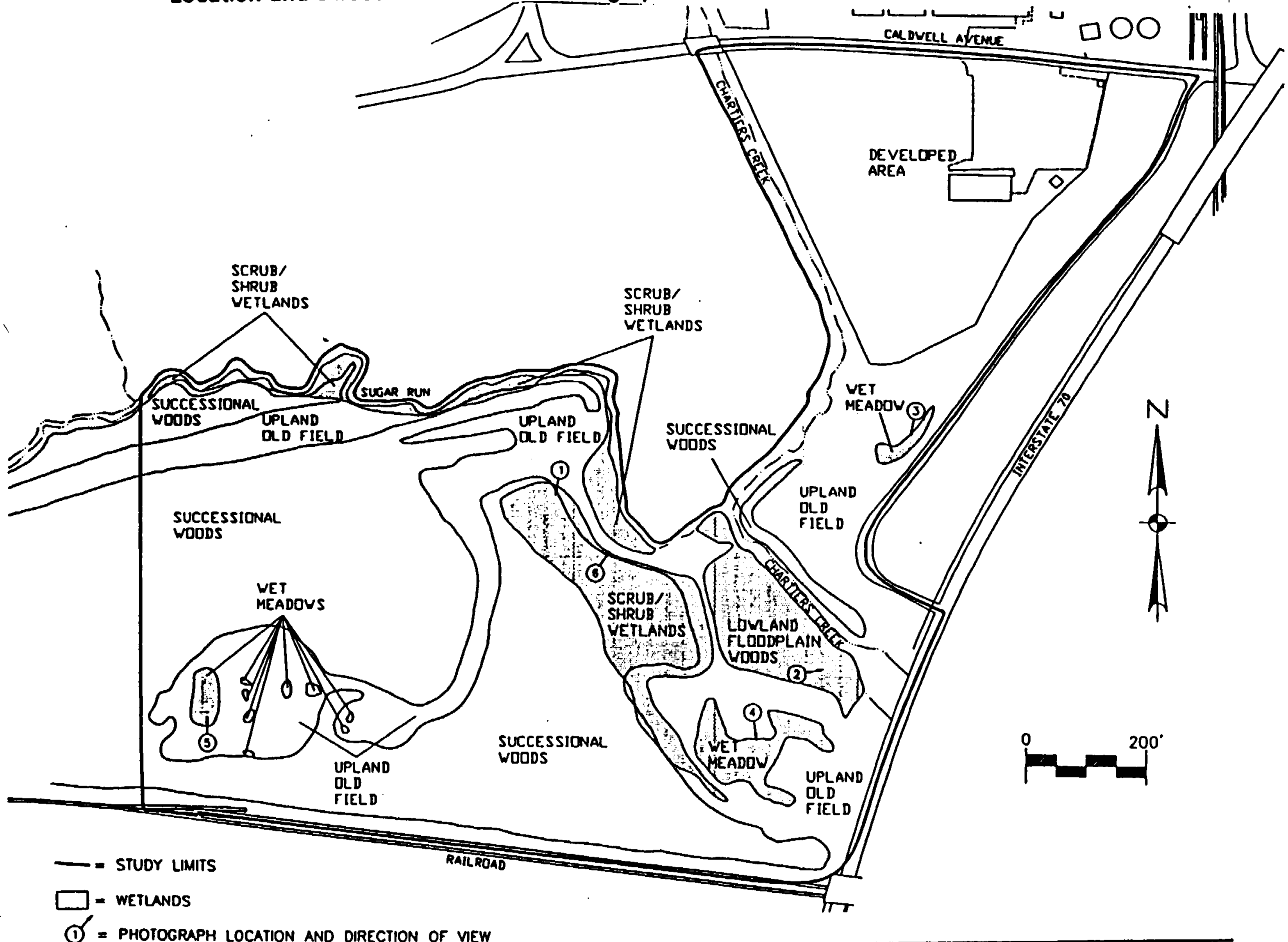
Attachment G. List of Hydric Soils, Washington County, Pennsylvania

Symbol	Soil Name
Py	Purdy silt loam

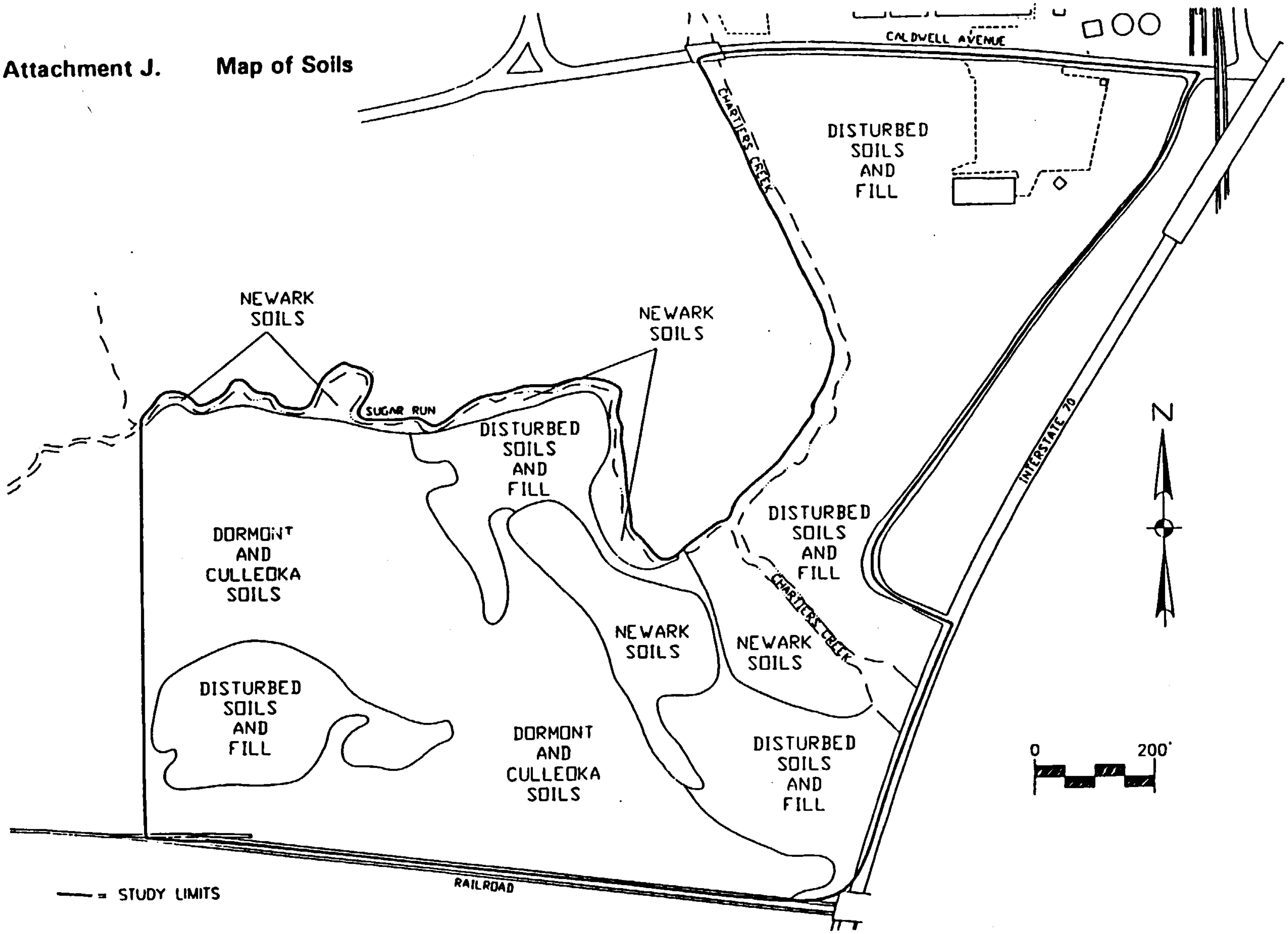
Attachment H. **Supplemental List of Non-Hydric Soil Map Units with Hydric Components, Washington County, Pennsylvania**

Symbol	Soil Name	Location Notes
DoB	Dormont silt loam, 3 to 8 percent slopes	Depressions, swales
DoC	Dormont silt loam, 8 to 15 percent slopes	Depressions, swales
Du	Dumps, mine	Depressions
Fa	Fluvaquents, loamy	Bottom lands
GdA	Glenford silt loam, 0 to 3 percent slopes	Depressions, drainageways
GdB	Glenford silt loam, 3 to 8 percent slopes	Depressions, drainageways
GdC	Glenford silt loam, 8 to 15 percent slopes	depressions, drainageways
GeB	Guernsey silt loam, 3 to 8 percent slopes	depressions, drainageways
GeC	Guernsey silt loam, 8 to 15 percent slopes	Depressions, drainageways
Hu	Huntington silt loam	Bottom lands
LbA	Library silty clay loam, 0 to 3 percent slopes	Low flats, depressions
LbB	Library silty clay loam, 3 to 8 percents slopes	Low flats, depressions
LbC	Library silty clay loam, 8 to 15 percent slopes	Drainageways, depressions
Nw	Newark silt loam	Bottom lands
UdB	Udorthents, smoothed, gently sloping	Depressions, drainageways
UdD	Udorthents, smoothed, moderately steep	Depressions, drainageways
UkB	Udorthents, strip mine, gently sloping	Depressions, drainageways
UkD	Udorthents, strip mine, moderately steep	Depressions, drainageways
WeB	Weikert-Culleoka complex, 3 to 8 percent slopes	Seepy areas
WeC	Weikert-Culleoka complex, 8 to 15 percent slopes	Seepy areas
WeD	Weikert-Culleoka complex, 15 to 25 percent slopes	Seepy areas
W	Water	—

Attachment I. **Map of Major Plant Communities and Location and Direction of View of Photographs**



Attachment J. Map of Soils



Attachment K. Description of Soil Types Found on Site

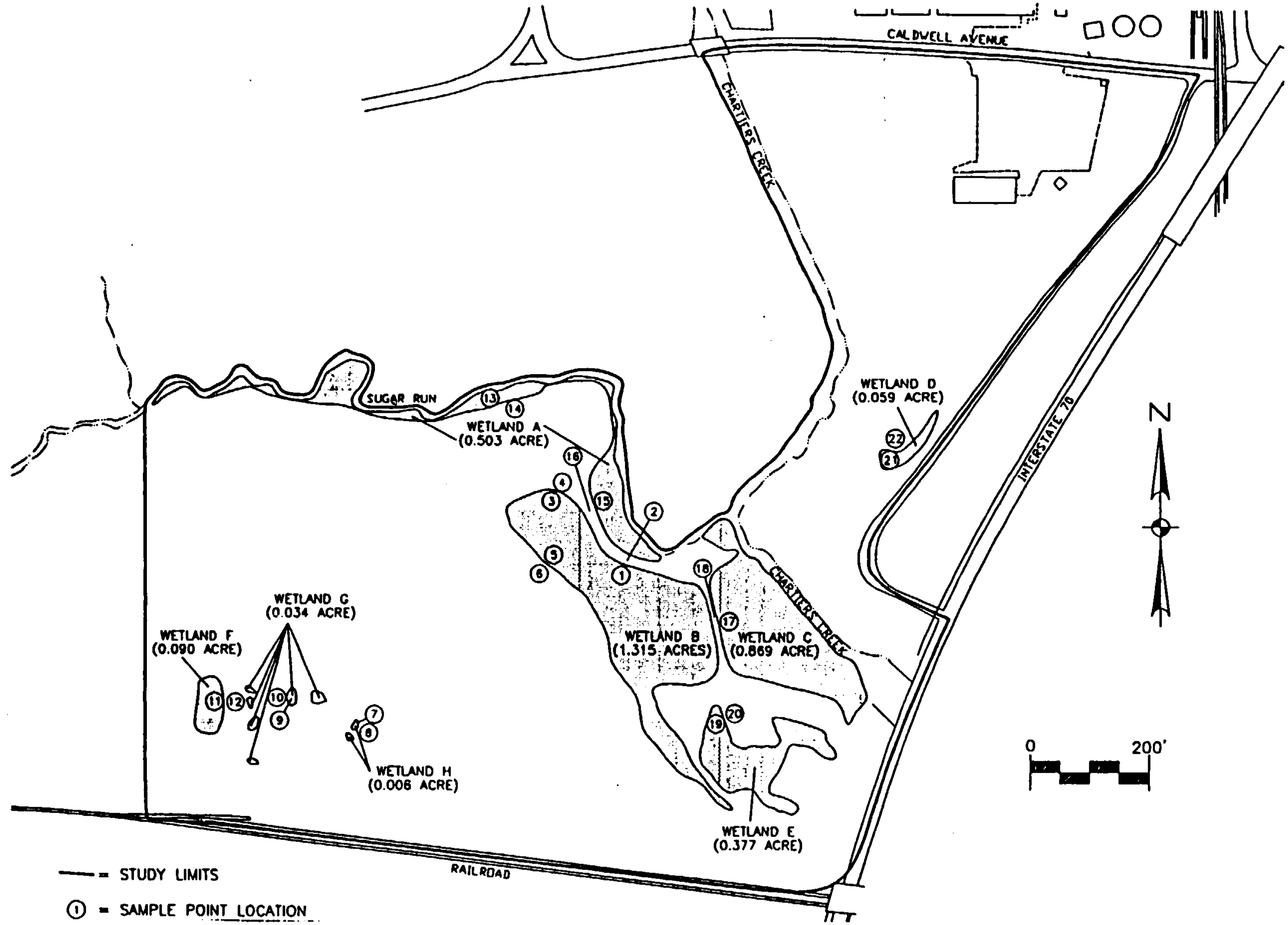
Non-hydric soils

Dormont and Culleoka Soils. The undisturbed uplands and steep slopes are covered by an association of Dormont and Culleoka soils. These are deep, moderately well drained and well drained soils that occur on uplands. Dormont and Culleoka soils formed in residuum of weathered shale, siltstone, and limestone.

Newark Soils. Newark soils occur in association with Chartiers Creek and Sugar Run. These are deep and somewhat poorly drained. Newark soils can have hydric inclusions, and most of these soils on the site meet the hydric soils criteria used to identify jurisdictional wetlands.

Disturbed Soils and Fill. A large portion of the site is covered by disturbed soils and fill and has been utilized for industrial purposes by previous land owners and Molycorp for many years. A significant portion of the hill top area, mainly the steeply sloped sides, have not been affected by industrial activities. Previous land owners placed fill debris consisting of relocated soils, slags, industrial and structural debris primarily in the area of Sugar Run.

Attachment L. Map of Field Sampling Points and Derived Wetlands Boundaries, with Wetlands Areas in Acres



Attachment M. **Field Sampling Date**

August 20, 1996 . . . . Wetlands Delineation Field Work and GPS Boundary Survey

Attachment N. Data Summary Table

Sample Number	Hydric Soil	Wetlands Hydrology	Percent Wetlands Vegetation	Wetlands	Comments
1	Yes	Yes	100	Yes	Scrub/Shrub Wetlands (Wetland B)
2	No	No	33	No	Upland Old Field
3	Yes	Yes	100	Yes	Scrub/Shrub Wetlands (Wetland B)
4	No	No	17	No	Upland old field
5	Yes	Yes	100	Yes	Scrub/Shrub Wetlands (Wetland B)
6	No	No	33	No	Successional Woods
7	No (Disturbed)	Yes	100	Yes	Wet Meadow (Wetland H)
8	No	No	50	No	Upland old field
9	Yes	Yes	100	Yes	Wet Meadow (Wetland G)
10	No	No	50	No	Upland Old Field
11	No (Disturbed)	Yes	100	Yes	Wet Meadow (Wetland F)
12	No	No	33	No	Upland Old Field
13	Yes	Yes	100	Yes	Scrub/Shrub Wetlands (Wetland A)
14	No	No	25	No	Successional Woods
15	Yes	Yes	100	Yes	Scrub/Shrub Wetlands (Wetland A)
16	No	No	0	No	Upland Old Field
17	Yes	Yes	100	Yes	Lowland Floodplain Woods (Wetland C)
18	No	No	25	No	Upland Old Field
19	No	Yes	100	Yes	Wet Meadow (Wetland E)
20	No	No	33	No	Upland Old Field
21	No	Yes	100	Yes	Wet Meadow (Wetland D)
22	No	No	0	No	Upland Old Field

Attachment O. Definition of Wetlands Vegetation Indicator Status **

Obligate Wetlands (OBL) = Occur almost always (estimated probability is greater than 99%) under natural conditions in wetlands.

Facultative Wetlands (FACW) = Usually occur in wetlands (estimated probability 67% - 99%), but occasionally found in non-wetlands.

Facultative (FAC) = Equally likely to occur in wetlands or non-wetlands (estimated probability 34% - 66%).

Facultative Upland (FACU) = Usually occur in non-wetlands (estimated probability 67% - 99%), but occasionally found in wetlands (estimated probability 1% - 33%).

Obligate Upland (UPL) = Occur in wetlands in another region, but occur almost always (estimated probability > 99%) under natural conditions in non-wetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the *National List*.

Species for which little or no information was available to base an indicator status were assigned a no indicator (NI) status. An asterisk (*) after the indicator status indicates that the indicator status was based on limited ecological information.

The wetlands indicator categories should not be equated to degrees of wetness. Many obligate wetlands species occur in permanently or semipermanently flooded wetlands, but a number of obligates also occur and some are restricted to wetlands that are only temporarily or seasonally flooded. The facultative upland species include a diverse collection of plants that range from weedy species adapted to exist in a number of environmentally stressful or disturbed sites (including wetlands) to species in which a portion of the gene pool (an ecotype) always occurs in wetlands. Both the weedy and ecotype representatives of the facultative upland category occur in seasonally and semipermanently flooded wetlands.

ADDENDUM: ACRT uses two additional status indicators when a plant cannot be identified. The status of Probable Non-Wetlands Indicator (PNI) is used for unidentified plants that are growing on non-hydric soils in an assemblage of upland plants. The status of Probable Wetlands Indicator (PWI) is used for unidentified species that are likely to be hydrophytic based on the surrounding soil and hydrology conditions.

** From: National List of Plant Species That Occur in Wetlands: Pennsylvania, May 1988. United States Fish and Wildlife Service in Cooperation with the National and Regional Interagency Review Panels. Available from the U.S. Department of Commerce, National Technical Information Service, Springfield, VA 22161.

ATTACHMENT P.

