~~LINDHAW~~ HJP

Final

environmental statement

related to operation of

THE HIGHLAND URANIUM MILL

BY THE EXXON COMPANY, U.S.A.

(Formerly Humble Oil and Refining Company)

DOCKET NO. 40-8102

March 1973

UNITED STATES ATOMIC ENERGY COMMISSION

DIRECTORATE OF LICENSING

FINAL DETAILED STATEMENT ON THE ENVIRONMENTAL CONSIDERATIONS

BY

FUELS AND MATERIALS

DIRECTORATE OF LICENSING

U. S. ATOMIC ENERGY COMMISSION

RELATED TO THE PROPOSED ISSUANCE OF A LICENSE

TO EXXON COMPANY, USA

FOR THE HIGHLAND URANIUM MILL

DOCKET NO. 40-8102

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(X) FINAL ENVIRONMENTAL STATEMENT

RESPONSIBLE AGENCY OFFICE - FUELS AND MATERIALS
Directorate of Licensing
U.S. Atomic Energy Commission

1. TYPE OF ACTION -

Administrative Action (X)
Legislative Action ( )

2. DESCRIPTION OF ACTION

This statement is related to the proposed issuance of a source materials license to Exxon Company, USA, formerly known as Humble Oil and Refining Company, for the operation of a uranium mill in the Highland Flats Area of Converse County, State of Wyoming.

3. SUMMARY OF ENVIRONMENTAL IMPACT

The Highland Uranium Mill utilizes the conventional hydrometallurgical process in which an acid-leach, solvent extraction circuit is used in the uranium ore processing plant which has a capacity of about 2000 tons of ore per day. Although the present licensing action does not extend to mining, the Statement considers the environmental impact of the combined mining and milling project to be conducted by Exxon Company, USA.

The environmental impact, including adverse and benefical environmental effects of the Highland Uranium Mill, is as follows:

a. Temporary (12-14 years) reassignment of use of about 3200 acres (1500 are fenced) of land normally used for sheep grazing.

b. The extraction and recovery of approximately 32 million pounds of uranium concentrates which will eventually be used to produce approximately 2.3×10^7 megawatt days of electricity.

c. A change in the local topography involving about 830 acres. Following reclamation and restoration this change will probably be unnoticeable except for two small lakes of 50 acres each which will be created and a stabilized tailings pile of approximately 250 acres.

d. Removal of approximately 500-gallons per minute of local ground water from the mine.

e. Stimulation of the local economy through taxes and direct employment of about 170 persons in Converse County over the next 12-14 years.

f. The creation of a stabilized tailings pile covering about 250 acres and involving 11 million tons of tailings containing solidified waste chemicals and low concentrations of radioactive uranium and its daughter products.

g. Discharge of very small quantities of chemicals and radioactive materials (that are not expected to produce discernible effects) into the local environs.

h. A temporary (12-14 years) adverse aesthetic impact on the local area from open-pit mining.

4. ALTERNATIVES CONSIDERED

The following alternatives to the Highland Uranium Project were considered.

- Construction of the mill at an alternate site.
- Underground mining rather than open-pit mining.
- Construction of the tailings retention system at an alternate location at the Highland site.
- Alternate equipment and operating procedures.
- Use of alternate mill process.
- Transporting and milling the ore at an alternate mill.

5. A tabulation of all Federal, State, and local agencies and other sources from which written comments have been received are listed below.

a. Environmental Protection Agency, National Water Quality Laboratory
b. Department of Health, Education and Welfare, Region Denver
c. Advisory Council on Historic Preservation, Washington, D.C.
d. Department of the Army, Omaha District, Corps of Engineers
e. Department of Commerce
f. Department of Agriculture

g. National Oceanic and Atmospheric Administration, Air Resources Laboratories
h. Environmental Protection Agency, Washington, D. C.
i. Department of Transportation, United States Coast Guard
j. United States Department of Interior
k. Texas State Department of Health, Division of Occupational Health and Radiation Control
l. Wyoming Recreation Commission
m. State of Wyoming Game and Fish Commission
n. Dr. A. C. Wilbraham, Associate Professor in Chemistry, Southern Illinois University, Edwardsville, Illinois

6. On the basis of the analysis and evaluations set forth in this statement, after weighing the benefits of the Highland Uranium Mill against the environmental costs and considering available alternatives, it is concluded that a source materials license should be issued to Exxon Company, USA, subject to the following conditions for the protection of the environment:

   (a) The applicant will be required to carry out an environmental monitoring program of the comprehensive character delineated in Chapter II, Section E, of the AEC Final Environmental Statement.