FIELD DATA SHEETS
(SOILS/HYDROLOGY AND VEGETATION ANALYSIS)

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 1

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum Dominance Level = 19%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CYPERUS SP	PWI	10		
EPILOBIUM COLORATUM	FACW+	15		
LYSIMACHIA NUMMULARIA	FACW-	40	Yes	Yes
PHALARIS ARUNDINACEA	FACW	30	Yes	Yes

Shrub Stratum Dominance Level = 6%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CORNUS AMOMUM	FACW	30	Yes	Yes

Summary Information for Sample 1
Total Number of Dominant Species: 3
Total Number of Dominant Wetlands Indicator Species: 3

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
SCRUB/SHRUB WETLANDS (WETLAND B)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 1 | Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL AT EDGE OF WETLANDS HAS INCREASED HYDROLOGY

SOIL:

Series: NEWARK SILT LOAM | Subgroup:

Is Soil on Hydric Soil List? No | Hydric Inclusions? Yes

Is Soil a Histosol? No | Histic Epipedon Present? No

Is Soil Mottled? No | Is Soil Gleyed? No

Matrix Colors: 10 YR 3/2 | Mottle Colors: | Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? Yes

Rationale: SOMEWHAT POORLY DRAINED SOIL PROFILE; HYDRIC INCLUSION

HYDROLOGY:

Is ground surface inundated? No | Surface water depth? N/A

Is soil saturated? No | Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks: Yes | Wetlands Drainage Patterns: Yes
Drift Lines: No | Morphological Adaptations: No
Sediment Deposits: Yes | Blackened Leaves: No
Surface Scoured Area: Yes | Buttressed Trunks: No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: SCRUB/SHRUB WETLANDS (WETLAND B)

Is this sample a wetlands? Yes

Rationale: HYDRIC SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 2

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum — Dominance Level = 18%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
AMBROSIA ARTEMISIIFOLIA	FACU	10		
CORONILLA VARIA	UPL	10		
MELILOTUS ALBA	FACU-	30	Yes	
RUMEX CRISPUS	FACU	10		
SAPONARIA OFFICINALIS	FACU-	20	Yes	
VERBESINA ALTERNIFOLIA	FAC	10		

Shrub Stratum — Dominance Level = 1%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CORNUS AMOMUM	FACW	5	Yes	Yes

Summary Information for Sample 2

Total Number of Dominant Species: 3
Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 33.3%
This Analysis indicates Non-Wetlands Conditions

Comments:
UPLAND OLD FIELD

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 2 | Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: OLD ROADBED

SOIL:

Series: DISTURBED SOILS | Subgroup:

Is Soil on Hydric Soil List? N/A | Hydric Inclusions? N/A

Is Soil a Histosol? No | Histic Epipedon Present? No

Is Soil Mottled? No | Is Soil Gleyed? No

Matrix Colors: 10 YR 4/3 | Mottle Colors: | Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: MATRIX CHROMA GREATER THAN 2

HYDROLOGY:

Is ground surface inundated? No | Surface water depth? N/A

Is soil saturated? No | Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	No
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	No	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 3

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum — Dominance Level = 20%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
PHALARIS ARUNDINACEA	FACW	90	Yes	Yes
SCIRPUS VALIDUS	OBL	10		

Shrub Stratum — Dominance Level = 10%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CORNUS AMOMUM	FACW	25	Yes	Yes
SALIX SP	PWI	25	Yes	Yes

Summary Information for Sample 3
Total Number of Dominant Species: 3
Total Number of Dominant Wetlands Indicator Species: 3

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
SCRUB/SHRUB WETLANDS (WETLAND B)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 3 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILLING AROUND EDGES OF WETLAND HAS INCREASED HYDROLOGY

SOIL:

Series: NEWARK SILT LOAM Subgroup:

Is Soil on Hydric Soil List? No Hydric Inclusions? Yes

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: 10 YR 3/1 Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? Yes

Rationale: SOMEWHAT POORLY DRAINED SOIL PROFILE; HYDRIC INCLUSION

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? Yes Depth to free standing water in pit/soil probe hole: 10"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	Yes
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	Yes	Blackened Leaves:	No
Surface Scoured Area:	Yes	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: OBVIOUS HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: SCRUB/SHRUB WETLANDS (WETLAND B)

Is this sample a wetlands? Yes

Rationale: HYDRIC SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 4 Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum Dominance Level = 20%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CORONILLA VARIA	UPL	50	Yes	
DAUCUS CAROTA	UPL	20	Yes	
LOTUS CORNICULATUS	FACU-	20	Yes	
OENOTHERA BIENNIS	FACU-	10		

Shrub Stratum Dominance Level = 6%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
LONICERA TATARICA	FACU	10	Yes	
RUBUS OCCIDENTALIS	UPL	10	Yes	
ULMUS RUBRA	FAC-	10	Yes	Yes

Summary Information for Sample 4
Total Number of Dominant Species: 6
Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 16.7%
This Analysis indicates Non-Wetlands Conditions

Comments:
UPLAND OLD FIELD

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 4

Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL AND DISTURBED SOILS

SOIL:

Series: DISTURBED SOILS

Subgroup:

Is Soil on Hydric Soil List? N/A

Hydric Inclusions? N/A

Is Soil a Histosol? No

Histic Epipedon Present? No

Is Soil Mottled? No

Is Soil Gleyed? No

Matrix Colors:

Mottle Colors:

Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: FILL WITH PREDOMINATELY NON-HYDRIC COLORS

HYDROLOGY:

Is ground surface inundated? No

Surface water depth? N/A

Is soil saturated? No

Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks: No
Drift Lines: No
Sediment Deposits: No
Surface Scoured Area: No

Wetlands Drainage Patterns: No
Morphological Adaptations: No
Blackened Leaves: No
Buttressed Trunks: No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 5

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum Dominance Level = 17%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
IMPATIENS CAPENSIS	FACW	50	Yes	Yes
LYSIMACHIA NUMMULARIA	FACW-	25	Yes	Yes
TYPHA LATIFOLIA	OBL	10		

Shrub Stratum Dominance Level = 15%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CORNUS AMOMUM	FACW	75	Yes	Yes

Summary Information for Sample 5
Total Number of Dominant Species: 3
Total Number of Dominant Wetlands Indicator Species: 3

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
SCRUB/SHRUB WETLANDS (WETLAND B)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 5

Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILLING AROUND EDGES OF WETLANDS HAS INCREASED HYDROLOGY

SOIL:

Series: NEWARK SILT LOAM Subgroup:

Is Soil on Hydric Soil List? No Hydric Inclusions? Yes

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: 10 YR 4/1 Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? Yes

Rationale: SOMEWHAT POORLY DRAINED SOIL PROFILE; HYDRIC INCLUSION

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	Yes
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	Yes	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: SCRUB/SHRUB WETLANDS (WETLAND B)

Is this sample a wetlands? Yes

Rationale: HYDRIC SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 6

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum — Dominance Level = 18%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
AGERATINA ALTISSIMA	FACU-	10		
GLECHOMA HEDERACEA	FACU	10		
OXALIS EUROPAEA	FACU	10		
VERBESINA ALTERNIFOLIA	FAC	50	Yes	Yes
VIOLA PAPILIONACEA	FAC	10		

Shrub Stratum — Dominance Level = 9%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
LONICERA TATARICA	FACU	25	Yes	
RUBUS ALLEGHENIENSIS	FACU-	10	Yes	
ULMUS RUBRA	FAC-	10	Yes	Yes

Tree Stratum — Dominance Level = 16%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
JUGLANS NIGRA	FACU	30	Yes	
PRUNUS SEROTINA	FACU	50	Yes	

Summary Information for Sample 6
Total Number of Dominant Species: 6
Total Number of Dominant Wetlands Indicator Species: 2

Percent Dominant Species that are Wetlands Species: 33.3%
This Analysis indicates Non-Wetlands Conditions

Comments:
SUCCESSIONAL WOODS

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 6

Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? No

Comments:

SOIL:

Series: DORMONT-CULLEOKA SILT LOAMS
Subgroup:

Is Soil on Hydric Soil List? No
Hydric Inclusions? No

Is Soil a Histosol? No
Histic Epipedon Present? No

Is Soil Mottled? No
Is Soil Gleyed? No

Matrix Colors: 10 YR 4/4
Mottle Colors:
Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: WELL DRAINED SOIL PROFILE

HYDROLOGY:

Is ground surface inundated? No
Surface water depth? N/A

Is soil saturated? No
Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	No
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	No	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: SUCCESSIONAL WOODS

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 7

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 10%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CAREX SP	PWI	10	Yes	Yes
TYPHA LATIFOLIA	OBL	40	Yes	Yes

Summary Information for Sample 7
Total Number of Dominant Species: 2
Total Number of Dominant Wetlands Indicator Species: 2

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
WET MEADOW (WETLAND H)

SAMPLE: 7

Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: RECENTLY DISTURBED HILLSIDE CUT; WETLANDS IS IN SMALL DEPRESSION

SOIL:

Series: DISTURBED SOILS

Subgroup:

Is Soil on Hydric Soil List? N/A

Hydric Inclusions? N/A

Is Soil a Histosol? No

Histic Epipedon Present? No

Is Soil Mottled? No

Is Soil Gleyed? No

Matrix Colors: DISTURBED SHALE AND SUBSOIL

Mottle Colors:

Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC SOIL COLORS

HYDROLOGY:

Is ground surface inundated? Yes

Surface water depth? 2"

Is soil saturated? Yes

Depth to free standing water in pit/soil probe hole: N/A

Other Indicators:

Water Marks: No
Drift Lines: No
Sediment Deposits: Yes
Surface Scoured Area: Yes

Wetlands Drainage Patterns: No
Morphological Adaptations: No
Blackened Leaves: No
Buttressed Trunks: No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: OBVIOUS HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: WET MEADOW (WETLAND H)

Is this sample a wetlands? Yes

Rationale: DISTURBED SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS

Sample # 8

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 15%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
ACHILLEA MILLEFOLIUM	FACU	10		
DIPSACUS SYLVESTRIS	FACU-	5		
EUTHAMIA GRAMINIFOLIA	FAC	25	Yes	Yes
TUSSILAGO FARFARA	FACU	35	Yes	

Summary Information for Sample 8
Total Number of Dominant Species: 2
Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 50.0%
This Analysis indicates Non-Wetlands Conditions

Comments:
UPLAND OLD FIELD

SAMPLE: 8

Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? No

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: RECENTLY DISTURBED HILLSIDE CUT

SOIL:

Series: DISTURBED SOILS

Subgroup:

Is Soil on Hydric Soil List? N/A

Hydric Inclusions? N/A

Is Soil a Histosol? No

Histic Epipedon Present? No

Is Soil Mottled? No

Is Soil Gleyed? No

Matrix Colors: DISTURBED SHALE AND SUBSOIL

Mottle Colors:

Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC SOIL COLORS

HYDROLOGY:

Is ground surface inundated? No

Surface water depth? N/A

Is soil saturated? No

Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks: No
Drift Lines: No
Sediment Deposits: No
Surface Scoured Area: No

Wetlands Drainage Patterns: No
Morphological Adaptations: No
Blackened Leaves: No
Buttressed Trunks: No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND FACULTATIVE UPLAND VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 9 Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum Dominance Level = 17%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
ASCLEPIAS INCARNATA	OBL	10		
SCIRPUS ATROVIRENS	OBL	50	Yes	Yes
SCIRPUS VALIDUS	OBL	15		
TYPHA LATIFOLIA	OBL	10		

Summary Information for Sample 9
Total Number of Dominant Species: 1
Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
WET MEADOW (WETLAND G)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 9 | Field Investigator: M. JOHNSON | Date: 08/20/96

Do normal environmental conditions exist at the plant community? No

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL AND DISTURBED SOILS

SOIL:

Series: DISTURBED SOILS | Subgroup:

Is Soil on Hydric Soil List? N/A | Hydric Inclusions? N/A

Is Soil a Histosol? No | Histic Epipedon Present? No

Is Soil Mottled? Yes | Is Soil Gleyed? No

Matrix Colors: 10 YR 5/1 | Mottle Colors: 10 YR 5/6 | Percent: 10

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? Yes

Rationale: MATRIX CHROMA OF 1 WITH MOTTLE

HYDROLOGY:

Is ground surface inundated? No | Surface water depth? N/A

Is soil saturated? No | Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	Yes	Wetlands Drainage Patterns:	Yes
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	Yes
Surface Scoured Area:	Yes	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: WET MEADOW (WETLAND G)

Is this sample a wetlands? Yes

Rationale: HYDRIC SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 10

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 19%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
AMBROSIA ARTEMISIIFOLIA	FACU	10		
DIPSACUS SYLVESTRIS	FACU-	10		
EUTHAMIA GRAMINIFOLIA	FAC	20	Yes	Yes
MELILOTUS ALBA	FACU-	45	Yes	
SOLIDAGO CANADENSIS	FACU	10		

Summary Information for Sample 10
Total Number of Dominant Species: 2
Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 50.0%
This Analysis indicates Non-Wetlands Conditions

Comments:
UPLAND OLD FIELD

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 10 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL AND DISTURBED SOILS

SOIL:

Series: DISTURBED SOILS Subgroup:

Is Soil on Hydric Soil List? N/A Hydric Inclusions? N/A

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? Yes Is Soil Gleyed? No

Matrix Colors: FILL AND DISTURBED SOILS Mottle Colors:
Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC SOIL COLORS

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	No
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	No	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 11

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 19%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
ASCLEPIAS INCARNATA	OBL	40	Yes	Yes
SCIRPUS ATROVIRENS	OBL	15		
TYPHA LATIFOLIA	OBL	40	Yes	Yes

Summary Information for Sample 11
Total Number of Dominant Species: 2
Total Number of Dominant Wetlands Indicator Species: 2

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
WET MEADOW (WETLAND F)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 11 | Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL AND DISTURBED SOILS

SOIL:

Series: DISTURBED SOILS | Subgroup:

Is Soil on Hydric Soil List? N/A | Hydric Inclusions? N/A

Is Soil a Histosol? No | Histic Epipedon Present? No

Is Soil Mottled? No | Is Soil Gleyed? No

Matrix Colors: FILL AND DISTURBED SOILS | Mottle Colors:
Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC SOIL COLORS

HYDROLOGY:

Is ground surface inundated? No | Surface water depth? N/A

Is soil saturated? No | Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	Yes
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	Yes	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: WET MEADOW (WETLAND F)

Is this sample a wetlands? Yes

Rationale: DISTURBED SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 12

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 19%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
DAUCUS CAROTA	UPL	15		
DIPSACUS SYLVESTRIS	FACU-	20	Yes	
EUTHAMIA GRAMINIFOLIA	FAC	20	Yes	Yes
SOLIDAGO CANADENSIS	FACU	40	Yes	

Summary Information for Sample 12

Total Number of Dominant Species: 3

Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 33.3%

This Analysis indicates Non-Wetlands Conditions

Comments:

UPLAND OLD FIELD

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 12 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL AND DISTURBED SOILS

SOIL:

Series: DISTURBED SOILS Subgroup:

Is Soil on Hydric Soil List? N/A Hydric Inclusions? N/A

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: FILL AND DISTURBED SOILS Mottle Colors:
Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC SOIL COLORS

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks: No Wetlands Drainage Patterns: No
Drift Lines: No Morphological Adaptations: No
Sediment Deposits: No Blackened Leaves: No
Surface Scoured Area: No Buttressed Trunks: No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

Sample # 13

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum — Dominance Level = 19%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CONVOLVULUS ARVENSIS	UPL	10		
IMPATIENS CAPENSIS	FACW	25	Yes	Yes
PILEA PUMILA	FACW	20	Yes	Yes
VERBESINA ALTERNIFOLIA	FAC	40	Yes	Yes

Shrub Stratum — Dominance Level = 15%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CORNUS AMOMUM	FACW	75	Yes	Yes

Summary Information for Sample 13

Total Number of Dominant Species: 4
Total Number of Dominant Wetlands Indicator Species: 4

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
SCRUB/SHRUB WETLANDS (WETLAND A)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 13 | Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? No

Comments:

SOIL:

Series: NEWARK SILT LOAM | Subgroup:

Is Soil on Hydric Soil List? No | Hydric Inclusions? Yes

Is Soil a Histosol? No | Histic Epipedon Present? No

Is Soil Mottled? No | Is Soil Gleyed? No

Matrix Colors: 10 YR 5/1 | Mottle Colors: | Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? Yes

Rationale: SOMEWHAT POORLY DRAINED SOIL PROFILE; HYDRIC INCLUSION

HYDROLOGY:

Is ground surface inundated? No | Surface water depth? N/A

Is soil saturated? No | Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	Yes
Drift Lines:	Yes	Morphological Adaptations:	No
Sediment Deposits:	Yes	Blackened Leaves:	No
Surface Scoured Area:	Yes	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: SCRUB/SHRUB WETLANDS (WETLAND A)

Is this sample a wetlands? Yes

Rationale: HYDRIC SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 14 Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum Dominance Level = 9%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
ALLIARIA PETIOLATA	FACU-	20	Yes	
VERBESINA ALTERNIFOLIA	FAC	25	Yes	Yes

Shrub Stratum Dominance Level = 17%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
LONICERA TATARICA	FACU	10		
PRUNUS SEROTINA	FACU	50	Yes	
PYRUS MALUS	UPL	25	Yes	

Summary Information for Sample 14
Total Number of Dominant Species: 4
Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 25.0%
This Analysis indicates Non-Wetlands Conditions

Comments:
SUCCESSIONAL WOODS

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 14 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL AND DISTURBED SOILS

SOIL:

Series: DISTURBED SOILS Subgroup:

Is Soil on Hydric Soil List? N/A Hydric Inclusions? N/A

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: 10 YR 5/3 Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: MATRIX CHROMA GREATER THAN 2

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	No
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	No	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: SUCCESSIONAL WOODS

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 15 Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum Dominance Level = 20%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
DIPSACUS SYLVESTRIS	FACU-	10		
IMPATIENS CAPENSIS	FACW	50	Yes	Yes
PHALARIS ARUNDINACEA	FACW	30	Yes	Yes
VERBESINA ALTERNIFOLIA	FAC	10		

Shrub Stratum Dominance Level = 7%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CORNUS AMOMUM	FACW	35	Yes	Yes

Summary Information for Sample 15
Total Number of Dominant Species: 3
Total Number of Dominant Wetlands Indicator Species: 3

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
SCRUB/SHRUB WETLANDS (WETLAND A)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 15 | Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? No

Comments:

SOIL:

Series: NEWARK SILT LOAM | Subgroup:

Is Soil on Hydric Soil List? No | Hydric Inclusions? Yes

Is Soil a Histosol? No | Histic Epipedon Present? No

Is Soil Mottled? No | Is Soil Gleyed? No

Matrix Colors: 10 YR 3/2 | Mottle Colors: | Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? Yes

Rationale: SOMEWHAT POORLY DRAINED SOIL PROFILE; SMALL HYDRIC INCLUSION

HYDROLOGY:

Is ground surface inundated? No | Surface water depth? N/A

Is soil saturated? No | Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	Yes
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	Yes	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: SCRUB/SHRUB WETLANDS (WETLAND A)

Is this sample a wetlands? Yes

Rationale: HYDRIC SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 16

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 21%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
ACHILLEA MILLEFOLIUM	FACU	10		
APOCYNUM CANNABINUM	FACU	10		
CORONILLA VARIA	UPL	30	Yes	
DACTYLIS GLOMERATA	FACU	10		
DAUCUS CAROTA	UPL	10		
MELILOTUS OFFICINALIS	FACU-	30	Yes	
VERBESINA ALTERNIFOLIA	FAC	5		

Summary Information for Sample 16

Total Number of Dominant Species: 2

Total Number of Dominant Wetlands Indicator Species: None

Percent Dominant Species that are Wetlands Species: 0.0%

This Analysis indicates Non-Wetlands Conditions

Comments:

UPLAND OLD FIELD

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 16 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: OLD ROADBED; FILL AND DISTURBED SOILS

SOIL:

Series: DISTURBED SOILS Subgroup:

Is Soil on Hydric Soil List? N/A Hydric Inclusions? N/A

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC SOIL COLORS

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	No
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	No	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 17 Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum Dominance Level = 13%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
IMPATIENS CAPENSIS	FACW	15	Yes	Yes
LYSIMACHIA NUMMULARIA	FACW-	50	Yes	Yes

Shrub Stratum Dominance Level = 7%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CORNUS AMOMUM	FACW	25	Yes	Yes
ULMUS AMERICANA	FACW-	10	Yes	Yes

Tree Stratum Dominance Level = 17%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
ACER NEGUNDO	FAC+	35	Yes	Yes
ACER SACCHARINUM	FACW	50	Yes	Yes

Summary Information for Sample 17
Total Number of Dominant Species: 6
Total Number of Dominant Wetlands Indicator Species: 6

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
LOWLAND FLOODPLAIN WOODS (WETLAND C)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 17 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? No

Comments:

SOIL:

Series: NEWARK SILT LOAM Subgroup:

Is Soil on Hydric Soil List? No Hydric Inclusions? Yes

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: 10 YR 4/1 Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? Yes

Rationale: SOMEWHAT POORLY DRAINED SOIL PROFILE; HYDRIC INCLUSION

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks: No Wetlands Drainage Patterns: Yes
Drift Lines: No Morphological Adaptations: No
Sediment Deposits: Yes Blackened Leaves: No
Surface Scoured Area: Yes Buttressed Trunks: No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: LOWLAND FLOODPLAIN WOODS (WETLAND C)