   (b) The applicant will control the wastes and effluents as described in Chapter II, Section C, of the AEC Final Environmental Statement.

   (c) The applicant will reclaim and restore the site as described in Chapter II, Section H, of the AEC Final Environmental Statement.

7. This Final Detailed Environmental Statement is being made available to the Council on Environmental Quality, to the agencies and persons mentioned above, and to the public in March, 1973.

FOREWORD

The final detailed statement on environmental considerations associated with the proposed issuance of an operating license for the Highland Uranium Mill (Docket No. 40-8102) to Exxon Company, USA (applicant) has been prepared by Fuels and Materials, Directorate of Licensing (the staff) of the U. S. Atomic Energy Commission (AEC) in accordance with the AEC's regulation 10 CFR Part 50, Appendix D, implementing the requirements of the National Environmental Policy Act of 1969.

This statement is based on information contained in the Exxon Company Environmental Report dated July 1971, its supplemental report dated January 1972, its response to agency comments on the Draft Detailed Statement dated August 1972, and on comments received on the Draft Detailed Statement from Federal, State and local agencies and consultants in various disciplines in environmental concerns. Additional information is contained in the applicant's license application dated August 12, 1971. Copies of the applicant's Environmental Reports are available for inspection in the AEC Public Document Room, 1717 H Street, N.W., Washington, D. C. 20006; the Wyoming State Clearinghouse, Capitol Building, Cheyenne, Wyoming 82001; and the Converse County Library, Douglas, Wyoming 82633. Copies of the applicant's license application are available for public inspection in the AEC Public Document Room, 1717 H Street, N.W., Washington, D. C.

The applicant must comply with all applicable requirements of Section 401 of the Federal Water Pollution Control Act, as amended, under terms of the operating license to be issued by the Commission.

Mr. John Kendig is the AEC Environmental Analyst (301-973-7463) for this Final Environmental Statement.

I. INTRODUCTION

Exploration by Exxon Company, USA led to the discovery of a uranium bearing ore body in the Highland Flats area of Converse County, Wyoming, in 1968. Based on the anticipated demands for uranium in the nuclear power industry (over the next 14 years, the demand for uranium mill concentrates is expected to increase from 6900 tons in 1971 to 59,300 tons by 1985)[1] Exxon Company initiated a mining and milling project in 1970 consisting of an open-pit mine and a 2000 ton per day mill. Mining activities commenced in 1970 and the mill commenced operations under an interim license issued by the Commission on October 5, 1972. The interim license was issued in accordance with the provisions of Section A.14 of Appendix D, 10 CFR Part 50.

Under the Atomic Energy Commission's regulation, 10 CFR Part 40, an AEC license is required in order to mill ores containing 0.05% or more of uranium. Moreover, Appendix D of the Commission's regulation, 10 CFR Part 50, provides for the preparation of a Detailed Environmental Statement pursuant to the National Environmental Policy Act of 1969 prior to the issuance of an AEC license to authorize uranium milling.

The National Environmental Policy Act of 1969 became effective on January 1, 1970. Pursuant to Section 102(2)(C) of that Act, Federal agencies must include, in every major Federal action significantly affecting the quality of the human environment, a detailed statement by the responsible official on:

1. The environmental impact of the proposed action;

2. Any adverse environmental effects which cannot be avoided should the proposal be implemented.

3. Alternatives to the proposed action;

4. The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity;

5. Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

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[1] Statistical Data of the Uranium Industry, U.S. Atomic Energy Commission, January 1, 1971.