Is this sample a wetlands? Yes

Rationale: HYDRIC SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

Sample # 18

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum — Dominance Level = 9%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
ALLIARIA PETIOLATA	FACU-	20	Yes	
MELILOTUS ALBA	FACU-	10	Yes	
SOLIDAGO CANADENSIS	FACU	15	Yes	

Shrub Stratum — Dominance Level = 11%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
ACER NEGUNDO	FAC+	55	Yes	Yes

Summary Information for Sample 18

Total Number of Dominant Species: 4
Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 25.0%
This Analysis indicates Non-Wetlands Conditions

Comments:
UPLAND OLD FIELD

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 18

Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: OLD ROADBED

SOIL:

Series: DISTURBED SOILS

Subgroup:

Is Soil on Hydric Soil List? N/A

Hydric Inclusions? N/A

Is Soil a Histosol? No

Histic Epipedon Present? No

Is Soil Mottled? No

Is Soil Gleyed? No

Matrix Colors:

Mottle Colors:

Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC DISTURBED SOILS AND FILL

HYDROLOGY:

Is ground surface inundated? No

Surface water depth? N/A

Is soil saturated? No

Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks: No
Drift Lines: No
Sediment Deposits: No
Surface Scoured Area: No

Wetlands Drainage Patterns: No
Morphological Adaptations: No
Blackened Leaves: No
Buttressed Trunks: No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: NON-HYDRIC SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

Sample # 19

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 16%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
EPILOBIUM COLORATUM	FACW+	20	Yes	Yes
SCIRPUS ATROVIRENS	OBL	25	Yes	Yes
TYPHA LATIFOLIA	OBL	35	Yes	Yes

Summary Information for Sample 19
Total Number of Dominant Species: 3
Total Number of Dominant Wetlands Indicator Species: 3

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
WET MEADOW (WETLAND E)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 19 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL OVER OLD TAR PIT

SOIL:

Series: DISTURBED SOILS Subgroup:

Is Soil on Hydric Soil List? N/A Hydric Inclusions? N/A

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC DISTURBED SOILS AND FILL

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	Yes
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	Yes	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: WET MEADOW (WETLAND E)

Is this sample a wetlands? Yes

Rationale: NON-HYDRIC DISTURBED SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 20

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 20%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
DAUCUS CAROTA	UPL	10		
DIPSACUS SYLVESTRIS	FACU-	10		
EUTHAMIA GRAMINIFOLIA	FAC	20	Yes	Yes
LOTUS CORNICULATUS	FACU-	20	Yes	
MELILOTUS ALBA	FACU-	40	Yes	

Summary Information for Sample 20
Total Number of Dominant Species: 3
Total Number of Dominant Wetlands Indicator Species: 1

Percent Dominant Species that are Wetlands Species: 33.3%
This Analysis indicates Non-Wetlands Conditions

Comments:
UPLAND OLD FIELD

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 20 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: FILL OVER OLD TAR PIT

SOIL:

Series: DISTURBED SOILS Subgroup:

Is Soil on Hydric Soil List? N/A Hydric Inclusions? N/A

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC DISTURBED SOILS AND FILL

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	No
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	No	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: NON-HYDRIC DISTURBED SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 21

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 18%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
CYPERUS SP	PWI	10		
TYPHA ANGUSTIFOLIA	OBL	30	Yes	Yes
TYPHA LATIFOLIA	OBL	50	Yes	Yes

Summary Information for Sample 21
Total Number of Dominant Species: 2
Total Number of Dominant Wetlands Indicator Species: 2

Percent Dominant Species that are Wetlands Species: 100.0%
This Analysis indicates Wetlands Conditions

Comments:
WET MEADOW (WETLAND D)

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 21 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: DRAINAGEWAY

SOIL:

Series: URBAN LAND Subgroup:

Is Soil on Hydric Soil List? No Hydric Inclusions? No

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC DISTURBED SOILS AND FILL

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	Yes
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	Yes	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? Yes

Rationale: SECONDARY HYDROLOGICAL INDICATORS IN DRAINAGEWAY

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: WET MEADOW (WETLAND D)

Is this sample a wetlands? Yes

Rationale: DISTURBED SOILS, WETLANDS HYDROLOGY, AND HYDROPHYTIC VEGETATION

WETLANDS DELINEATION: VEGETATION ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

Sample # 22

Field Investigator T. CRANDALL
Collection Date 08/20/96

Herb Stratum

Dominance Level = 16%

Species	Indic	% Dom	Dominant	Dominant Wetlands Indic
MELILOTUS ALBA	FACU-	20	Yes	
PHLEUM PRATENSE	FACU	40	Yes	
TRIFOLIUM PRATENSE	FACU-	20	Yes	

Summary Information for Sample 22

Total Number of Dominant Species: 3
Total Number of Dominant Wetlands Indicator Species: None

Percent Dominant Species that are Wetlands Species: 0.0%
This Analysis indicates Non-Wetlands Conditions

Comments:

UPLAND OLD FIELD

WETLANDS DELINEATION: SOIL AND HYDROLOGY ANALYSIS
ACRT Client: IT CORPORATION
ACRT Project No: 962236
Site: MOLYCORP SITE, 28.8 ACRES, WASHINGTON, PENNSYLVANIA

SAMPLE: 22 Field Investigator: M. JOHNSON
Date: 08/20/96

Do normal environmental conditions exist at the plant community? Yes

Have vegetation, soil, and/or hydrology been significantly disturbed? Yes

Comments: DISTURBED SOILS AND FILL

SOIL:

Series: URBAN LAND Subgroup:

Is Soil on Hydric Soil List? No Hydric Inclusions? No

Is Soil a Histosol? No Histic Epipedon Present? No

Is Soil Mottled? No Is Soil Gleyed? No

Matrix Colors: Mottle Colors: Percent:

Other Hydric Soil Indicators: NONE

Is Hydric Soil Criterion Met? No

Rationale: APPARENT NON-HYDRIC DISTURBED SOILS AND FILL

HYDROLOGY:

Is ground surface inundated? No Surface water depth? N/A

Is soil saturated? No Depth to free standing water in pit/soil probe hole: > 18"

Other Indicators:

Water Marks:	No	Wetlands Drainage Patterns:	No
Drift Lines:	No	Morphological Adaptations:	No
Sediment Deposits:	No	Blackened Leaves:	No
Surface Scoured Area:	No	Buttressed Trunks:	No

Is Wetlands Hydrology Criterion Met? No

Rationale: NO HYDROLOGICAL INDICATORS

JURISDICTIONAL DETERMINATION:

Analysis of Vegetation: UPLAND OLD FIELD

Is this sample a wetlands? No

Rationale: DISTURBED SOILS, NO EVIDENCE OF WETLANDS HYDROLOGY, AND UPLAND VEGETATION

ATTACHMENT Q.

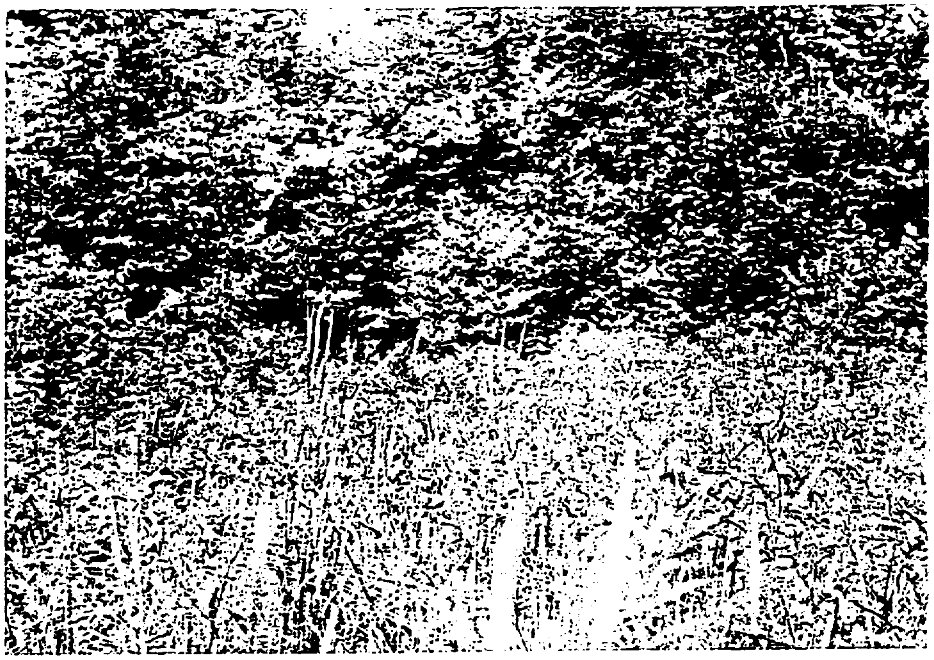
PHOTOGRAPHS

Photograph 1 (08-20-96) Wetlands A and B are scrub/shrub wetlands. *Cornus amomum* (silky dogwood) is common in these areas.

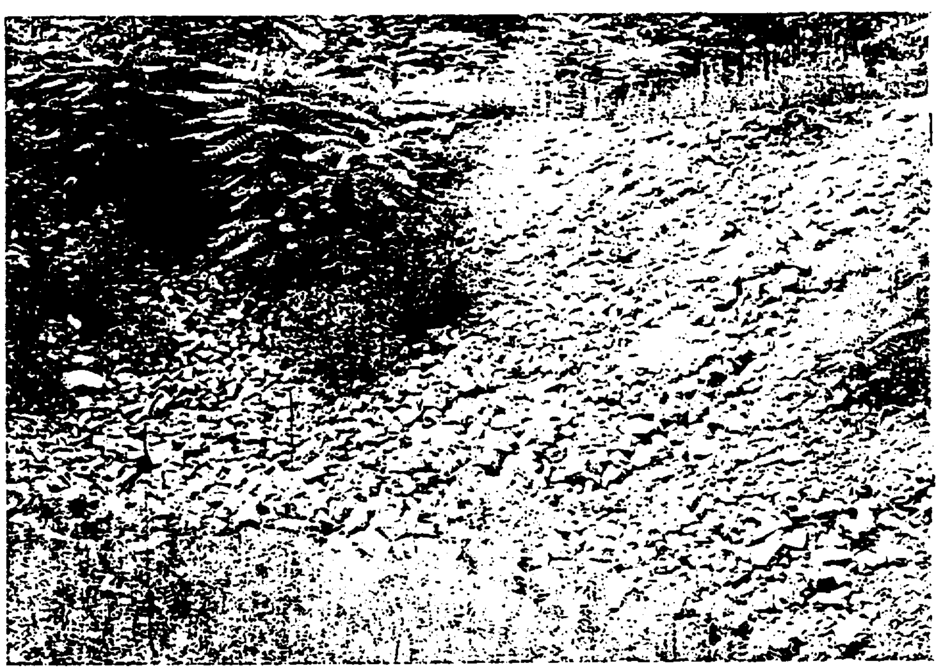
Photograph 2 (08-20-96) Wetland C is a lowland floodplain woods. *Acer saccharinum* (silver maple) and *Cornus amomum* (silky dogwood) dominate much of this area.

Photograph 3 (08-20-96) Wetland D is associated with a drainageway along an access road and is dominated by *Typha* sp. (cattail).

Photograph 4 (08-20-96) Wetland E is a wet meadow that has formed over the fill in the tar impoundment. Limited exposed areas of tar are visible in the foreground of this picture.



Photograph 5 (08-20-96) *Asclepias incarnata* (swamp milkweed) is common throughout Wetlands F, G, and H. These are wet meadows that have formed in disturbed areas.



Photograph 6 (08-20-96) Various industrial and structural debris were used as fill by former land owners, as depicted by this photograph. This photo shows an old railroad bed, which is located on the site.

Attachment R. References

Federal Interagency Committee for Wetland Delineation. 1989. *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service, Washington. Cooperative technical publication. 76 pp. plus appendices.

Gleason, H. A. and A. C. Cronquist. 1991 (2nd edition). *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*. New York Botanical Garden, Bronx. lxxv + 910 pp.

National Technical Committee for Hydric Soils. 1991. *Hydric Soils of the United States*. United States Department of Agriculture Soil Conservation Service, Washington.

Newcomb, L. 1977. *Newcomb's Wildflower Guide*. Little, Brown and Co., Boston. xxii + 490 pp.

Reed, P. B., Jr. 1988. *National List of Plant Species that Occur in Wetlands: Pennsylvania*. United States Fish and Wildlife Service, Washington.

Seibert, Daniel R., Jay B. Weaver, R. Dennis Bush, David J. Belz, Dean D. Rector, Joseph S. Hallowich, and Robert G. Grubb. 1983. *Soil Survey of Greene and Washington Counties, Pennsylvania*. United States Department of Agriculture, Soil Conservation Service. Washington. 93 pp. + 164 maps.

Wherry, Edgar T., John M. Fogg, Jr., and Herbert A. Wahl. 1979. *Atlas of the Flora of Pennsylvania*. The Morris Arboretum, Philadelphia. xxx + 390 pp.

ATTACHMENT S. PROFILES OF ACRT SCIENTISTS

Profiles of the following ACRT, Inc. personnel are attached:

Jay Abercrombie, Ph.D., Entomologist, Project Coordinator
Karen M.Wise, M.S., Wetlands Biologist, Project Manager
Todd A. Crandall, M.En., Wetlands Biologist
Michael D. Johnson, M.A., Biologist/Vertebrate Zoologist
Kenneth John Christensen, Conservationist/GPS Specialist

Address: ACRT, Inc.
2545 Bailey Road
P.O. Box 401
Cuyahoga Falls, Ohio 44221
Phone: 800-622-2562

JAY ABERCROMBIE, Ph.D., Entomologist: Dr. Abercrombie is senior vice president of Ecological Services for ACRT, Inc. He manages and coordinates the biological and ecological projects at ACRT. Dr. Abercrombie has expertise in the ecology, taxonomy, and morphology of aquatic insects and other invertebrates of streams and wetlands. Dr. Abercrombie holds a bachelor's degree in biology from the University of Akron and a doctorate in entomology from Cornell University.

KAREN M. WISE, M.S., Wetlands Biologist: Ms. Wise specializes in freshwater wetlands ecology, particularly constructed wetlands for wastewater treatment. She is the manager for projects involving wetlands restoration, mitigation, and monitoring. Ms. Wise also specializes in wetlands permitting and is experienced in streamlining the regulatory compliance process. She has a bachelor's degree in biology from Wheeling Jesuit College and a master's degree from the Ohio State University in natural resources.

TODD A. CRANDALL, M.En., Wetlands Biologist: An environmental scientist specializing in plant identification, Mr. Crandall directs vegetation data collection for wetlands assessments and delineations. He also prepares and implements wetlands restoration and mitigation plans. He is certified for wetlands studies by the U.S. Army Wetlands Delineator Certification Program. Mr. Crandall has a bachelor's degree from Hiram College in biology and a master's degree from Miami University in environmental science.

MICHAEL D. JOHNSON, M.A., Biologist/Vertebrate Zoologist: As a member of ACRT's Ecological Services Department, Mr. Johnson specializes in fish, mammal, and macroinvertebrate studies. He has a bachelor's degree in biology, with emphasis in vertebrate zoology, and a master's degree in general science, both from Kent State University.

KENNETH JOHN CHRISTENSEN, Conservationist/GPS Specialist: Mr. Christensen performs ecological surveys for transportation projects and other studies. His focus is the field analysis of vertebrate populations, especially amphibians and reptiles. He also excels in plant identification and wetlands identification. Mr. Christensen is responsible for managing the GPS mapping operations of the Ecological Services and urban forestry groups at ACRT. He has a bachelor's degree in conservation from Kent State University.

APPENDIX B

NATIONAL REGISTER OF INDIVIDUAL PROPERTIES AND HISTORIC DISTRICTS IN PENNSYLVANIA

National Register Individual Properties and Historic Districts in Pennsylvania

Pennsylvania Historical & Museum Commission
Bureau for Historic Preservation
P.O. Box 1026
Harrisburg, Pennsylvania 17108-1026
(717) 783-8946

County Codes

001	Adams
003	Allegheny
005	Armstrong
007	Beaver
009	Bedford
011	Berks
013	Blair
015	Bradford
017	Bucks
019	Butler
021	Cambria
023	Cameron
025	Carbon
027	Centre
029	Chester
031	Clarion
033	Clearfield
035	Clinton
037	Columbia
039	Crawford
041	Cumberland
043	Dauphin
045	Delaware
047	Elk
049	Erie
051	Fayette
053	Forest
055	Franklin
057	Fulton
059	Greene
061	Huntingdon
063	Indiana
065	Jefferson
067	Juniata
069	Lackawanna
071	Lancaster
073	Lawrence
075	Lebanon
077	Lehigh
079	Luzerne
081	Lycoming
083	McKean
085	Mercer
087	Mifflin
089	Monroe
091	Montgomery
093	Montour
095	Northampton
097	Northumerland
099	Perry
101	Philadelphia
103	Pike
105	Potter
107	Schuylkill
109	Snyder
111	Somerset
113	Sullivan
115	Susquehanna
117	Tioga
119	Union
121	Venango
123	Warren
125	Washington
127	Wayne
129	Westmoreland
131	Wyoming
133	York

REPORT NO. 01

PENNSYLVANIA HISTORICAL & MUSEUM COMMISSION
BUREAU OF HISTORIC PRESERVATION
NATIONAL REGISTER/INDIVIDUAL PROPERTIES AND DISTRICTS IN PA.

NRF019A

CO.	MUNICIPALITY	HISTORIC NAME	ADDRESS	DATE LISTED	KEY	NUM
119	BUFFALO TWP	BUFFALO PRESBYTERIAN CHURCH	RT.192, W OF LEWISBURG	01/30/76	000830	1
119	EAST BUFFALO TWP	LEWISBURG ARMORY	R D 1, US RT. 15	11/14/91	096469	1
119	GREG TWP	GRIFFEY, BENJAMIN HOUSE	RT.44, W OF ALLENWOOD	09/13/78	000828	1
119	HARTLEY TWP	MILLMONT RED BRIDGE	LR59005, SW OF MILLMONT	02/08/80	050854	1
119	HARTLY TWP	HALFWAY LAKE DAM (R.B. WINTER SP.)	R.B.WINTER STATE PARK	05/11/87	088878	1
119	KELLY TWP	SLIFER HOUSE	LR59024, 1/2MI S.E. OFF RT. 15	06/18/75	000822	1
119	LEWISBURG	CHAMBERLIN IRON FRONT BUILDING	434 MARKET STREET	05/14/79	000829	1
119	LEWISBURG	PACKWOOD HOUSE - AMERICAN HOTEL	10 MARKET STREET	09/20/78	000831	1
119	LEWISBURG	READING RAILROAD FREIGHT STATION	ST. LOUIS & S. FIFTH STS	01/22/92	092734	1
119	MIFFLINBURG	HASSENPLUG BRIDGE	NORTH 4TH ST	02/08/80	050855	1
119	MIFFLINBURG	HEISS, WILLIAM A. HOUSE AND BUGGY SHOP	523 GREEN STREET	08/06/79	000826	1
119	MIFFLINBURG	MIFFLINBURG HISTORIC DISTRICT	RT.45	04/10/80	000824	1
119	NEW BERLIN	NEW BERLIN PRESBYTERIAN CHURCH	VINE STREET & HIGH STREET	10/26/72	000823	1
119	NEW BERLIN	OLD UNION COUNTY COURTHOUSE	MARKET & VINE STREETS	11/09/72	000825	1
119	W BUFFALO TWP	HAYES BRIDGE	T376	02/08/80	086600	1
119	WHITE DEER TWP	FACTORY COVERED BRIDGE	T629, W OF WHITE DEER	02/08/80	050856	1
						16
121	CHERRY TREE TWP	DRAKE OIL WELL	T588 .5 MILE SOUTH OF L.R. 60052	11/13/66	001206	1
121	CHERRYTREE TWP	BRIDGE IN CHERRYTREE TOWNSHIP	L.R. 60052 OVER OIL CREEK	06/22/88	000028	1
121	CLINTON TWP	BRIDGE IN CLINTON TOWNSHIP	L.R. 60010 OVER SCRUBGRASS CREEK	06/22/88	000029	1
121	CLINTON TWP	WITHERUP BRIDGE	L.R. 60007 OVER SCRUBGRASS CREEK	06/22/88	000430	1
121	CORNPLANTER TWP	PITHOLE CITY, SITE OF	OFF RT. 227 NEAR LR60049	03/20/73	001207	1
121	FRANKLIN	DALE, SAMUEL F. HOME	1409 ELK STREET	12/04/75	001205	1
121	FRANKLIN	FRANKLIN HISTORIC DISTRICT	PARTS OF WARDS 1 AND 2	01/26/84	064348	1
121	FRANKLIN	PLUMER BLOCK	1205 LIBERTY ST & COR. OF 12TH ST	04/20/78	001203	1
121	OIL*CITY	NATIONAL TRANSIT BUILDING	206 SENECA STREET	09/13/78	001204	1
121	OIL*CITY	OIL CITY ARMORY	E. 2ND & STATE STS.	05/09/91	096490	1
121	OIL*CITY	OIL CITY U.S. POST OFFICE	270 SENECA STREET	09/15/77	001202	1
121	PLEASANTVILLE	ALLEGHENY BAPTIST CHURCH	RT. 27, MAIN STREET	12/15/78	001201	1
121	PRESIDENT TWP	PITHOLE STONE ARCH	L. R. 60046 OVER PITHOLE CREEK	06/22/88	000112	1
121	ROCKLAND TWP	INDIAN GOD ROCK PETROGLYPH		05/14/84	064449	1
121	ROCKLAND TWP	ROCKLAND FURNACE	NEAR ROCKLAND STA. ON T480	09/06/91	096850	1
						15
123	BROKEN STRAW TWP	IRVINE UNITED PRESBYTERIAN CHURCH	S SIDE OLD RT.6, IRVINE	08/27/76	001198	1
123	PINE GROVE TWP	IRVINE, GUY C. HOUSE	RT.62, 1-1/2MI S OF RUSSELL	09/13/78	001199	1
123	WARREN	HAZELTINE, A. J. HOUSE	710 PENNSYLVANIA AVE. WEST	11/21/76	001200	1
123	WARREN	JEFFERSON, J.P. HOUSE	119 MARKET STREET	05/09/85	067779	1
123	WARREN	STRUTHERS LIBRARY BUILDING	3RD & LIBERTY STREET	10/10/75	001197	1
123	WARREN	WARREN ARMORY	330 HICKORY ST.	05/09/91	096475	1
123	WARREN	WARREN COUNTY COURTHOUSE	MARKET STREET & FOURTH STREET	04/18/77	001196	1
123	WARREN	WETMORE HOUSE	210 4TH AVE	04/28/75	001195	1
						8
125	AMWELL TWP	BAILEY COVERED BRIDGE	LR62082, SW OF AMITY	06/22/79	050859	1
125	AMWELL TWP	LITTLE, MOSES TAVERN	US 40, .75 MI. E OF I-79 INTERCHANGE	02/16/96	096954	1
125	AMWELL TWP	MARTIN'S MILL COVERED BRIDGE	T323, W OF BISSELL	06/22/79	050881	1
125	BLAINE TWP	SAWHILL COVERED BRIDGE	T426, SW OF TAYLORSTOWN	06/22/79	050868	1
125	BLAINE TWP	TAYLORSTOWN HISTORIC DISTRICT	MAIN ST.	09/05/85	050897	1
125	BUFFALO TWP	"S" BRIDGE	U.S. RT. 40, 6MI W OF WASHINGTON	04/04/75	001177	1
125	BUFFALO TWP	CALDWELL, JAMES TAVERN	INTERSECTION US 40 & TR-474	02/16/96	096956	1
125	CALIFORNIA	OLD MAIN, CALIFORNIA STATECOLLEGE	CALIFORNIA STATE COLLEGE	05/02/74	001185	1
125	CALIFORNIA	PENNSYLVANIA RAILROAD PASSENGER STATION	WATER & WOOD STREETS	06/19/79	001181	1
125	CANONSBURG	CANONSBURG ARMORY	W. COLLEGE & N. CENTRAL AVES.	12/22/89	096479	1
125	CANONSBURG	HAWTHORNE SCHOOL	HAWTHORNE ST AT BLUFF ST	05/08/86	082515	1
125	CANONSBURG	ROBERTS HOUSE	225 N. CENTRAL AVE.	04/16/75	001178	1

REPORT NO. 01

PENNSYLVANIA HISTORICAL & MUSEUM COMMISSION
BUREAU OF HISTORIC PRESERVATION
NATIONAL REGISTER/INDIVIDUAL PROPERTIES AND DISTRICTS IN PA.

NRF019A

CO.	MUNICIPALITY	HISTORIC NAME	ADDRESS	DATE LISTED	KEY	NUM
125	CENTERVILLE	WELSH/EMERY HOUSE	114 EMERY ROAD	03/07/95	087085	1
125	CENTERVILLE TWP	DORSEY, JOSEPH HOUSE	113 CHERRY AVENUE	11/19/74	001188	1
125	CENTERVILLE TWP	HARRISON HOUSE	RT.40, 1MI E. OF CENTERVILLE	12/30/74	001182	1
125	CENTERVILLE TWP	MALDEN INN	RT. 40 EAST, MALDEN PLACE	01/24/74	001186	1
125	CHARLEROI	CHARLEROI UNITED STATES POST OFFICE	638 FALLOWFIELD AVE	01/04/90	094455	1
125	CHARLEROI/MONESSEN	CHARLEROI-MONESSEN BRIDGE	LR247 OVER MONONGAHELA RIVER	06/22/88	000398	1
125	CLAYSVILLE	MONTGOMERY HOUSE	WEST MAIN ST.	10/25/74	001183	1
125	CROSS CREEK/HOPEWELL TWPS	WILSON'S MILL COVERED BRIDGE	T48LO, W OF WEST MIDDLETOWN STATION	06/22/79	050869	1
125	CROSS CREEK/INDEPENDENCE	MEADOWCROFT ROCK SHELTER		11/21/78	001176	1
125	DEEMSTOWN	KINDER'S MILL	LR 62194, 3MI S. OF JCT WITH LR62018	10/16/86	082510	1
125	DONEGAL TWP	DERROW, MARGARET HOUSE	WEST MAIN STREET	11/05/74	001189	1
125	DONEGAL TWP	MAYS, BLANEY COVERED BRIDGE	T423, SE OF WEST ALEXANDER	06/22/79	050874	1
125	DONORA	CEMENT CITY HISTORIC DISTRICT	WALNUT, CHESTNUT, MODISETTE, IDA STS.	02/16/96	102318	1
125	DONORA/ROSTRAVER TWP	WEBSTER-DONORA BRIDGE	LR143, OVER MONONGAHELA RIVER	06/22/88	000399	1
125	E BETHLEHEM TWP	REGESTER LOG HOUSE	LR62176 (R.D. #1)	10/16/74	001179	1
125	E FINLEY TWP	BROWNLEE, SCOTT COVERED BRIDGE	T414, NE OF EAST FINLEY	06/22/79	050876	1
125	E FINLEY TWP	PLANT'S COVERED BRIDGE	T408, W OF EAST FINLEY	06/22/79	050863	1
125	E FINLEY TWP	SPROWL'S COVERED BRIDGE	T450, SW OF EAST FINLEY	06/22/79	050862	1
125	E WASHINGTON	EAST WASHINGTON HISTORIC DISTRICT	CHESTNUT, WHEELING,BEAU, PENN, NORTH,F	11/15/84	050895	1
125	HANOVER TWP	DEVEL'S DEN, MCCLURG COVERED BRIDGE	T346, N OF PARIS	06/22/79	050865	1
125	HANOVER TWP	JACKSON'S MILL COVERED BRIDGE	T853, S OF BOYD	06/22/79	050872	1
125	HANOVER TWP	LYLE COVERED BRIDGE	T500 OVER RACCOON CREEK, SE OF FIVE PO	06/22/79	050871	1
125	HANOVER TWP	RALSTON FREEMAN COVERED BRIDGE	T352, NW OF BOYD	06/22/79	050864	1
125	INDEPENDENCE TWP	MANCHESTER, ISAAC HOUSE	RT.231, 1/2MI N OF RT.844	05/21/75	001180	1
125	MARIANNA	MARIANNA HISTORIC DISTRICT	TEN MILE CREEK, BEESON AVE. HILL, 6TH	11/15/84	050896	1
125	MONONGAHELA	ACHESON, EDWARD G. HOUSE	908 MAIN STREET	05/11/76	001194	1
125	MONONGAHELA	LONGWELL, DAVID, HOUSE	711 W. MAIN ST.	08/02/93	001103	1
125	MORRIS TWP	DAY COVERED BRIDGE	T339, E OF SPARTA	06/22/79	050880	1
125	N BETHLEHEM TWP	HILL'S TAVERN	RT.40(NATIONAL ROAD), SCENERY HILL	11/19/74	001191	1
125	N BETHLEHEM TWP	LEATHERMAN COVERED BRIDGE	T449, NW OF COKESBURG	06/22/79	050861	1
125	N BETHLEHEM TWP	RINGLAND TAVERN	MAIN ST., SCENERY HILL	02/16/96	096959	1
125	N FRANKLIN TWP	LEMOYNE CREMATORIUM	S. MAIN ST. (LR62161) @ HILLSVIEW SANI	02/16/96	087051	1
125	N FRANKLIN TWP	TRINITY HALL	RT.18(PARK AVE.), 1MI S OF WASHINGTON	09/27/76	001174	1
125	N STRABANE TWP	BROWNLEE, SAMUEL HOUSE	RT. 519, BOX 66 (RD 2)	11/07/76	001192	1
125	NOTTINGHAM TWP	EBENEZER CHURCH COVERED BRIDGE	OFF LR62032, MINGO CREEK COUNTY PARK	06/22/79	050882	1
125	NOTTINGHAM TWP	HENRY COVERED BRIDGE	T822, E OF HENRY	06/22/79	050860	1
125	PLEASANT TWP	KREPPS COVERED BRIDGE	T799, S OF CHERRY VALLEY	06/22/79	050879	1
125	SOMERSET TWP	HUFFMAN DISTILLERY & CHOPPING MILL	LR62155, 2 MILES NORTH OF RT. 917	11/12/92	097610	1
125	SOMERSET TWP	WRIGHT, CERL COVERED BRIDGE	T802, S OF US70L, NE OF VANCEVILLE	06/22/79	050878	1
125	SOUTH STRABANE TWP	MARTIN FARMSTEAD	PA 136, 2 MI. W OF TOWN OF EIGHTY-FOUR	07/21/95	102374	1
125	UNION TWP	DUSMAL HOUSE	LR69174 NEAR GILMORE ROAD	02/24/75	001187	1
125	UNION TWP	MINGO PRESBYTERIAN CHURCH AND CHURCHYARD	RT. 88 & MINGO CHURCH RD.	11/12/92	097612	1
125	W ALEXANDER	WEST ALEXANDER HISTORIC DISTRICT	MAIN ST., HIGH AND AVE.,N.LIBERTY ST.	03/07/85	050898	1
125	W BETHLEHAM TWP	HUGHES COVERED BRIDGE	OFF LR62082 NW OF TEN MILE	06/22/79	050858	1
125	W BETHLEHEM TWP	ULERY MILL	LR62078 NEAR LR62053	04/20/78	001173	1
125	W FINLEY TWP	CRAWFORD COVERED BRIDGE	LR62007, S OF GOOD INTENT	06/22/79	050877	1
125	W FINLEY TWP	DANLEY COVERED BRIDGE	T379, N OF GOOD INTENT	06/22/79	050873	1
125	W FINLEY TWP	ERSKINE COVERED BRIDGE	T314, NW OF KIMMINS SCHOOL	06/22/79	050867	1
125	W FINLEY TWP	MILLER, LONGDON L. COVEREDBRIDGE	T414, S OF LIBERTY	06/22/79	050866	1
125	W FINLEY TWP	WYIT SPROWLS COVERED BRIDGE	T360, N OF WEST FINLEY	06/22/79	050875	1
125	W MIDDLETOWN	WEST MIDDLETOWN HISTORIC DISTRICT		08/08/85	050899	1
125	WASHINGTON	ADMINISTRATION BLDG., WASHINGTON & JEFFE	WASHINGTON & JEFFERSON COLLEGE CAMPUS	08/16/77	001170	1
125	WASHINGTON	BRADFORD, DAVID HOUSE	175 SOUTH MAIN STREET	07/16/73	001193	1
125	WASHINGTON	LEMOYNE, DR. JULIUS HOUSE	49 E. MAIDEN ST.	10/25/73	001184	1
125	WASHINGTON	MAURER, DR. JOSEPH HOUSE	97 WEST WHEELING ST	12/30/93	089490	1
125	WASHINGTON	PENNSYLVANIA RAILROAD FREIGHT STATION	111 WASHINGTON ST.	07/21/95	097185	1
125	WASHINGTON	SACKVILLE HOUSE	309 EAST WHEELING ST.	11/21/76	001175	1
125	WASHINGTON	WASHINGTON ARMORY	76 W. MAIDEN ST.	05/09/91	096442	1
125	WASHINGTON	WASHINGTON COUNTY COURTHOUSE	SOUTH MAIN ST.	07/30/74	001172	1
125	WASHINGTON	WASHINGTON COUNTY JAIL	CHERRY STREET	07/30/74	001171	1

APPENDIX C

THREATENED AND ENDANGERED SPECIES INFORMATION

COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA GAME COMMISSION

2001 ELMERTON AVENUE
HARRISBURG, PA 17110-9797

ADMINISTRATIVE BUREAUS:

ADMINISTRATION	717-787-5670
AUTOMOTIVE AND PROCUREMENT DIVISION	717-787-6594
LICENSE DIVISION	717-787-2084
PERSONNEL DIVISION	717-787-7836
WILDLIFE MANAGEMENT	717-787-5529
INFORMATION & EDUCATION	717-787-6286
LAW ENFORCEMENT	717-787-5740
LAND MANAGEMENT	717-787-6818
REAL ESTATE DIVISION	717-787-6568
MANAGEMENT INFORMATION SYSTEMS	717-787-4076

October 2, 1996

Mr. William Stanhope
IT Corporation
2790 Mosside Blvd.
Monroeville, PA 15146-2792

Dear Mr. Stanhope:

In response to your request for information services, we are providing the enclosed printouts from the Pennsylvania Fish and Wildlife Data Base.

We have no record of threatened or endangered species occurring on or near your project area.

Additional comments concerning this data search are included on the following page.

Very truly yours,

Calvin W. DuBrock, Director
Bureau of Wildlife Management
Pennsylvania Game Commission

Encl.
CWD:sp

Pennsylvania Fish and Wildlife Data Base
LIST A: Endangered and Threatened Species
** Int. Tech. Corp, Washngton Co. **
Washington West Quadrangle
26 SEP 1996

Note: The purpose of the following list is to identify endangered or threatened species which occur or are likely to occur on a designated site. We have record of the following species occurring in or near your project area. Their occurrence may depend on season, habitat type, and individual movements or migration patterns. Field surveys may be required to determine whether these species exist on your project area.

Species.ID Common Name.................. Scientific Name........................

ZERO Records Listed

Pennsylvania Fish and Wildlife Data Base
LIST B: Potential Special Concern Species
(Includes Accidental and Migrant Species)
** Int. Tech. Corp, Washngton Co. **
Washington County
26 SEP 1996

Note: The purpose of the following list is to identify endangered, threatened, and special concern species which may potentially occur within a designated area. This list includes species which may exist on your project area as well as migrating and accidental species. This information is based on records of these animals inhabiting specific habitat types within Washington County.

Status	No. of Species Listed
PA / Fed Endangered	2
PA Endangered	3
Fed Endangered	1
PA Threatened	4
Candidate Species	24
Total Species Listed:	34

Pennsylvania Fish and Wildlife Data Base
LIST B: Potential Special Concern Species
(Includes Accidental and Migrant Species)
** Int. Tech. Corp, Washngton Co. **
Washington County
26 SEP 1996

Common Name.................	Scientific Name...........	Status.....................	Status
Eagle, Bald	Haliaeetus leucocephalus	PA / Fed Endangered	A
Falcon, Peregrine	Falco peregrinus	PA / Fed Endangered	A
	•••		
Osprey	Pandion haliaetus	PA Endangered	E
Owl, Short-eared	Asio flammeus	PA Endangered	E
Tern, Black	Chlidonias niger	PA Endangered	E
	•••		
Mussel, Pink Mucket Pearly	Lampsilis abrupta	Fed Endangered	F
	•••		
Bittern, American	Botaurus lentiginosus	PA Threatened	T
Flycatcher, Yellow-bellied	Empidonax flaviventris	PA Threatened	T
Heron, Yellow-crowned Night	Nycticorax violaceus	PA Threatened	T
Sandpiper, Upland	Bartramia longicauda	PA Threatened	T
	•••		
Harrier, Northern	Circus cyaneus	Candidate - At Risk	U
Owl, Common Barn	Tyto alba	Candidate - At Risk	U
Snipe, Common	Gallinago gallinago	Candidate - At Risk	U
Sparrow, Henslow's	Ammodramus henslowii	Candidate - At Risk	U
	•••		
Coot, American	Fulica americana	Candidate - Rare	V
Goshawk, Northern	Accipiter gentilis	Candidate - Rare	V
Grebe, Pied-billed	Podilymbus podiceps	Candidate - Rare	V
Grosbeak, Blue	Guiraca caerulea	Candidate - Rare	V
Tanager, Summer	Piranga rubra	Candidate - Rare	V
Teal, Green-winged	Anas crecca	Candidate - Rare	V

Thrush, Swainson's	Catharus ustulatus	Candidate - Rare	V

...

Bobwhite, Northern	Colinus virginianus	Candidate - Undeterm	W
Crossbill, Red	Loxia curvirostra	Candidate - Undeterm	W
Dickcissel	Spiza americana	Candidate - Undeterm	W
Duck, Ruddy	Oxyura jamaicensis	Candidate - Undeterm	W
Egret, Cattle	Bubulcus ibis ibis	Candidate - Undeterm	W
Gadwall	Anas strepera	Candidate - Undeterm	W
Nighthawk, Common	Chordeiles minor	Candidate - Undeterm	W
Owl, Northern Saw-whet	Aegolius acadicus	Candidate - Undeterm	W
Pintail, Northern	Anas acuta	Candidate - Undeterm	W

Pennsylvania Fish and Wildlife Data Base
LIST B: Potential Special Concern Species
(Includes Accidental and Migrant Species)
** Int. Tech. Corp, Washngton Co. **
Washington County
26 SEP 1996

Common Name.................	Scientific Name...........	Status....................	Status
Wigeon, American	Anas americana	Candidate - Undeterm	W
Weasel, Least	Mustela nivalis	Candidate - Undeterm	W

...

Madtom, Brindled	Noturus miurus	Candidate Species	Y
Rattlesnake, Timber	Crotalus horridus	Candidate Species	Y

...