By application dated August 12, 1971, Exxon Company, USA applied for an AEC Source Material License to authorize uranium milling activities at the applicant's proposed Highland Uranium Mill (HUM) which was under construction at that time. In conjunction with the application for a license, the applicant filed an Environmental Report (supplemented January 1972) entitled, "Applicant's Environmental Report, Highland Uranium Mill, Converse County, Wyoming," dated July 1971. This report discusses the known and potential environmental impact associated with the proposed mining and milling activities to be conducted by the applicant.

AEC regulations do not require mining activities to be licensed by the Commission. However, for the purpose of this detailed statement, the combined environmental impact from both the mining and milling activities is considered since they are interrelated.

Additional applications, approvals and regulatory actions required for the Highland Uranium Project are listed in Table 1.

TABLE 1

List of Regulatory Approvals and Permits

Government Agency	Type of Application	Date of Approval
Wyoming Department of Health and Social Services	Embankment Retention Systems	April 29, 1971
Wyoming Department of Health and Social Services	Sewage Disposal System	September 8, 1970
Wyoming Department of Health and Social Services	Air Quality Act	None Required
Wyoming Department of Health and Social Services	Water Quality Act	None required
Wyoming Land Commission	Open Cut Land Reclamation Act	August 3, 1970
Wyoming State Engineer	Water Use Permits	April 22, 1969 and June 27, 1969
Wyoming State Engineer	Diversion Dams around Tailings Pond	June 18, 1971

I. DESCRIPTION OF THE PROPOSED ACTION

A. LOCATION

The HUM is located in Converse County in eastern Wyoming (Fig. 1). The site is approximately 75 miles west of the common point on the Wyoming - South Dakota - Nebraska borders and about mid-state in the north-south direction. It is about 130 air miles to Montana on the north and 140 miles to Colorado on the south. The nearest major city, Casper, is about 50 air miles west-southwest. Douglas and Glenrock are incorporated towns located about 24 miles south-southeast and southwest, respectively (Fig. 2). The settlement of Orpha is about 15 miles south, and the settlement of Bill is located about 18 miles northeast. The site may be reached from Highway 26 via the Orpha-Ross Road near Douglas or via the Glenrock Road near Glenrock.

The Highland uranium mill and mine are located at an elevation of 5300 feet above sea level within an exclusion area of 3200 acres owned or controlled through long-term leases by the applicant (Fig. 3). Within this area a 1500 acre site on which the mine and mill are located is fenced with sheep-tight fence (Fig. 4). The site topography is typical of eastern Wyoming plains with moderate elevation changes, i.e., the topography of the vicinity is characterized by rolling hills and valleys. Elevation differences of 300 feet are present within 2 to 3 mile distances. Local slopes are 20 to 50 percent.

B. REGIONAL DEMOGRAPHY AND LAND USE

1. Population

The area surrounding the Highland mill and mine is very sparsely populated. There are only two residences within a five mile radius of the mill, the nearest being the Fowler ranch 2.9 miles to the northeast. Population data for the area are shown in Table 2. The average population for Converse County, excluding the towns of Douglas and Glenrock, is 0.4 persons per square mile. For the 113 square mile area around the site shown in Figure 3, the population density is between 0.00 and 0.04 persons per square mile, depending upon the season of the year.

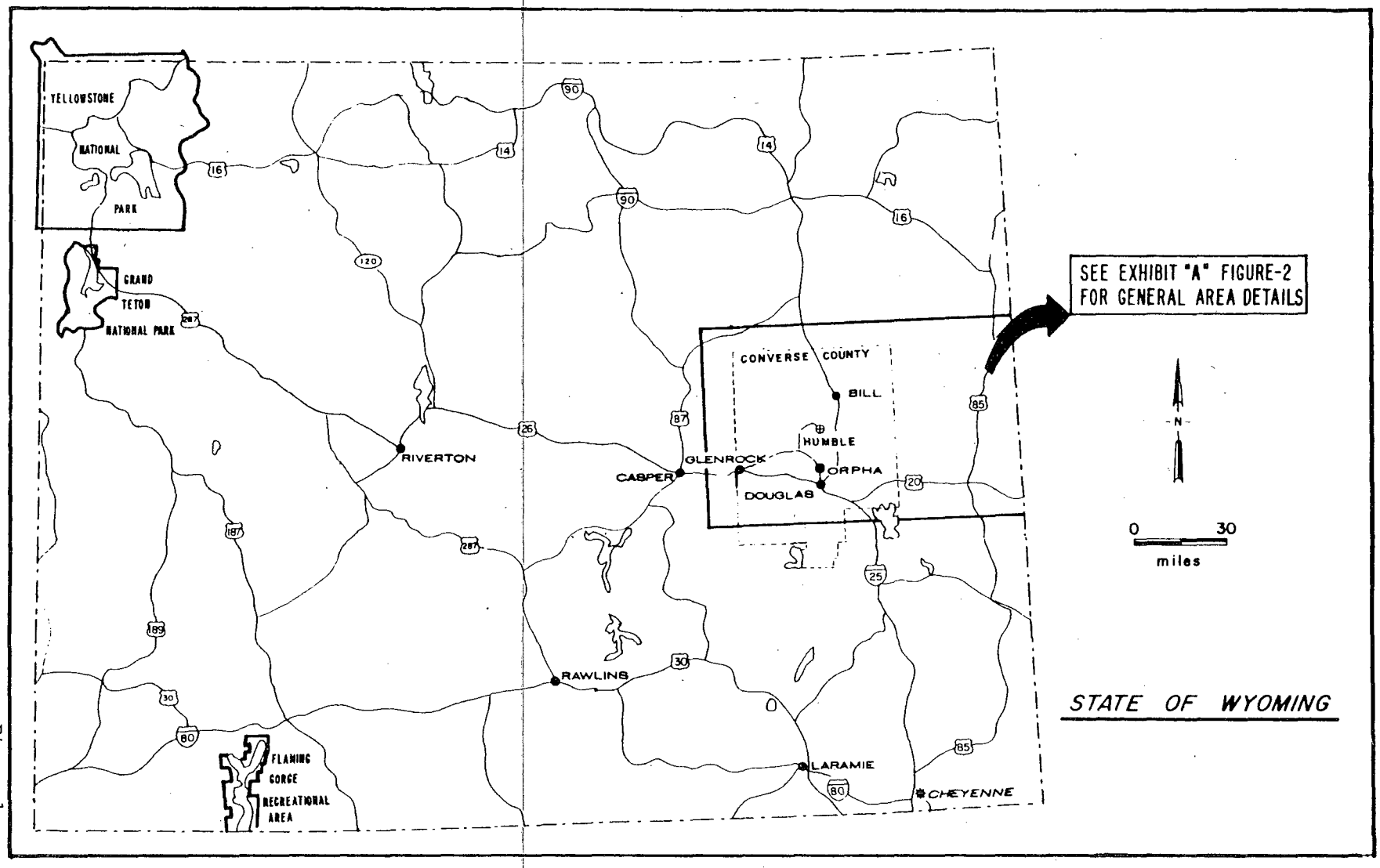

YELLOWSTONE
NATIONAL
PARK
GRAND
TETON
NATIONAL PARK
FLAMING
GORGE
RECREATIONAL
AREA
RIVERTON
CASPER
GLENROCK
HUMBLE
BILL
ORPHA
DOUGLAS
CONVERSE COUNTY
RAWLINS
LARAMIE
CHEYENNE
SEE EXHIBIT "A" FIGURE-2
FOR GENERAL AREA DETAILS
N
0
30
miles
STATE OF WYOMING