Pennsylvania Fish and Wildlife Data Base
LIST C: Potential Special Concern Species Land Use/Cover Type List
** Int. Tech. Corp, Washngton Co. **
Washington County
26 SEP 1996

Land Use/Cover Type	No. Species
Urban Land	9
Agricultural Land - Cropland/Pasture	22
Agricultural Land - Orchards/Vineyards/Nurseries	6
Agricultural Land - Confined Feeding Operations	3
Rangeland - Herbaceous	16
Rangeland - Shrub/Brush	10
Rangeland - Mixed	9
Forest Land - Deciduous	19
Forest Land - Evergreen	18
Forest Land - Mixed	19
Water - Streams/Rivers/Canals	16
Water - Lakes	14
Water - Reservoirs	13
Water - Estuaries	11
Wetland - Forested	20
Wetland - Nonforested	20
Barren Land	5

Pennsylvania Fish and Wildlife Data Base
LIST C: Potential Special Concern Species Land Use/Cover Type List
** Int. Tech. Corp, Washngton Co. **
Washington County
26 SEP 1996

Species Common Name..................	*Stat.	Feeding Behavior Herb	Omni	Carn..	Land Use/Cover Type Urban.. (10's)	Agric Crops (21)	Agric Orchd (22)	Agric.. Feed (23)	Range Herb (31)	Range Shrub (32)	Range.. Mix (33)	Forest Decid (41)	Forest Conif (42)	Forest.. Mix (43)	Water. Stream (51)	Water Lake (52)	Water. Reserv (53)	Water.. Bay (54)	Wetlnd Forest (61)	Wetlnd.. Non-For (62)	Barren (70's)
Madtom, Brindled	Y			X											X	X					
Rattlesnake, Timber	Y			X		X	X			X	X	X	X	X							
Bittern, American	T			X											X	X	X	X	X	X	
Bobwhite, Northern	W		X			X			X	X	X	X	X	X					X		
Coot, American	V		X			X									X	X	X	X	X	X	
Crossbill, Red	W		X				X					X	X	X					X		
Dickcissel	W		X		X	X	X		X	X	X										
Duck, Ruddy	W		X												X	X	X			X	
Eagle, Bald	E			X		X						X	X	X	X	X	X		X	X	
Egret, Cattle	W			X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Falcon, Peregrine	E			X	X	X			X	X	X			X					X	X	X
Flycatcher, Yellow-bellied	T		X									X	X	X					X		
Gadwall	W		X			X			X				X		X	X	X	X	X	X	
Goshawk, Northern	V			X		X		X	X			X	X	X					X		
Grebe, Pied-billed	V			X											X	X	X	X		X	
Grosbeak, Blue	V		X						X	X	X	X									
Harrier, Northern	U			X	X	X			X	X	X									X	X
Heron, Yellow-crowned Night	T			X		X						X	X	X	X	X	X	X	X	X	
Nighthawk, Common	W			X	X	X			X												
Osprey	E			X	X							X	X	X	X	X	X	X	X	X	
Owl, Common Barn	U			X	X	X	X	X				X	X	X					X	X	
Owl, Northern Saw-whet	W			X		X						X	X	X					X		
Owl, Short-eared	E			X		X			X	X	X							X		X	X
Pintail, Northern	W		X			X			X						X	X	X	X		X	

* Status Codes: E = Endangered; T = Threatened. Candidate Classifications: U = At Risk; V = Rare; W = Undetermined Status; Y = Unspecified.

Pennsylvania Fish and Wildlife Data Base
LIST C: Potential Special Concern Species Land Use/Cover Type List
** Int. Tech. Corp, Washngton Co. **
Washington County
26 SEP 1996

Species Common Name...................	*Stat.	Feeding Behavior Herb	Omni	Carn..	Land Use/Cover Type Urban.. (10's)	Agric Crops (21)	Agric Orchd (22)	Agric.. Feed (23)	Range Herb (31)	Range Shrub (32)	Range.. Mix (33)	Forest Decid (41)	Forest Conif (42)	Forest.. Mix (43)	Water. Stream (51)	Water Lake (52)	Water. Reserv (53)	Water.. Bay (54)	Wetlnd Forest (61)	Wetlnd.. Non-For (62)	Barren (70's)
Sandpiper, Upland	T		X		X	X			X			X	X	X							
Snipe, Common	U		X			X	X		X	X	X	X	X	X					X	X	X
Sparrow, Henslow's	U		X			X			X											X	
Tanager, Summer	V		X				X					X		X					X		
Teal, Green-winged	V		X			X			X			X	X	X	X	X	X	X	X	X	X
Tern, Black	E			X											X	X	X			X	
Thrush, Swainson's	V		X		X							X	X	X					X		
Wigeon, American	W		X			X						X	X	X	X	X	X	X	X	X	
Weasel, Least	W			X	X	X			X	X		X	X	X	X				X	X	
Mussel, Pink Mucket Pearly	E		X												X						

* Status Codes: E = Endangered; T = Threatened.   Candidate Classifications: U = At Risk; V = Rare; W = Undetermined Status; Y = Unspecified.

3200-FM-DWW0016 Rev. 3/96

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF DAMS, WATERWAYS AND WETLANDS

For Department Use Only	
PNDI Search - Computer ____	Map ____
Reviewer NZ 295	
Date 10/9/96	Phone No. ____

SUPPLEMENT NO. 1
PENNSYLVANIA NATURAL DIVERSITY INVENTORY SEARCH FORM

A. This Supplement No. 1 provides the site information necessary to perform a computer search for species of special concern listed under the Endangered Species Act of 1973, the Wild Resources Conservation Act, the Pennsylvania Fish and Boat Code or the Wildlife Code. Records regarding species of special concern are maintained in a computer data base called the "Pennsylvania Natural Diversity Inventory" (PNDI).

B. Complete the information below and mail to the appropriate regional office or the delegated County Conservation District (SEE REVERSE SIDE FOR LIST OF OFFICES AND ADDRESSES).

C. This Supplement No. 1 will be returned to you with information relevant to your project concerning species of special concern. Include it and any correspondence received from the agencies below, with your submission of a Chapter 105 Permit Application for a Water Obstruction and Encroachment Permit and/or a Dam Permit and/or a General Permit Registration.

D. The information in PNDI is routinely updated. Results of this PNDI search are valid for one year.

PROJECT LOCATION:

Washington County
County

Canton Township
Township and/or Municipality

NAME: Bill Stanhope / IT Corp.

ADDRESS: 2790 Mosside Blvd.
Monroeville, PA 15146

PHONE (8:00 AM TO 4:00 PM): (412) 372-7701

1) Name of the United States Geological Survey (U.S.G.S.) 7½ Minute Quadrangle Map where project is located: Washington West, PA

2) Project size (in acres) <0.25.

3) Indicate location of approximate project center on the U.S.G.S. Quad map by measuring in inches (to nearest one-tenth) from the lower right corner of the full U.S.G.S. Quadrangle map.

- North (Up) ~~7.9~~ inches 8.4
- West (to the left) ~~3.7~~ inches 3.5

N: 6.3"
W: 3.1"
(example, not to scale)

4) Attach an 8½" x 11" photocopy (DO NOT REDUCE) of the section of the U.S.G.S. Quadrangle Map which identifies the project location and outlines the approximate boundaries of the project.

FOR DEPARTMENT USE ONLY

NZ ☒ No known record of habitats for species of special concern has been identified in the area designated above.

☐ No impact to species of special concern. (PNDI staff person ____ on ____).
initials date

☐ Potential impact to species of special concern. Written recommendations on measures necessary to resolve this matter will be provided by:

☐ Dept. of Conservation & Natural Resources
Bureau of Forestry/FAS
P.O. Box 8552
Harrisburg, PA 17105-8552
717-787-3444

☐ Mr. Andrew L. Shiels
PA Fish & Boat Commission
450 Robinson Lane
Bellefonte, PA 16823
814-359-5113

☐ Mr. Denver A. McDowell
PA Game Commission
2001 Elmerton Ave.
Harrisburg, PA 17110-9797
717-783-8743

Element Occurrence Code ____

☐ PNDI Interpretation Requested

APPENDIX D

ECORADIOLOGICAL CALCULATION BRIEFS

Purpose:

The purpose of the following is to estimate the dose rate (in units of rads/day) received by either the pup fish (primary organism) or the heron (secondary organism) to thorium contamination in their aqatic environment. The total dose rate for both internal and external exposure to thorium must be below 1 rad/day. These calculations were completed by using an existing spreadsheet model that utilized a method outlined in Baker & Soldat, 1992. A model for both internal and external exposure to thorium were included.

The radiological data for thorium was taken from Appendix K of Molycorp, 1995. The maximum concentration of thorium-232 in pCi/L was found and recorded. Any other data relevent to thorium from the same well and sampling date was recorded as well. For this case, a maximum concentration of 1.38 +/- 0.39 pCi/L for thorium-232 for well i.d. # MW25, sample date 7/28/94, was used. In the same well and same sampling date, thorium-228 was also reported at a concentration of 1.04 +/- 0.50 pCi/L. Both Th-228 and Th-232 was used in the spreadsheet model to provide a overall estimate due to the thorium contamination. It should be noted that Th-228 originates as a decay daughter of Th-232. The daughter, Th-228, was included as a conservative estimation to Th-232 exposure since it is produced by the radioactive decay of Th-232. The maximum concentration of Th-232 in sediment was 0.86 pCi/g (+/- 0.18 pCi/g) from Sediment Sample SS7A on page 2 of the Radiological Sediment Data in Appenidix K of the Molycorp document.

The following methodology shows how the concentration data for thorium is applied to the spreadsheet model to produce an estimate of the dose rate to both a primary organism (a fish with a 2 cm effective radius) and the secondary organism (a great blue heron with a mass of 2.39 kg and a 10 cm effective radius) consuming the primary organism. The methodology presented below is approached from a general standpoint and applies to a combination of radionuclides in the aquatic environment. This is done since thorium-232 is not the only radionuclide being considered. The Molycorp surface water data includes a daughter of Th-232, Th-228. The model for external/internal dose rates presented by Baker & Soldat can be applied to any number or variation of radionuclides present.

For these calculations it is assumed that all of the alpha radiation is internally absorbed within the organism and that the Th-232 and its daughters are uniformly distributed throughout the organism's interior. Also, the model assumes that the geometry of the fish and heron was approximated by a sphere. The dose rate calculated is assumed to be only for the organism's exposure to thorium. It was assumed for this model that the fish had an effective radius of 2 cm. The heron is assumed to receive all of its internal exposure to Th-232 and its daughters by eating contaminated fish. The heron is assumed to have an effective radius of 10 cm and a body weight of 2.39 kg.

The total dose rates calculated by the Baker & Soldat model are summarized below.

Internal Dose Rate Model		
Organism	**Radionuclide**	**Dose Rate (Rad/Day)**
Fish (Primary Organism)	Th-228 and Th-232	5.88E-05
Heron (Secondary Organism)	Th-228 and Th-232	5.30E-07

INTERNATIONAL TECHNOLOGY CORPORATION

By Doug Bowen Date 9/6/96 Subject Molycorp, Inc.Aquatic Dose Rate Model Sheet No. 2 of 5

Chkd. By SD Date 9/12/96 Proj. No. 768592.03.00.00.00

External Dose Rate Model

Organism	Model	Exposure Fraction	Radionuclide	Dose Rate (Rad/Day)
Fish	Immersion	1.0	Th-232	5.96E-05
Fish	Sediment	0.5	Th-232	
Heron	Immersion	0.0	Th-232	1.34E-06
Heron	Sediment	0.5	Th-232	

Please refer to the spreadsheet models for these results.

References:

Baker, D.A., and Soldat, J.K., 1992, *Methods for Estimating Doses to Organisms from Radioactive Materials Released into the Aquatic Environment*, DOE-AC06-76RLO, pp. 1-21.

Molycorp, Inc., Site Characterization Report for License Termination of the Washington, PA Facility, Volume 2 of 3, January, 1995, Foster Wheeler Environmental Corporation.

Perry, Robert H., Perry's Chemical Engineers' Handbook, 1984, 6th edition, Mc Graw-Hill, Inc., New York, New York, pp. 3-96 - 3-96.

U.S. Department of Energy, 1994, *Hanford Site Risk Assessment Methodology (HSRAM), "Ecological Dose and Exposure Calculations,"* DOE/RL-91-45, Review Draft, pp. E12-E18.

Methodology:

Aquatic Internal Dose

The total daily doses to a primary organism are estimated as the sum of doses (based on a weighted gamma energy from radioactive decay for specific radionuclides) received from all internal and external exposure to all radioactive contaminants in the environment in which the organisms reside.

The total internal total-body dose rate (rad/day) to an organism exposed to N radionuclides is given by equation 1:

$$R_c = \sum_{i=1}^{N} b_{ic} \cdot E_{ic}$$

where: R_c=Internal total-body dose rate of organism c (rad/day),
$b_{i,c}$=Specific body burden of nuclide i in organism c (Ci/kg),
$E_{i,c}$=Effective energy absorbed for radionuclide i per unit activity in organism c (kg-rad/Ci-day) (See below:)

$$E_{i,c} = \varepsilon_{i,c} \text{ (MeV/dis)} \times 5.12E04$$

where: $\varepsilon_{i,c}$= the effective radionuclide energy for diameter of aquatic organism for nuclide i in organism c. The proportionality constant, 5.14E4, is defined on page 3 of Baker & Soldat, 1992.

The specific body burden of nuclide i in organism c (Ci/kg) for the primary organism is given by:

$$b_{i,c} = C_{i,c} \times BF_{i,c} \times CF_{i,c}$$

$$R_c = \sum_{i=1}^{N} E_{ic} \cdot C_{ic} \cdot BF_{ic} \cdot CF_{ic}$$

where: R_c = Internal total-body dose rate of organism c (rad/day)
$b_{i,c}$ = specific body burden of nuclide i in organism c (Ci/kg)
$C_{i,c}$ = concentration of radionuclide i in water to which organism c is exposed (Ci/L)
$BF_{i,}$ = bioaccumulation factor for nuclide i and organism c (m^3/kg)
CF = conversion factor (0.001 L/m^3).

The spreadsheet labeled "Internal Fish and Heron Example" has two parts. The first part is labeled "Internal Fish Dose as Primary Organism." This spreadsheet is clearly labeled with headers and performs the following calculation:

where everything is defined above. R_c is calculated in rad/day and rad/yr in the spreadsheet.

The heron, as the secondary organism, consumes the fish and thus receives an exposure internally due to the uptake of radionuclides in fish. The internal dose rate received by the heron is given by equation 2:

$$R_c = \frac{\sum_{i=1}^{N} b_i \cdot U_c \cdot f_{1_i} \cdot E_{ic} \cdot B_{ic}}{M_c}$$

where: R_c = Internal total-body dose rate of secondary organism c (rad/day)
U_c = intake rate of primary organism by sęcondary organism c (kg/d),
M_c = mass of secondary organism c (kg)
b_i = body burden of primary organism (Ci/kg),
$f_{i,c}$ = fraction of radionuclide initially retained in total body of secondary organism (unitless)
$E_{i,c}$ = defined previously
$B_{i,c}$ = effective decay constant of radionuclide i in the secondary organism (day) defined below as equation 3:

$$B_{ic} = \frac{(1 - \exp(-\lambda_{ic} \cdot T_e))}{\lambda_{ic}}$$

where equation 4 defines the effective decay contant in the secondary organism:

$$\lambda_{ic} = (\lambda_b + \lambda_r)\ day^{-1}$$

The parameter λ_b=ln(2)/T_b where λ_b=biological decay constant of radionuclide and T_b is the biological half-life of the radionuclide in the organism, and λ_r=ln(2)/T_r where λ_r=radiological decay constant of radionuclide and T_r is the radiological half-life of the radionuclide in the organism. The variable T_e is defined as the exposure time or period of exposure which is assumed to be 365 days

(Baker and Soldat, 1992).

The second section of the spreadsheet labeled "Internal Fish and Heron Example" calculates the internal dose rate to a heron due to consumption of a fish containing radioactive material. The headers for the spreadsheet are clearly labeled with the appropriate units as well.

Aquatic External Dose:

The primary organism resides in the water continuously. They can be exposed externally from immersion in water contaminated with radionuclides and from contaminated river bottom sediments. It can be assumed that primary organisms (fish) have an immersion fraction of 1.0 and a sediment exposure fraction of 0.5. Secondary organisms can be exposed externally from immersion in the water, and/or exposure to river bottom or shoreline sediments. Therefore, the external exposure to the secondary organism is weighted by the fraction of the time it is exposed to these pathways. For the heron, the immersion exposure fraction is zero and the sediment exposure fraction is 0.5. Immersion and sediment dose rate factors are used to calculate external dose rates. The following equation was used to calculate the dose rate from immersion in water (equation 5):

$$R_c = \sum_{i=1}^{N} C_{ic} \cdot DF_{im} \cdot F_{exp} \cdot CF$$

where: R_c = dose rate (rad/day) from immersion in the water,
$C_{i,c}$ = concentration of radionuclide i in water to which the organism c is exposed (Ci/L),
$DF_{im,i}$ = immersion dose rate factor for radionuclide i (rad-m^3/Ci-day),
F_{exp} = exposure fraction (unitless),
CF = conversion factor (0.001 in units of L/m^3).

The next part of aquatic external exposure is that due to sediment. The following equation defines the external dose rate due to sediment exposure.

$$R_c = F_{sed} \cdot F_{ruf} \cdot F_{exp} \cdot \sum_{i=1}^{N} C_{ic} \cdot DF_{gnd} \cdot \frac{(1-\exp(-\lambda_r \cdot T_s))}{\lambda_r}$$

where: R_c = dose rate (rad/day) from sediment exposure in the water,
F_{sed} = sediment deposition transfer factor, 0.07 Ci m^{-2} d^{-1} Ci^{-1} m^3
F_{ruf} = geometry roughness factor (unitless)
Df_{gnd} = ground irradiation dose factor for nuclide, rad d^{-1} Ci^{-1} m
T_s = time sediment is exposed to contaminated water, d.
$C_{i,c}$ = concentration of radionuclide i in water to which the organism c is exposed (Ci/m^3),
λ = radiological decay contstant, d^{-1}
F_{exp} = exposure fraction (unitless),

The external dose due to sediment and immersion are simply multiplied by their associated immersion or sediment exposure fraction to by the external dose rate calculated for immersion or sediment. Summing up each component will estimate the total external dose due to water immersion or sediment exposure to the fish and heron. The spreadsheet model calculates these parameters automatically.

INTERNATIONAL
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By Doug Bowen Date 9/6/96 Subject Molycorp, Inc.Aquatic Dose Rate Model. Sheet No. 5 of 5

Chkd. By SD Date 9/12/96 Proj. No. 768592.03.00.00.00

Total Internal/External Dose:

The total dose rate received by either the fish or heron is simply the sum of the external and internal components. For example, if a fish receives 0.1 rad/day of internal exposure and 0.05 rad/day of external exposure, the total dose rate the fish receives is 0.1 + 0.05 = 0.15 rad/day.

Unit Conversions:

Data retrieved from the Molycorp documentation with respect to thorium water and soil concentrations required some units manipulations so that they were compatible with the spreadsheet model. Water well concentrations of thorium were reported in units of pCi/L and needed to be converted to Ci/m³ to be inserted into the model. A cell in the spreadsheet was created to take the concentrations in units of pCi/L and convert them to Ci/m3 with the following formula:

$$\# \text{ Ci/m3} = (\# \text{ pCi/L}) \times (1000 \text{ L/m}^3) \times (1/1.0\text{E}12 \text{ pCi/Ci}) = 1.0\text{E-09 pCi/L}.$$

Sediment concentrations were reported in units of pCi/g and needed to be converted to Ci/m3, as well. The following formula was necessary for the sediment conversion:

$$\# \text{ Ci/m}^3 = (\# \text{ pCi/g}) \times (1000 \text{ g/kg}) \times (126 \text{ lb/ft}^3) \times (16.02 \text{ kg/m}^3 / \text{lb/ft}^3) \times (1/1.0\text{E}12 \text{ pCi/Ci}) = 2.019\text{E-06 Ci/m}^3$$

where:

126 lb/ft³ = density of wet sand/gravel (sediment) taken from Perry, 1984, Table 3-118, pg. 3-95.
16.02 kg/m³ per lb/ft³ = conversion from lb/ft³ to kg/m³ given by Perry, 1984, Table 3-118, pg. 3-96.

Example Calculations:

Please see the IT Calculation Brief, "NTS-UGTA Eco Risk Fish/Heron Dose Model, 12/1/95, Project #: 764027.02.03.00.00 for example calculations that verify example calculations in Baker & Soldat, 1992.

Originated by Douglas Bowen 9/6/96
Checked by_Sean Dundon___________ Date:____9/12/96_______________
Molycorp, Inc. 768592.03.00.00.00

Estimation of Internal and External Radiation Doses to the House Mouse at the Molycorp, Inc. Washington, PA Faciltiy.

Purpose:
The intent of this effort is to estimate the internal and external radiation doses to a house mouse that is continuously exposed to thorium-232. The calculated dose rates will be compared to the International Atomic Energy Agency maximum allowable dose rate of 1 rad/day. This represents the threshold where slight effects from radiation doses may become apparent in the house mouse. A spreadsheet was used in the calculational model. The methodology presented below describes the parameters used in the spreadsheet model. The spreadsheet models used assumes a maximum Th-232 concentration in soil/slag at the Molycorp site of 1,530 pCi/g (+/- 80 pCi/g) from Appendix J, Table J-2. This concentration was from Thorium Pile, Unit #2, Sample # TP-4-01, Depth 3.0-4.5 feet.

Discussion:
The house mouse will not receive any external dose due to the presence of Th-232. This is due to the fact that Th-232 does not emit gamma radiation via radioactive decay. Th-232's primary mode of radioactive decay is through the emission of an alpha particle with an energy of 4.0 MeV. Alpha particles do not penetrate the house mouse's skin to contribute to an internal dose. The alpha particles will, however, contribute to an internal dose. Th-232's long half-life will result in a reduced internal exposure due to the fact that the decay constant for Th-232 is relatively large (approximately 7.14E-11 decays per second. Th-232 does not significantly expose the house mouse found at the Molycorp, Inc Washington, PA facility to a significant dose rate (i.e. > 1 rad/day), externally or internally. The dose rate calculated for the house mouse based on the Molycorp data shows a total interal/external dose rate of 2.66E-06 rad/day which is far below the limit of 1.0 rad/day.

Assumptions:

For this model, it was assumed that the geometry of the house mouse could be approximated by a sphere to simplify the calculation. The entire activity of the radionuclide is assumed to be present at the center of the organism. The house mouse residing in the location of the Th-232 contamination is assumed to receive its internal radiation exposure from its diet of plants and ingestion of soil. This model is valid primarily for those radionuclides that emit gamma radiation, while Th-232 emits only alpha particles during radioactive decay. However, Baker & Soldat, 1992, provide data on the parameter, E_i (valid specifically for gamma emitting nuclides and nuclides that emit high energy alpha particles), for Th-232 which is the effective absorbed energy based upon the amount of energy the organism with a certain effective radius absorbs within its body or organ. The effective absorbed energy for the house mouse is constant for a house mouse with an assumed radius of 10 cm and lower. This is due to the fact that all of the alpha particle's energy is absorbed within the organism.

References:

from Radioactive Materials Released into the Aquatic Environment, PNL-8150, Pacific Northwest Laboratory, Richland, Washington, pp. 16-20.

Baes, III, C.F., R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984, "A Review and Analysis of Parameters for Assessing Transport of Enviromentally Released Radionuclides through Agriculture," ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, Tennessee, pp. 10-11.

U.S. Department of Energy, 1994, Hanford Site Risk Assessment Methodology (HSRAM), "Ecological Dose and Exposure Calculations", DOE/RL-91-45, Review Draft, pp. E-1 - E-9.

United States Department of Health, Education and Welfare, 1970, Radiological Health Handbook, Bureau of Radiological Health and Training Institute, Rockville, Maryland, pp. 70-86.

International Technology Corp., Checkprints

Methodology:

The basic methodology is summarized below. A detailed description of the methodology used to compute the internal and external radiation doses can be found in HSRAM (pages E-1 - E-9). Different methodologies exist for calculating external and internal radiation doses to the house mouse and will be presented below separately. For all calculations the house mouse will assume an effective radius of 2 centimeters. The house mouse is also assumed to have a body weight of 0.016 kg for these calculations.

Internal Total-body Dose Rate:

The following equation defines the internal dose rate to the pocket mouse in rad/day:

$$R_{Internal} = \sum_{i}^{N} \frac{(CS_i \cdot PS_i \cdot WW \cdot QV \cdot FI \cdot EF \cdot ED \cdot FR \cdot B_i \cdot E_i)}{(BW \cdot AT)}$$

where:

CS_i = the concentration of radionuclide, i, in the soil (Ci/kg),
PS_i = the soil-to-plant conversion factor specific to radionuclide, i, and chemical form in the soil (Baes et al. 1984 and Table E-3, HSRAM),
WW = the conversion from plant dry weight to wet weight, equal 0.32 (Table E-2 HSRAM),
QV = the ingestion rate of soil into the mouse (Kg/day), given as 0.0067 (Table E-2 HSRAM),
FI = the fraction ingested form contaminated source (unitless), given as 1.0 (Table E-2 HSRAM),
EF = the exposure frequency (day/yr), equal to 365 (Table E-2 HSRAM),

ED = the exposure duration (years), equal to 1.0 (Table E-2

HSRAM),

FR = the fraction of the radionuclide retained in the mouse (unitless) which is radioisotope specific (Baker and Soldat, 1992),

B_i = the sum of removal factor for nuclide i (day), equal to:

$$B_i = \frac{(1-\exp(-\lambda_i \cdot T_e))}{\lambda_i} \qquad \text{Eq. 1}$$

where: $\lambda_i = \lambda_b + \lambda_r$.

λ_r = the radiological decay constant (day^{-1}) defined as $\ln(2)/T_r$ where T_r is the half-life of the radioisotope in days (Baker and Soldat, 1992). For Th-232, T_r=5.11e12 day,

λ_b = the biological removal constant (day^{-1}) defined as $\ln(2)/T_b$ where T_b is the biological half-life after ingestion of a radioisotope in days (Baker and Soldat, 1992),

λ_i = the effective decay constant for radioisotope i (day^{-1}).

E_i = the effective energy absorbed constant for radionuclide, i ($Kg\text{-}rad\text{-}Ci^{-1}\text{-}day^{-1}$), equal to (Eq. E-4, HSRAM):

$$E_i = 5.12 \cdot 10^4 \cdot \epsilon_i$$

where: ε_i = the radionuclide energy for a particular diameter of mouse (MeV/dis) (Baker and Soldat, 1992). For thorium, ε = 4.1 MeV/Dis

BW = the body weight of the mouse (Kg) equal to 0.016 (Assumed),

AT = the averaging time equal to 365 days ((Table E-2, HSRAM)

R_i = the internal total-body dose rate (rad/day) (Eq. E-1, HSRAM).

External Total-body Dose Rate:

Although the external dose rate model is presented below and in the spreadsheet model, it is not considered significant for the case of Th-232 contamination due to the fact that Th-232 is strictly an alpha emitting isotope. The model, below, is based upon exposure to gamma emitting radioisotopes.

The following relationship defines the external dose rate (rad/day) to a mouse exposed to certain radionuclides:

$$D = 2.12 \cdot \sum_{i=1}^{N} \cdot \frac{E_i \cdot C_i \cdot}{\rho} \qquad \text{Eq. 2}$$

where:
E_i = the average gamma-ray energy emitted by the radioisotope per disintegration (MeV). This value is the sum of probabilities per decay multiplied by the energy of the emitted gamma-ray (checkprints, D. Bowen). For thorium-232, there are no gamma emitted. Therefore, this term is zero.
C_i = the concentration of the radionuclide ($\mu Ci/cm^3$),
ρ = the density of the soil ($grams/cm^3$) assumed as 1.5.
D = the external dose rate (rad/day) (Eq. E-7, HSRAM).

APPENDIX B

STABILITY ANALYSIS

STABILITY ANALYSIS

Preliminary stability analyses were performed for each containment cell option based on the conceptual designs. Both a static and seismic analysis was performed for each option. The PCSTABL5M computer software program developed by Purdue University was used to evaluate slope stability. The input parameters and stability results are discussed below.

SOIL PROPERTIES

The following soil properties were used for the analysis:

Cap System: (Soil 1)	ϕ = 25 degrees cohesion = 0 psf total unit weight = 110 pcf saturated unit weight = 110 pcf
Thoriated Slag: (Soil 2)	ϕ = 30 degrees cohesion = 0 psf total unit weight = 115 pcf saturated unit weight = 115 pcf
Liner System: (Soil 3)	ϕ = 11 degrees (Options 1 and 2) - see discussion below ϕ = 16 degrees (Option 3) - see discussion below cohesion = 0 psf total unit weight = 120 pcf saturated unit weight = 120 pcf
Underlying Soils/Berm Fill: (Soil 4)	ϕ = 30 degrees cohesion = 200 psf total unit weight = 115 pcf saturated unit weight = 115 pcf

The liner system was modeled as a 1 foot thick layer exhibiting the strength properties of the weakest interface within the liner system. For Options 1 and 2, smooth HDPE geomembrane would be utilized in the liner system, thus the weakest interface would be the GCL (Claymax)/smooth HDPE geomembrane interface exhibiting an interface friction angle of 11 degrees (from Claymax literature). For Option 3, textured HDPE geomembrane would be utilized in the liner system, thus the weakest interface would be the GCL (Claymax)/textured HDPE geomembrane interface exhibiting an interface friction angle of 16 degrees (from Claymax literature).

FAILURE MECHANISM

Both circular failures through the slag material and block failures along the liner system were analyzed. Cap stability was not evaluated as part of this analysis. Block failures along the liner system produced the most critical failure surfaces due to the relatively low interface friction angles exhibited by the system.

A factor of safety of 1.5 for static conditions and 1.2 for seismic conditions was judged to be adequate. The factors of safety for slope stability for each option are summarized below.

OPTION 1 (static)	FS = 1.5
OPTION 1 (seismic)	FS = 1.2
OPTION 2 (static)	FS = 1.7
OPTION 2 (seismic)	FS = 1.3
OPTION 3 (static)	FS = 1.5
OPTION 3 (seismic)	FS = 1.2

All of the options yielded adequate factors of safety for slope stability. The computer output files and cross sections indicating the critical failure planes are included on pages 3 through 45.

** PCSTABL5M **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: C:\MC\OPT1.IN
Output Filename: C:\MC\OPT123.O

PROBLEM DESCRIPTION MOLYCORP OPTION 1
HILL OPTION
STATIC ANALYSIS

BOUNDARY COORDINATES

5 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	1105.00	20.50	1115.00	4
2	20.50	1115.00	165.00	1151.00	1
3	165.00	1151.00	172.50	1151.00	1
4	172.50	1151.00	257.00	1130.00	1
5	257.00	1130.00	274.00	1121.00	4
6	20.50	1115.00	33.00	1115.00	4
7	33.00	1115.00	34.00	1115.00	3
8	34.00	1115.00	165.00	1148.00	2
9	165.00	1148.00	172.50	1148.00	2
10	172.50	1148.00	243.50	1130.00	2
11	243.50	1130.00	244.50	1130.00	3
12	244.50	1130.00	257.00	1130.00	4
13	34.00	1115.00	53.00	1106.00	3
14	53.00	1106.00	204.50	1111.00	3
15	204.50	1111.00	243.50	1130.00	3
16	33.00	1115.00	53.00	1105.00	4
17	53.00	1105.00	204.50	1110.00	4
18	204.50	1110.00	244.50	1130.00	4

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	110.0	.0	25.0	.00	.0	1
2	115.0	115.0	.0	30.0	.00	.0	1
3	120.0	120.0	.0	11.0	.00	.0	1
4	115.0	115.0	200.0	30.0	.00	.0	1

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	33.50	1115.00	40.50	1111.60	.00
2	53.00	1105.50	58.00	1105.60	.00
3	125.00	1107.90	150.00	1108.70	.00

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	31.88	1117.83
2	35.96	1113.80
3	53.02	1105.50
4	144.02	1108.51
5	151.06	1115.62
6	157.86	1122.95
7	162.99	1131.53
8	170.00	1138.66
9	176.49	1146.27

10	178.73	1149.45

*** 1.498 ***

Individual data on the 16 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm. Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	2.7	503.0	.0	.0	.0	.0	.0	.0	.0
2	.8	363.3	.0	.0	.0	.0	.0	.0	.0
3	.5	273.9	.0	.0	.0	.0	.0	.0	.0
4	17.0	21923.8	.0	.0	.0	.0	.0	.0	.0
5	.0	36.2	.0	.0	.0	.0	.0	.0	.0
6	91.0	285881.1	.0	.0	.0	.0	.0	.0	.0
7	.5	2152.8	.0	.0	.0	.0	.0	.0	.0
8	6.5	25713.2	.0	.0	.0	.0	.0	.0	.0
9	6.8	22663.0	.0	.0	.0	.0	.0	.0	.0
10	5.1	13258.5	.0	.0	.0	.0	.0	.0	.0
11	2.0	4181.7	.0	.0	.0	.0	.0	.0	.0
12	5.0	8478.6	.0	.0	.0	.0	.0	.0	.0
13	2.5	3090.4	.0	.0	.0	.0	.0	.0	.0
14	4.0	2959.1	.0	.0	.0	.0	.0	.0	.0
15	.4	160.7	.0	.0	.0	.0	.0	.0	.0
16	1.8	300.2	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.30	1116.69
2	28.29	1115.70
3	37.88	1112.87
4	53.96	1105.52
5	148.15	1108.64
6	153.55	1117.06
7	158.64	1125.66
8	163.68	1134.30
9	167.53	1143.53
10	174.27	1150.56

*** 1.528 ***

1

Failure Surface Specified By 10 Coordinate Points

Point X-Surf Y-Surf

No.	(ft)	(ft)
1	32.50	1117.99
2	39.74	1111.97
3	54.01	1105.52
4	145.52	1108.56
5	152.52	1115.70
6	159.52	1122.83
7	166.59	1129.91
8	173.40	1137.23
9	180.26	1144.51
10	182.85	1148.43

*** 1.544 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	24.48	1115.99
2	29.30	1114.62
3	39.03	1112.31
4	53.90	1105.52
5	148.92	1108.67
6	155.49	1116.20
7	162.28	1123.55
8	167.52	1132.06
9	173.97	1139.70
10	179.14	1148.27
11	179.54	1149.25

*** 1.546 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	25.27	1116.19
2	25.55	1116.10
3	35.35	1114.10
4	53.72	1105.51
5	141.15	1108.42
6	145.65	1117.35
7	152.71	1124.42
8	157.81	1133.03
9	164.79	1140.19
10	164.98	1150.19

11	165.46	1151.00

*** 1.571 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.90	1117.59
2	38.00	1112.82
3	53.36	1105.51
4	148.75	1108.66
5	153.31	1117.56
6	157.42	1126.67
7	160.85	1136.07
8	167.66	1143.40
9	169.29	1151.00

*** 1.577 ***

1

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.75	1118.05
2	38.40	1112.62
3	53.04	1105.50
4	141.78	1108.44
5	148.82	1115.54
6	152.82	1124.70
7	155.24	1134.40
8	162.00	1141.77
9	169.00	1148.92
10	170.38	1151.00

*** 1.596 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	33.04	1118.12
2	38.99	1112.33
3	54.57	1105.53
4	146.43	1108.59
5	152.56	1116.49
6	157.36	1125.26
7	162.76	1133.67
8	168.37	1141.95
9	174.21	1150.07
10	174.36	1150.54

*** 1.597 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	25.16	1116.16
2	27.03	1114.57
3	36.95	1113.32
4	53.04	1105.50
5	147.75	1108.63
6	153.31	1116.94
7	159.61	1124.70
8	161.46	1134.53
9	168.49	1141.65
10	175.56	1148.72
11	176.76	1149.94

*** 1.617 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.31	1117.94
2	36.91	1113.34
3	54.91	1105.54
4	139.21	1108.35
5	145.08	1116.45
6	150.96	1124.54
7	155.45	1133.48
8	161.91	1141.11
9	168.97	1148.19
10	169.51	1151.00

```
*** 1.621 ***

1

              Y          A     X     I     S          F     T

                  .00    253.22   506.44   759.66  1012.88  1266.10
X          .00  +---------+---------+---------+---------+---*-----+
                -                                           *
                -
                -                                           1.
                -                                           1*
                -                                           *
        253.22  +                                           **
                -
                -
                -
                -
                -
A       506.44  +
                -
                -
                -
                -
                -
X       759.66  +
                -
                -
                -
                -
                -
I      1012.88  +
                -
                -
                -
                -
                -
S      1266.10  +
                -
                -
                -
                -
                -
       1519.32  +
                -
                -
                -
                -
                -
F      1772.54  +
                -
                -
                -
                -
                -
T      2025.76  +
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** PCSTABL5M **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: C:\MC\OPT1.IN
Output Filename: C:\MC\OPT126.O

PROBLEM DESCRIPTION MOLYCORP OPTION 1
HILL OPTION
SEISMIC ANALYSIS

BOUNDARY COORDINATES

5 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	1105.00	20.50	1115.00	4
2	20.50	1115.00	165.00	1151.00	1
3	165.00	1151.00	172.50	1151.00	1
4	172.50	1151.00	257.00	1130.00	1
5	257.00	1130.00	274.00	1121.00	4
6	20.50	1115.00	33.00	1115.00	4
7	33.00	1115.00	34.00	1115.00	3
8	34.00	1115.00	165.00	1148.00	2
9	165.00	1148.00	172.50	1148.00	2
10	172.50	1148.00	243.50	1130.00	2
11	243.50	1130.00	244.50	1130.00	3
12	244.50	1130.00	257.00	1130.00	4
13	34.00	1115.00	53.00	1106.00	3
14	53.00	1106.00	204.50	1111.00	3
15	204.50	1111.00	243.50	1130.00	3
16	33.00	1115.00	53.00	1105.00	4
17	53.00	1105.00	204.50	1110.00	4
18	204.50	1110.00	244.50	1130.00	4

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	110.0	.0	25.0	.00	.0	1
2	115.0	115.0	.0	30.0	.00	.0	1
3	120.0	120.0	.0	11.0	.00	.0	1
4	115.0	115.0	200.0	30.0	.00	.0	1

A Horizontal Earthquake Loading Coefficient
Of .050 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	33.50	1115.00	40.50	1111.60	.00
2	53.00	1105.50	58.00	1105.60	.00
3	125.00	1107.90	150.00	1108.70	.00

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	31.88	1117.83
2	35.96	1113.80
3	53.02	1105.50
4	144.02	1108.51
5	151.06	1115.62
6	157.86	1122.95
7	162.99	1131.53
8	170.00	1138.66
9	176.49	1146.27
10	178.73	1149.45

*** 1.189 ***

Individual data on the 16 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	2.7	503.0	.0	.0	.0	.0	25.1	.0	.0
2	.8	363.3	.0	.0	.0	.0	18.2	.0	.0
3	.5	273.9	.0	.0	.0	.0	13.7	.0	.0
4	17.0	21923.8	.0	.0	.0	.0	1096.2	.0	.0
5	.0	36.2	.0	.0	.0	.0	1.8	.0	.0
6	91.0	285881.1	.0	.0	.0	.0	14294.1	.0	.0
7	.5	2152.8	.0	.0	.0	.0	107.6	.0	.0
8	6.5	25713.2	.0	.0	.0	.0	1285.7	.0	.0
9	6.8	22663.0	.0	.0	.0	.0	1133.2	.0	.0
10	5.1	13258.5	.0	.0	.0	.0	662.9	.0	.0
11	2.0	4181.7	.0	.0	.0	.0	209.1	.0	.0
12	5.0	8478.6	.0	.0	.0	.0	423.9	.0	.0
13	2.5	3090.4	.0	.0	.0	.0	154.5	.0	.0
14	4.0	2959.1	.0	.0	.0	.0	148.0	.0	.0
15	.4	160.7	.0	.0	.0	.0	8.0	.0	.0
16	1.8	300.2	.0	.0	.0	.0	15.0	.0	.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	27.30	1116.69
2	28.29	1115.70
3	37.88	1112.87
4	53.96	1105.52
5	148.15	1108.64
6	153.55	1117.06
7	158.64	1125.66
8	163.68	1134.30
9	167.53	1143.53
10	174.27	1150.56

*** 1.209 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	24.48	1115.99
2	29.30	1114.62
3	39.03	1112.31
4	53.90	1105.52
5	148.92	1108.67
6	155.49	1116.20
7	162.28	1123.55
8	167.52	1132.06
9	173.97	1139.70
10	179.14	1148.27
11	179.54	1149.25

*** 1.223 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.50	1117.99
2	39.74	1111.97
3	54.01	1105.52
4	145.52	1108.56
5	152.52	1115.70
6	159.52	1122.83
7	166.59	1129.91
8	173.40	1137.23
9	180.26	1144.51
10	182.85	1148.43

*** 1.225 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	25.27	1116.19
2	25.55	1116.10
3	35.35	1114.10
4	53.72	1105.51
5	141.15	1108.42
6	145.65	1117.35
7	152.71	1124.42
8	157.81	1133.03
9	164.79	1140.19
10	164.98	1150.19
11	165.46	1151.00

*** 1.235 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.90	1117.59
2	38.00	1112.82
3	53.36	1105.51
4	148.75	1108.66
5	153.31	1117.56
6	157.42	1126.67
7	160.85	1136.07
8	167.66	1143.40
9	169.29	1151.00

*** 1.238 ***

1

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.75	1118.05
2	38.40	1112.62
3	53.04	1105.50
4	141.78	1108.44
5	148.82	1115.54
6	152.82	1124.70
7	155.24	1134.40
8	162.00	1141.77
9	169.00	1148.92
10	170.38	1151.00

*** 1.260 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	25.16	1116.16
2	27.03	1114.57
3	36.95	1113.32
4	53.04	1105.50
5	147.75	1108.63
6	153.31	1116.94
7	159.61	1124.70
8	161.46	1134.53
9	168.49	1141.65
10	175.56	1148.72
11	176.76	1149.94

*** 1.269 ***

1

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	33.04	1118.12
2	38.99	1112.33
3	54.57	1105.53
4	146.43	1108.59
5	152.56	1116.49
6	157.36	1125.26
7	162.76	1133.67
8	168.37	1141.95
9	174.21	1150.07
10	174.36	1150.54

*** 1.279 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	32.31	1117.94
2	36.91	1113.34

3	54.91	1105.54
4	139.21	1108.35
5	145.08	1116.45
6	150.96	1124.54
7	155.45	1133.48
8	161.91	1141.11
9	168.97	1148.19
10	169.51	1151.00

*** 1.304 ***

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                     Y          A     X     I     S          F     T

                     .00   253.22    506.44    759.66   1012.88   1266.10

X         .00 +---------+---------+---------+---------+---*-----+
              -                                           *
              -
              -                                           1.
              -                                           1*
              -                                           *
       253.22 +                                           **
              -
              -
              -
              -
              -
A      506.44 +
              -
              -
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              -
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X      759.66 +
              -
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              -
              -
              -
I     1012.88 +
              -
              -
              -
              -
              -
S     1266.10 +
              -
              -
              -
              -
              -
      1519.32 +
              -
              -
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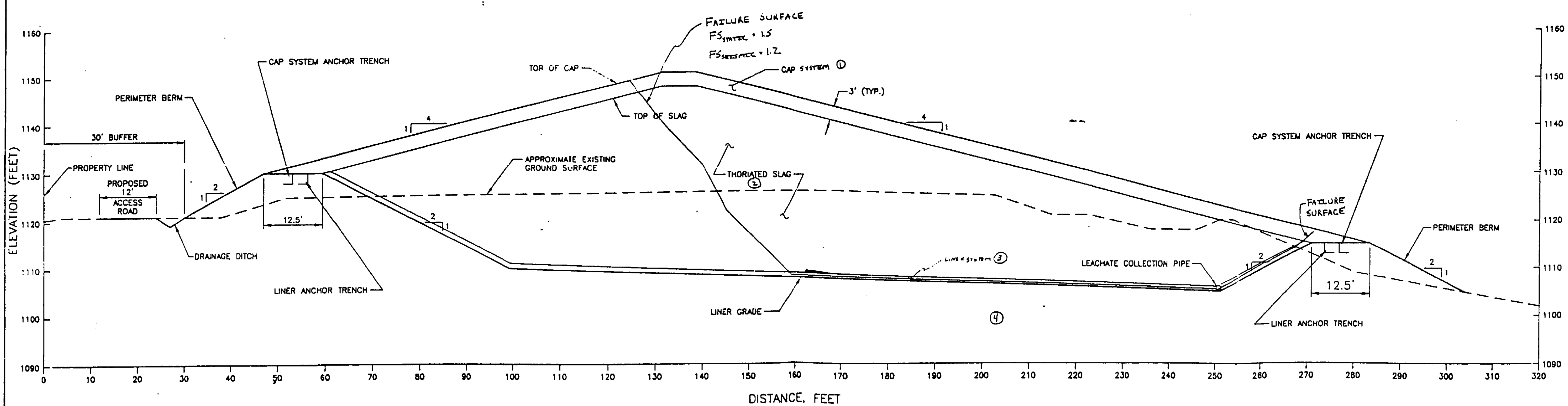

SECTION A–A

CONCEPTUAL

HORIZONTAL AND VERTICAL SCALE

0 5 10 20 FEET

MOLYCORP, INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 2–4

OPTION 1 – HILL OPTION
SECTION A–A

ICF KAISER

** PCSTABL5M **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: C:\MC\OPT2A.IN
Output Filename: C:\MC\OPT23.OU

PROBLEM DESCRIPTION MOLYCORP OPTION 2
OPEN STORAGE AREA OPTION
STATIC ANALYSIS

BOUNDARY COORDINATES

10 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	1022.00	43.00	1022.00	4
2	43.00	1022.00	47.00	1020.00	4
3	47.00	1020.00	52.00	1022.00	4
4	52.00	1022.00	55.00	1023.50	4
5	55.00	1023.50	58.00	1025.00	4
6	58.00	1025.00	68.00	1025.00	4
7	68.00	1025.00	89.00	1035.00	4
8	89.00	1035.00	229.00	1070.00	1
9	229.00	1070.00	255.00	1072.00	1
10	255.00	1072.00	282.00	1070.00	1
11	89.00	1035.00	102.50	1035.00	4
12	102.50	1035.00	103.50	1035.00	3
13	103.50	1035.00	229.00	1067.00	2
14	229.00	1067.00	255.00	1069.00	2
15	255.00	1069.00	282.00	1067.00	2
16	103.50	1035.00	130.00	1022.00	3
17	130.00	1022.00	282.00	1022.00	3
18	102.50	1035.00	130.00	1021.00	4
19	130.00	1021.00	282.00	1021.00	4

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	110.0	.0	25.0	.00	.0	1
2	115.0	115.0	.0	30.0	.00	.0	1
3	120.0	120.0	.0	11.0	.00	.0	1
4	115.0	115.0	200.0	30.0	.00	.0	1

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	103.00	1035.00	110.00	1031.50	.00
2	130.00	1021.50	135.00	1021.50	.00
3	175.00	1021.50	200.00	1021.50	.00

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.09	1038.27
2	107.87	1032.56
3	131.08	1021.50
4	199.60	1021.50
5	204.66	1030.12
6	210.88	1037.95
7	217.95	1045.02
8	223.82	1053.12

9	229.70	1061.21
10	234.19	1070.14
11	234.42	1070.42

*** 1.695 ***

Individual data on the 17 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	2.9	581.8	.0	.0	.0	.0	.0	.0	.0
2	2.3	1270.7	.0	.0	.0	.0	.0	.0	.0
3	.6	447.7	.0	.0	.0	.0	.0	.0	.0
4	20.9	35186.3	.0	.0	.0	.0	.0	.0	.0
5	1.2	3193.6	.0	.0	.0	.0	.0	.0	.0
6	1.0	2834.8	.0	.0	.0	.0	.0	.0	.0
7	68.5	255767.8	.0	.0	.0	.0	.0	.0	.0
8	.3	1379.8	.0	.0	.0	.0	.0	.0	.0
9	4.8	20382.9	.0	.0	.0	.0	.0	.0	.0
10	6.2	21830.8	.0	.0	.0	.0	.0	.0	.0
11	7.1	20108.0	.0	.0	.0	.0	.0	.0	.0
12	5.9	12661.4	.0	.0	.0	.0	.0	.0	.0
13	5.2	7469.4	.0	.0	.0	.0	.0	.0	.0
14	.7	740.0	.0	.0	.0	.0	.0	.0	.0
15	3.1	2034.6	.0	.0	.0	.0	.0	.0	.0
16	1.4	256.8	.0	.0	.0	.0	.0	.0	.0
17	.2	3.2	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.27	1037.82
2	103.17	1034.91
3	130.14	1021.50
4	192.49	1021.50
5	197.98	1029.86
6	202.16	1038.94
7	208.89	1046.34
8	215.82	1053.55
9	222.86	1060.65
10	226.70	1069.42

*** 1.696 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	96.55	1036.89
2	97.79	1035.64
3	107.38	1032.81
4	130.96	1021.50
5	198.15	1021.50
6	203.55	1029.91
7	208.64	1038.52
8	213.68	1047.16
9	217.53	1056.39
10	224.45	1063.61
11	230.20	1070.09

*** 1.729 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	98.28	1037.32
2	106.72	1033.14
3	130.55	1021.50
4	189.35	1021.50
5	196.42	1028.57
6	199.35	1038.13
7	205.62	1045.93
8	212.40	1053.27
9	213.71	1063.19
10	214.07	1066.27

*** 1.848 ***

1

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.25	1038.31
2	108.33	1032.34
3	130.46	1021.50
4	180.42	1021.50
5	186.92	1029.10
6	192.66	1037.29
7	196.63	1046.47

8	199.59	1056.02
9	201.84	1063.21

*** 1.864 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	98.77	1037.44
2	106.11	1033.45
3	130.06	1021.50
4	192.52	1021.50
5	199.40	1028.76
6	204.48	1037.37
7	206.42	1047.18
8	213.30	1054.43
9	214.71	1064.33
10	215.40	1066.60

*** 1.880 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.21	1038.30
2	108.09	1032.46
3	131.30	1021.50
4	193.92	1021.50
5	200.78	1028.77
6	203.91	1038.27
7	209.78	1046.36
8	216.56	1053.71
9	223.19	1061.21
10	228.61	1069.61
11	228.65	1069.91

*** 1.883 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.95	1036.74
2	99.28	1035.95
3	108.56	1032.22
4	131.05	1021.50
5	185.06	1021.50
6	191.79	1028.90
7	198.86	1035.97
8	201.25	1045.68
9	203.79	1055.35
10	210.83	1062.45
11	210.91	1065.48

*** 1.913 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.90	1038.23
2	108.38	1032.31
3	133.37	1021.50
4	189.79	1021.50
5	196.26	1029.12
6	203.29	1036.23
7	209.77	1043.85
8	216.12	1051.57
9	223.11	1058.73
10	230.18	1065.80
11	234.02	1070.39

*** 1.928 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.10	1037.78
2	104.67	1034.17
3	133.05	1021.50
4	195.88	1021.50
5	202.54	1028.95
6	208.24	1037.18
7	214.64	1044.85
8	221.68	1051.96

9	227.61	1060.01
10	228.82	1069.94
11	228.83	1069.96

*** 1.948 ***

1

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            Y           A     X     I     S            F     T

            .00    235.84    471.68    707.52    943.36   1179.20
X        .00 +---------+---------+---------+---------+--*------+
             -                                          *
             -                                          **
             -                                          **
             -                                          .
             -                                          112
      235.84 +                                           1*
             -                                          * *
             -
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A     471.68 +
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X     707.52 +
             -
             -
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             -
             -
I     943.36 +
             -
             -
             -
             -
             -
S    1179.20 +
             -
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             -
             -
             -
     1415.04 +
             -
             -
             -
             -
             -
F    1650.88 +
             -
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** PCSTABL5M **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: C:\MC\OPT2A.IN
Output Filename: C:\MC\OPT27.OU

PROBLEM DESCRIPTION MOLYCORP OPTION 2
OPEN STORAGE AREA OPTION
SEISMIC ANALYSIS

BOUNDARY COORDINATES

10 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	1022.00	43.00	1022.00	4
2	43.00	1022.00	47.00	1020.00	4
3	47.00	1020.00	52.00	1022.00	4
4	52.00	1022.00	55.00	1023.50	4
5	55.00	1023.50	58.00	1025.00	4
6	58.00	1025.00	68.00	1025.00	4
7	68.00	1025.00	89.00	1035.00	4
8	89.00	1035.00	229.00	1070.00	1
9	229.00	1070.00	255.00	1072.00	1
10	255.00	1072.00	282.00	1070.00	1
11	89.00	1035.00	102.50	1035.00	4
12	102.50	1035.00	103.50	1035.00	3
13	103.50	1035.00	229.00	1067.00	2
14	229.00	1067.00	255.00	1069.00	2
15	255.00	1069.00	282.00	1067.00	2
16	103.50	1035.00	130.00	1022.00	3
17	130.00	1022.00	282.00	1022.00	3
18	102.50	1035.00	130.00	1021.00	4
19	130.00	1021.00	282.00	1021.00	4

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	110.0	.0	25.0	.00	.0	1
2	115.0	115.0	.0	30.0	.00	.0	1
3	120.0	120.0	.0	11.0	.00	.0	1
4	115.0	115.0	200.0	30.0	.00	.0	1

A Horizontal Earthquake Loading Coefficient
Of .050 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	103.00	1035.00	110.00	1031.50	.00
2	130.00	1021.50	135.00	1021.50	.00
3	175.00	1021.50	200.00	1021.50	.00

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 10 Coordinate Points

Point X-Surf Y-Surf

No.	(ft)	(ft)
1	100.27	1037.82
2	103.17	1034.91
3	130.14	1021.50
4	192.49	1021.50
5	197.98	1029.86
6	202.16	1038.94
7	208.89	1046.34
8	215.82	1053.55
9	222.86	1060.65
10	226.70	1069.42

*** 1.345 ***

Individual data on the 14 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	2.8	545.7	.0	.0	.0	.0	27.3	.0	.0
2	.1	33.9	.0	.0	.0	.0	1.7	.0	.0
3	.3	135.8	.0	.0	.0	.0	6.8	.0	.0
4	26.5	41559.5	.0	.0	.0	.0	2078.0	.0	.0
5	.1	380.2	.0	.0	.0	.0	19.0	.0	.0
6	62.3	225520.4	.0	.0	.0	.0	11276.0	.0	.0
7	.3	1474.8	.0	.0	.0	.0	73.7	.0	.0
8	5.2	21097.3	.0	.0	.0	.0	1054.9	.0	.0
9	4.2	13584.5	.0	.0	.0	.0	679.2	.0	.0
10	6.7	16525.4	.0	.0	.0	.0	826.3	.0	.0
11	6.9	12560.6	.0	.0	.0	.0	628.0	.0	.0
12	7.0	8387.1	.0	.0	.0	.0	419.4	.0	.0
13	2.4	1431.2	.0	.0	.0	.0	71.6	.0	.0
14	1.5	245.8	.0	.0	.0	.0	12.3	.0	.0

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.09	1038.27
2	107.87	1032.56
3	131.08	1021.50
4	199.60	1021.50
5	204.66	1030.12
6	210.88	1037.95
7	217.95	1045.02
8	223.82	1053.12
9	229.70	1061.21
10	234.19	1070.14
11	234.42	1070.42

*** 1.355 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	96.55	1036.89
2	97.79	1035.64
3	107.38	1032.81
4	130.96	1021.50
5	198.15	1021.50
6	203.55	1029.91
7	208.64	1038.52
8	213.68	1047.16
9	217.53	1056.39
10	224.45	1063.61
11	230.20	1070.09

*** 1.371 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	98.28	1037.32
2	106.72	1033.14
3	130.55	1021.50
4	189.35	1021.50
5	196.42	1028.57
6	199.35	1038.13
7	205.62	1045.93
8	212.40	1053.27
9	213.71	1063.19
10	214.07	1066.27

*** 1.447 ***

1

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	98.77	1037.44
2	106.11	1033.45
3	130.06	1021.50
4	192.52	1021.50
5	199.40	1028.76
6	204.48	1037.37
7	206.42	1047.18
8	213.30	1054.43
9	214.71	1064.33
10	215.40	1066.60

*** 1.464 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.25	1038.31
2	108.33	1032.34
3	130.46	1021.50
4	180.42	1021.50
5	186.92	1029.10
6	192.66	1037.29
7	196.63	1046.47
8	199.59	1056.02
9	201.84	1063.21

*** 1.479 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	95.95	1036.74
2	99.28	1035.95
3	108.56	1032.22
4	131.05	1021.50
5	185.06	1021.50
6	191.79	1028.90
7	198.86	1035.97
8	201.25	1045.68
9	203.79	1055.35
10	210.83	1062.45
11	210.91	1065.48

*** 1.500 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	102.21	1038.30
2	108.09	1032.46
3	131.30	1021.50
4	193.92	1021.50
5	200.78	1028.77
6	203.91	1038.27
7	209.78	1046.36
8	216.56	1053.71
9	223.19	1061.21
10	228.61	1069.61
11	228.65	1069.91

*** 1.507 ***

1

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	101.90	1038.23
2	108.38	1032.31
3	133.37	1021.50
4	189.79	1021.50
5	196.26	1029.12
6	203.29	1036.23
7	209.77	1043.85
8	216.12	1051.57
9	223.11	1058.73
10	230.18	1065.80
11	234.02	1070.39

*** 1.570 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.10	1037.78

2	104.67	1034.17
3	133.05	1021.50
4	195.88	1021.50
5	202.54	1028.95
6	208.24	1037.18
7	214.64	1044.85
8	221.68	1051.96
9	227.61	1060.01
10	228.82	1069.94
11	228.83	1069.96

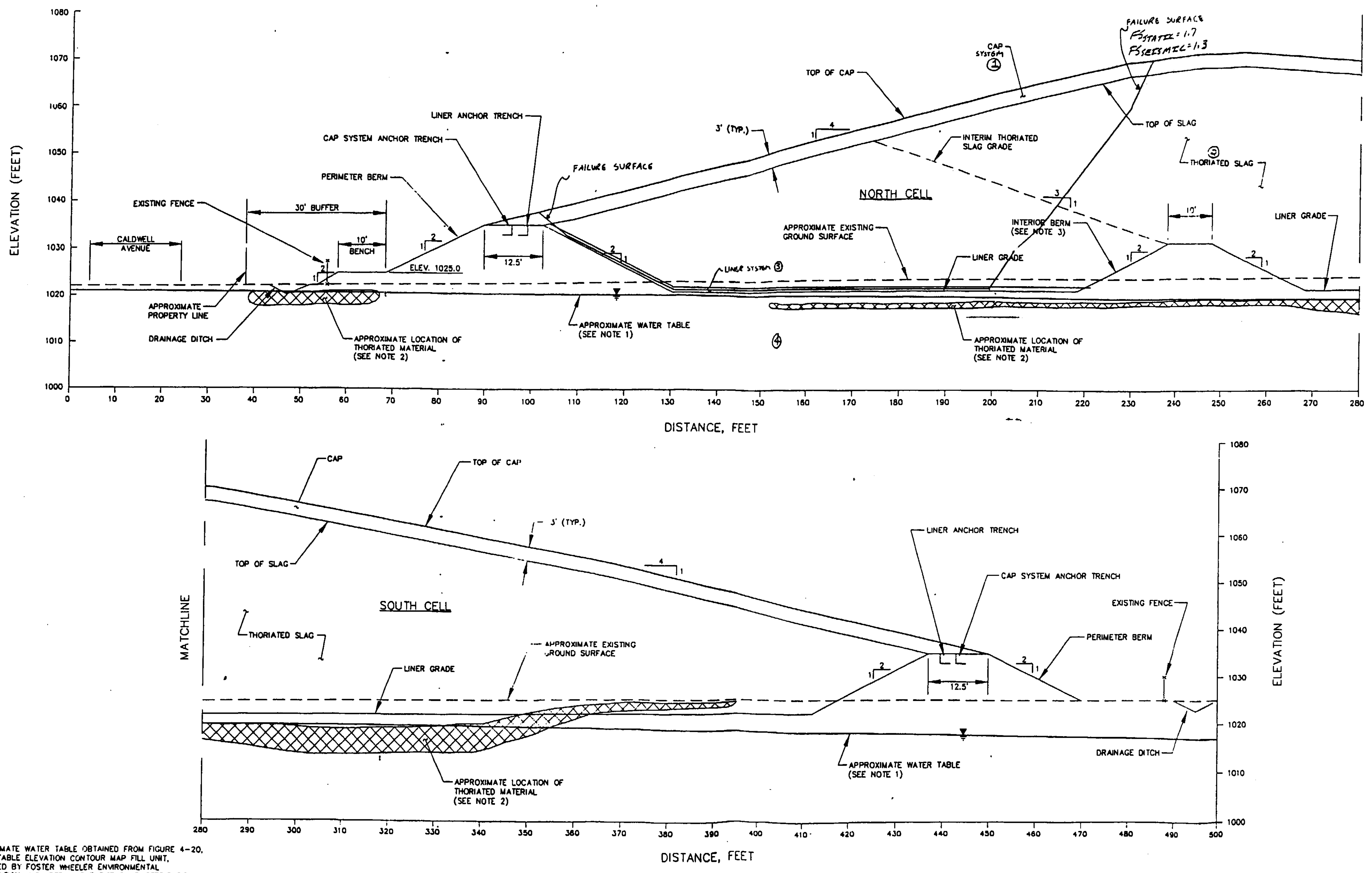
*** 1.575 ***

1

```
                  Y            A     X     I     S            F     T

                   .00    235.84    471.68    707.52    943.36   1179.20

X              .00 +---------+---------+---------+---------+--*------+
                   -                                          *
                   -                                          **
                   -                                          **
                   -                                          .
                   -                                          111
            235.84 +                                           2*
                   -                                          * *
                   -
                   -
                   -
                   -
A           471.68 +
                   -
                   -
                   -
                   -
                   -
X           707.52 +
                   -
                   -
                   -
                   -
                   -
I           943.36 +
                   -
                   -
                   -
                   -
                   -
S          1179.20 +
                   -
                   -
                   -
                   -
                   -
           1415.04 +
```



NOTES.

1. APPROXIMATE WATER TABLE OBTAINED FROM FIGURE 4-20, WATER TABLE ELEVATION CONTOUR MAP FILL UNIT, PREPARED BY FOSTER WHEELER ENVIRONMENTAL CORPORATION, INCLUDED IN THE SITE CHARACTERIZATION REPORT FOR LICENSE TERMINATION OF THE WASHINGTON, PA FACILITY, DATED JANUARY 1995.
2. APPROXIMATE LOCATION OF THORIATED MATERIAL OBTAINED FROM FIGURE 2-1A, SOIL AREAS AND BORING LOCATIONS WITH GREATER THAN 30 pCi/g THORIUM-232, PREPARED BY FOSTER WHEELER ENVIRONMENTAL CORPORATION, INCLUDED IN THE DECOMMISSIONING PLAN FOR THE WASHINGTON, PA FACILITY, DATED JULY 1995.
3. THE INTERIOR BERM WILL BE CONSTRUCTED SUCH THAT THE AVAILABLE THORIATED SLAG VOLUME IN THE NORTH CELL IS LARGE ENOUGH TO CONTAIN ALL THORIATED SLAG EXCAVATED FROM THE EXISTING OPEN STORAGE AREA (≈8,100 CY) AND THE MATERIAL FROM THE YORK FACILITY STORED IN THE TEMPORARY STORAGE FACILITY (≈3,500 CY).

CONCEPTUAL

HORIZONTAL AND VERTICAL SCALE
0 5 10 20 FEET

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 2-6

OPTION 2 - OPEN STORAGE AREA OPTION
SECTION B-B

ICF KAISER

** PCSTABL5M **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: A:OPT3B.IN
Output Filename: A:OPT3B.OUT

PROBLEM DESCRIPTION MOLYCORP OPTION 3
RAILROAD AREA OPTION
STATIC ANALYSIS

BOUNDARY COORDINATES

5 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	1050.00	23.50	1054.00	4
2	23.50	1054.00	29.50	1057.00	4
3	29.50	1057.00	195.00	1098.00	1
4	195.00	1098.00	202.00	1098.00	1
5	202.00	1098.00	246.00	1087.00	1
6	29.50	1057.00	42.00	1057.00	4
7	42.00	1057.00	43.00	1057.00	3
8	43.00	1057.00	195.00	1095.00	2
9	195.00	1095.00	202.00	1095.00	2
10	202.00	1095.00	232.50	1087.00	2
11	232.50	1087.00	233.50	1087.00	3
12	233.50	1087.00	246.00	1087.00	4
13	43.00	1057.00	63.00	1048.00	3
14	63.00	1048.00	113.50	1048.00	3
15	113.50	1048.00	232.50	1087.00	3
16	42.00	1057.00	63.00	1047.00	4
17	63.00	1047.00	113.50	1047.00	4
18	113.50	1047.00	233.50	1087.00	4

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	110.0	.0	25.0	.00	.0	1
2	115.0	115.0	.0	30.0	.00	.0	1
3	120.0	120.0	.0	16.0	.00	.0	1
4	115.0	115.0	200.0	30.0	.00	.0	1

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

4 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	42.50	1057.00	45.00	1055.80	.00
2	60.00	1047.50	63.00	1047.50	.00
3	105.00	1047.50	113.50	1047.50	.00
4	175.00	1067.60	200.00	1075.80	.00

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	38.32	1059.18
2	44.91	1055.84
3	62.34	1047.50
4	111.86	1047.50
5	197.37	1074.94
6	203.94	1082.48
7	210.21	1090.27
8	211.86	1095.54

*** 1.532 ***

Individual data on the 18 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	4.3	771.0	.0	.0	.0	.0	.0	.0	.0
2	.4	139.5	.0	.0	.0	.0	.0	.0	.0
3	1.9	905.9	.0	.0	.0	.0	.0	.0	.0
4	17.4	22411.9	.0	.0	.0	.0	.0	.0	.0
5	.7	1343.6	.0	.0	.0	.0	.0	.0	.0
6	48.9	133362.2	.0	.0	.0	.0	.0	.0	.0
7	1.6	5325.4	.0	.0	.0	.0	.0	.0	.0
8	3.7	12595.3	.0	.0	.0	.0	.0	.0	.0
9	77.9	237732.6	.0	.0	.0	.0	.0	.0	.0
10	.8	2238.9	.0	.0	.0	.0	.0	.0	.0
11	1.5	4131.7	.0	.0	.0	.0	.0	.0	.0
12	.0	62.4	.0	.0	.0	.0	.0	.0	.0
13	.6	1674.9	.0	.0	.0	.0	.0	.0	.0
14	4.0	9049.9	.0	.0	.0	.0	.0	.0	.0
15	1.9	3631.3	.0	.0	.0	.0	.0	.0	.0
16	6.3	7369.9	.0	.0	.0	.0	.0	.0	.0
17	.7	364.2	.0	.0	.0	.0	.0	.0	.0
18	.9	154.2	.0	.0	.0	.0	.0	.0	.0

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	40.51	1059.73
2	43.91	1056.32
3	61.75	1047.50
4	112.62	1047.50
5	186.76	1071.46
6	191.11	1080.46
7	198.17	1087.54
8	202.25	1096.67
9	202.73	1097.82

*** 1.538 ***

1

Failure Surface Specified By 8 Coordinate Points

Point X-Surf Y-Surf

No.	(ft)	(ft)
1	38.72	1059.28
2	42.86	1056.83
3	61.94	1047.50
4	112.33	1047.50
5	190.93	1072.82
6	197.90	1079.99
7	198.09	1089.99
8	202.79	1097.80

*** 1.566 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	39.90	1059.58
2	42.50	1057.00
3	61.34	1047.50
4	112.84	1047.50
5	194.18	1073.89
6	200.02	1082.01
7	203.96	1091.20
8	206.59	1096.85

*** 1.589 ***

1

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	36.49	1058.73
2	42.57	1056.97
3	62.81	1047.50
4	111.51	1047.50
5	187.00	1071.54
6	194.06	1078.62
7	200.92	1085.90
8	205.27	1094.90
9	205.66	1097.08

*** 1.605 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	34.81	1058.32
2	44.26	1056.15
3	60.69	1047.50
4	112.72	1047.50
5	177.04	1068.27
6	182.63	1076.56
7	189.69	1083.64
8	193.34	1092.95
9	197.86	1098.00

*** 1.635 ***

1

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	34.81	1058.32
2	42.64	1056.93
3	60.57	1047.50
4	112.24	1047.50
5	184.61	1070.75
6	188.85	1079.80
7	195.73	1087.07
8	198.32	1096.73
9	198.52	1098.00

*** 1.635 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	39.59	1059.50
2	42.88	1056.82
3	60.32	1047.50
4	112.29	1047.50
5	184.22	1070.62
6	187.35	1080.12
7	193.90	1087.68
8	194.10	1097.68

9	194.20	1097.80

*** 1.704 ***

1

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	37.34	1058.94
2	43.63	1056.46
3	60.71	1047.50
4	112.97	1047.50
5	188.18	1071.92
6	193.52	1080.37
7	193.67	1090.37
8	198.65	1098.00

*** 1.716 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	39.65	1059.52
2	44.66	1055.96
3	62.99	1047.50
4	110.97	1047.50
5	180.03	1069.25
6	185.67	1077.51
7	192.50	1084.81
8	195.98	1094.19
9	196.58	1098.00

*** 1.716 ***

1

```
              Y          A     X     I     S          F     T

               .00    241.56    483.12    724.68    966.24   1207.80

X      .00 +---------+---------+---------+---------+--*------+
           -                                          8*
```

** PCSTABL5M **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:
Time of Run:
Run By:
Input Data Filename: A:OPT3BS.IN
Output Filename: A:OPT3BS.OUT

PROBLEM DESCRIPTION MOLYCORP OPTION 3
RAILROAD AREA OPTION
SEISMIC ANALYSIS

BOUNDARY COORDINATES

5 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	1050.00	23.50	1054.00	4
2	23.50	1054.00	29.50	1057.00	4
3	29.50	1057.00	195.00	1098.00	1
4	195.00	1098.00	202.00	1098.00	1
5	202.00	1098.00	246.00	1087.00	1
6	29.50	1057.00	42.00	1057.00	4
7	42.00	1057.00	43.00	1057.00	3
8	43.00	1057.00	195.00	1095.00	2
9	195.00	1095.00	202.00	1095.00	2
10	202.00	1095.00	232.50	1087.00	2
11	232.50	1087.00	233.50	1087.00	3
12	233.50	1087.00	246.00	1087.00	4
13	43.00	1057.00	63.00	1048.00	3
14	63.00	1048.00	113.50	1048.00	3
15	113.50	1048.00	232.50	1087.00	3
16	42.00	1057.00	63.00	1047.00	4
17	63.00	1047.00	113.50	1047.00	4
18	113.50	1047.00	233.50	1087.00	4

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	110.0	110.0	.0	25.0	.00	.0	1
2	115.0	115.0	.0	30.0	.00	.0	1
3	120.0	120.0	.0	16.0	.00	.0	1
4	115.0	115.0	200.0	30.0	.00	.0	1

A Horizontal Earthquake Loading Coefficient
Of .050 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

50 Trial Surfaces Have Been Generated.

4 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 10.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	42.50	1057.00	45.00	1055.80	.00
2	60.00	1047.50	63.00	1047.50	.00
3	105.00	1047.50	113.50	1047.50	.00
4	175.00	1067.60	200.00	1075.80	.00

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 8 Coordinate Points

Point X-Surf Y-Surf

No.	(ft)	(ft)
1	38.32	1059.18
2	44.91	1055.84
3	62.34	1047.50
4	111.86	1047.50
5	197.37	1074.94
6	203.94	1082.48
7	210.21	1090.27
8	211.86	1095.54

*** 1.233 ***

Individual data on the 18 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	4.3	771.0	.0	.0	.0	.0	38.5	.0	.0
2	.4	139.5	.0	.0	.0	.0	7.0	.0	.0
3	1.9	905.9	.0	.0	.0	.0	45.3	.0	.0
4	17.4	22411.9	.0	.0	.0	.0	1120.6	.0	.0
5	.7	1343.6	.0	.0	.0	.0	67.2	.0	.0
6	48.9	133362.2	.0	.0	.0	.0	6668.1	.0	.0
7	1.6	5325.4	.0	.0	.0	.0	266.3	.0	.0
8	3.7	12595.3	.0	.0	.0	.0	629.8	.0	.0
9	77.9	237732.6	.0	.0	.0	.0	11886.6	.0	.0
10	.8	2238.9	.0	.0	.0	.0	111.9	.0	.0
11	1.5	4131.7	.0	.0	.0	.0	206.6	.0	.0
12	.0	62.4	.0	.0	.0	.0	3.1	.0	.0
13	.6	1674.9	.0	.0	.0	.0	83.7	.0	.0
14	4.0	9049.9	.0	.0	.0	.0	452.5	.0	.0
15	1.9	3631.3	.0	.0	.0	.0	181.6	.0	.0
16	6.3	7369.9	.0	.0	.0	.0	368.5	.0	.0
17	.7	364.2	.0	.0	.0	.0	18.2	.0	.0
18	.9	154.2	.0	.0	.0	.0	7.7	.0	.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	38.72	1059.28
2	42.86	1056.83
3	61.94	1047.50
4	112.33	1047.50
5	190.93	1072.82
6	197.90	1079.99
7	198.09	1089.99
8	202.79	1097.80

*** 1.249 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	40.51	1059.73
2	43.91	1056.32
3	61.75	1047.50
4	112.62	1047.50
5	186.76	1071.46
6	191.11	1080.46
7	198.17	1087.54
8	202.25	1096.67
9	202.73	1097.82

*** 1.255 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	39.90	1059.58
2	42.50	1057.00
3	61.34	1047.50
4	112.84	1047.50
5	194.18	1073.89
6	200.02	1082.01
7	203.96	1091.20
8	206.59	1096.85

*** 1.295 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	36.49	1058.73
2	42.57	1056.97
3	62.81	1047.50
4	111.51	1047.50
5	187.00	1071.54

6	194.06	1078.62
7	200.92	1085.90
8	205.27	1094.90
9	205.66	1097.08

*** 1.301 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	34.81	1058.32
2	42.64	1056.93
3	60.57	1047.50
4	112.24	1047.50
5	184.61	1070.75
6	188.85	1079.80
7	195.73	1087.07
8	198.32	1096.73
9	198.52	1098.00

*** 1.339 ***

1

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	34.81	1058.32
2	44.26	1056.15
3	60.69	1047.50
4	112.72	1047.50
5	177.04	1068.27
6	182.63	1076.56
7	189.69	1083.64
8	193.34	1092.95
9	197.86	1098.00

*** 1.342 ***

Failure Surface Specified By 8 Coordinate Points

Point	X-Surf	Y-Surf

No.	(ft)	(ft)
1	37.34	1058.94
2	43.63	1056.46
3	60.71	1047.50
4	112.97	1047.50
5	188.18	1071.92
6	193.52	1080.37
7	193.67	1090.37
8	198.65	1098.00

*** 1.383 ***

1

Failure Surface Specified By 9 Coordinate Points

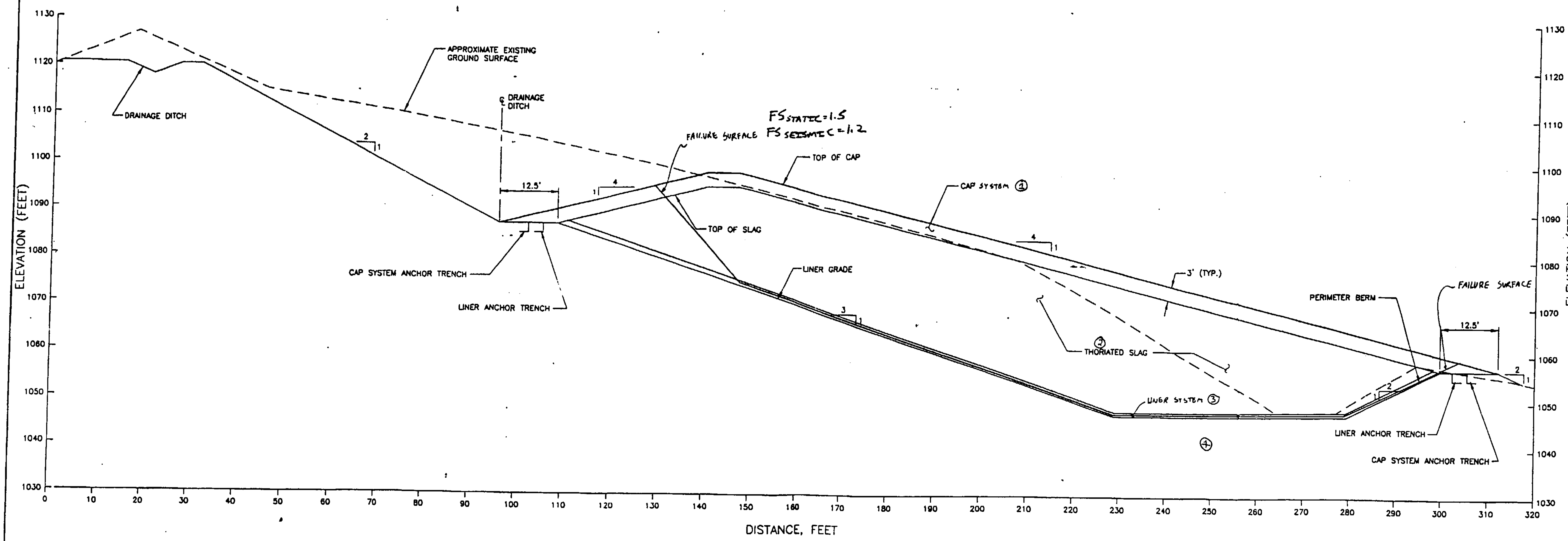
Point No.	X-Surf (ft)	Y-Surf (ft)
1	39.59	1059.50
2	42.88	1056.82
3	60.32	1047.50
4	112.29	1047.50
5	184.22	1070.62
6	187.35	1080.12
7	193.90	1087.68
8	194.10	1097.68
9	194.20	1097.80

*** 1.385 ***

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	39.65	1059.52
2	44.66	1055.96
3	62.99	1047.50
4	110.97	1047.50
5	180.03	1069.25
6	185.67	1077.51
7	192.50	1084.81
8	195.98	1094.19
9	196.58	1098.00

*** 1.395 ***



SECTION C-C

CONCEPTUAL

HORIZONTAL AND VERTICAL SCALE

0 5 10 20 FEET

MOLYCORP. INC.
300 CALDWELL AVENUE
WASHINGTON, PA.

FIGURE 2-6

OPTION 3 – RAILROAD AREA OPTION
SECTION C-C

ICF KAISER