Figure 1

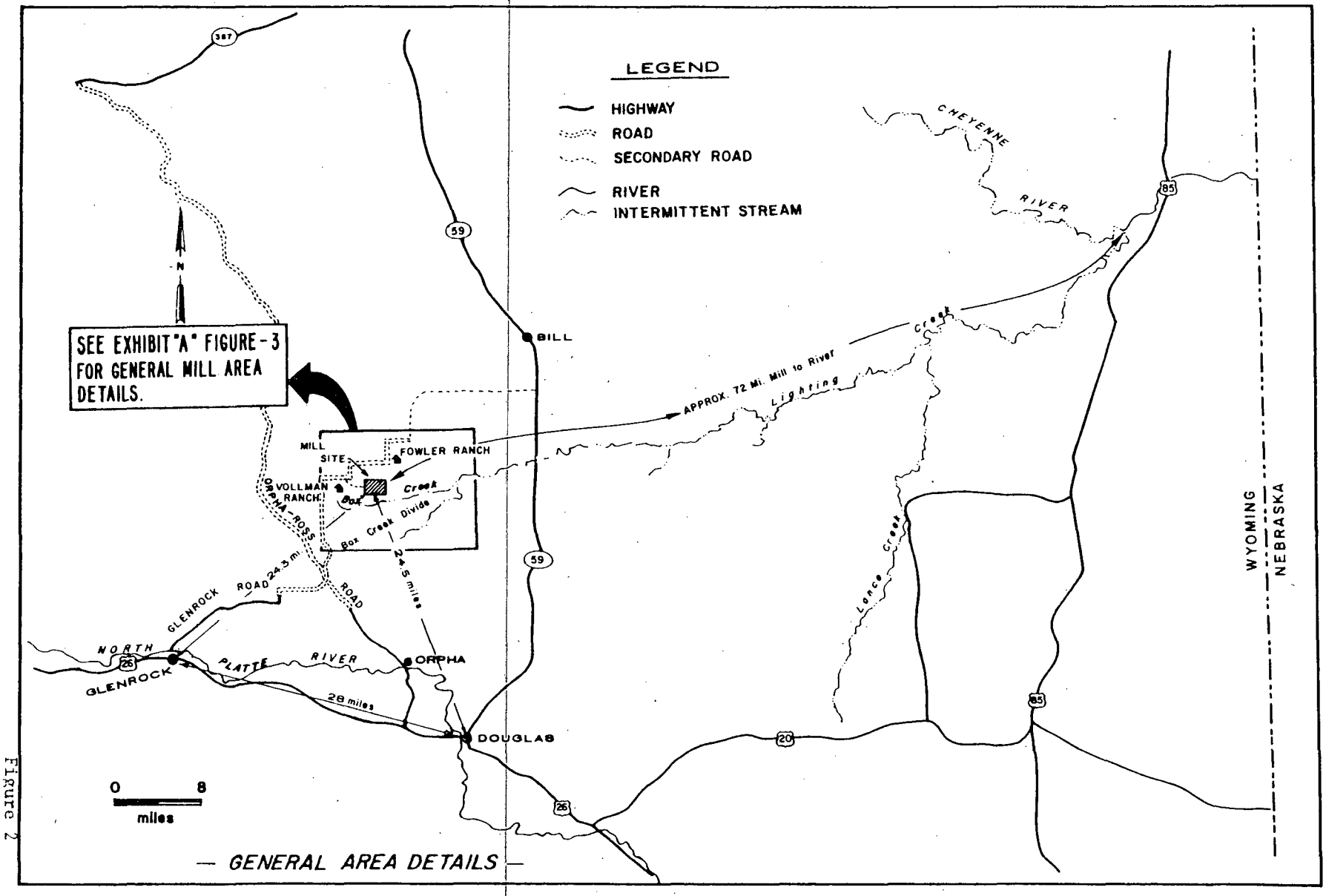
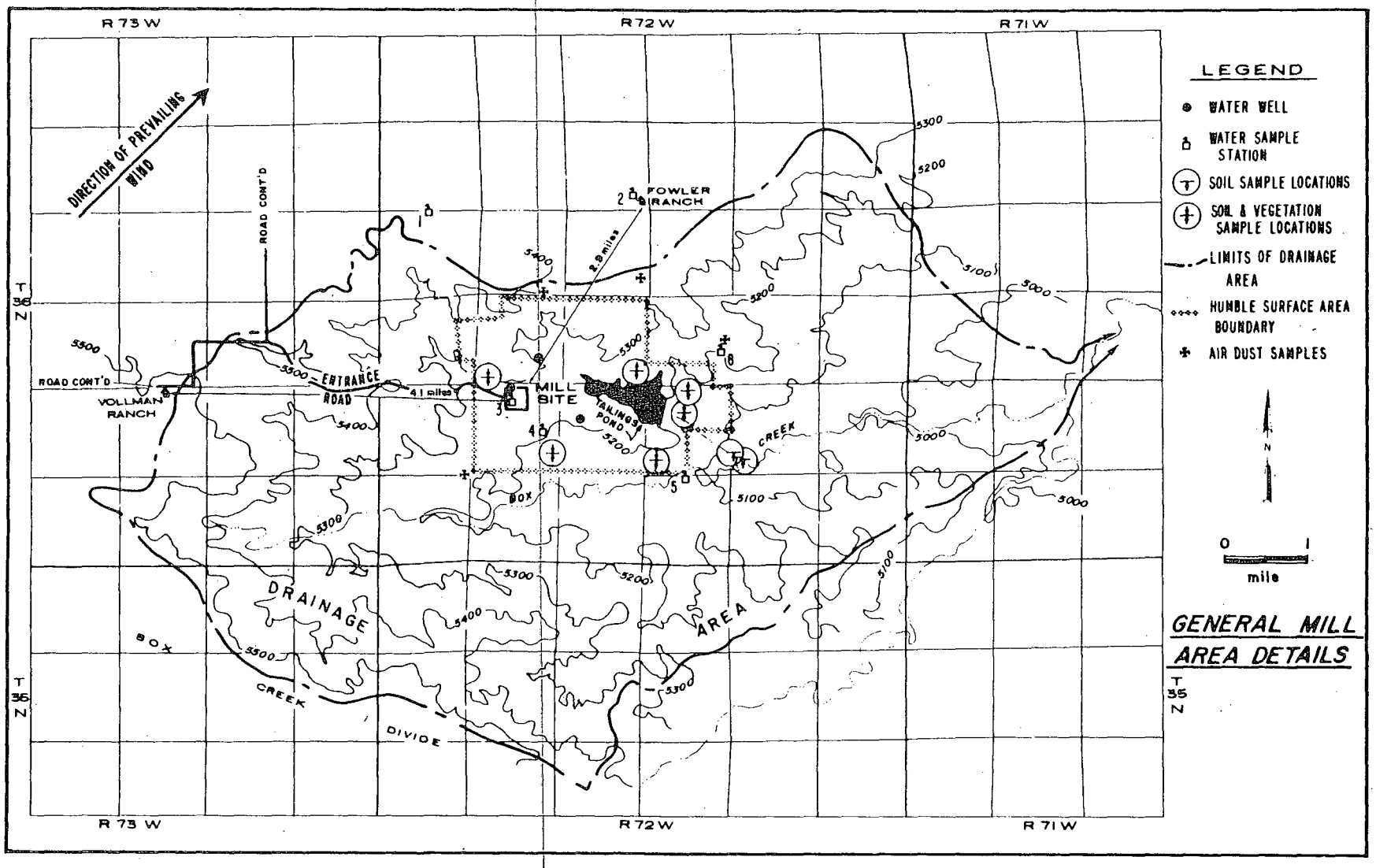

LEGEND
HIGHWAY
ROAD
SECONDARY ROAD
RIVER
INTERMITTENT STREAM
SEE EXHIBIT "A" FIGURE-3 FOR GENERAL MILL AREA DETAILS.
N
387
59
BILL
CHEYENNE
RIVER
85
APPROX. 72 Mi. Mill to River
Lighting
Creek
MILL
SITE
FOWLER RANCH
VOLLMAN RANCH
Box
Creek
Divide
ORPHA-ROSS
ROAD
Box Creek
24.5 mi.
24.5 miles
GLENROCK
ROAD
NORTH
PLATTE
RIVER
ORPHA
GLENROCK
26
28 miles
DOUGLAS
20
Lance Creek
WYOMING
NEBRASKA
0
8
miles
— GENERAL AREA DETAILS —

Figure 2



GENERAL MILL AREA DETAILS

Figure 3

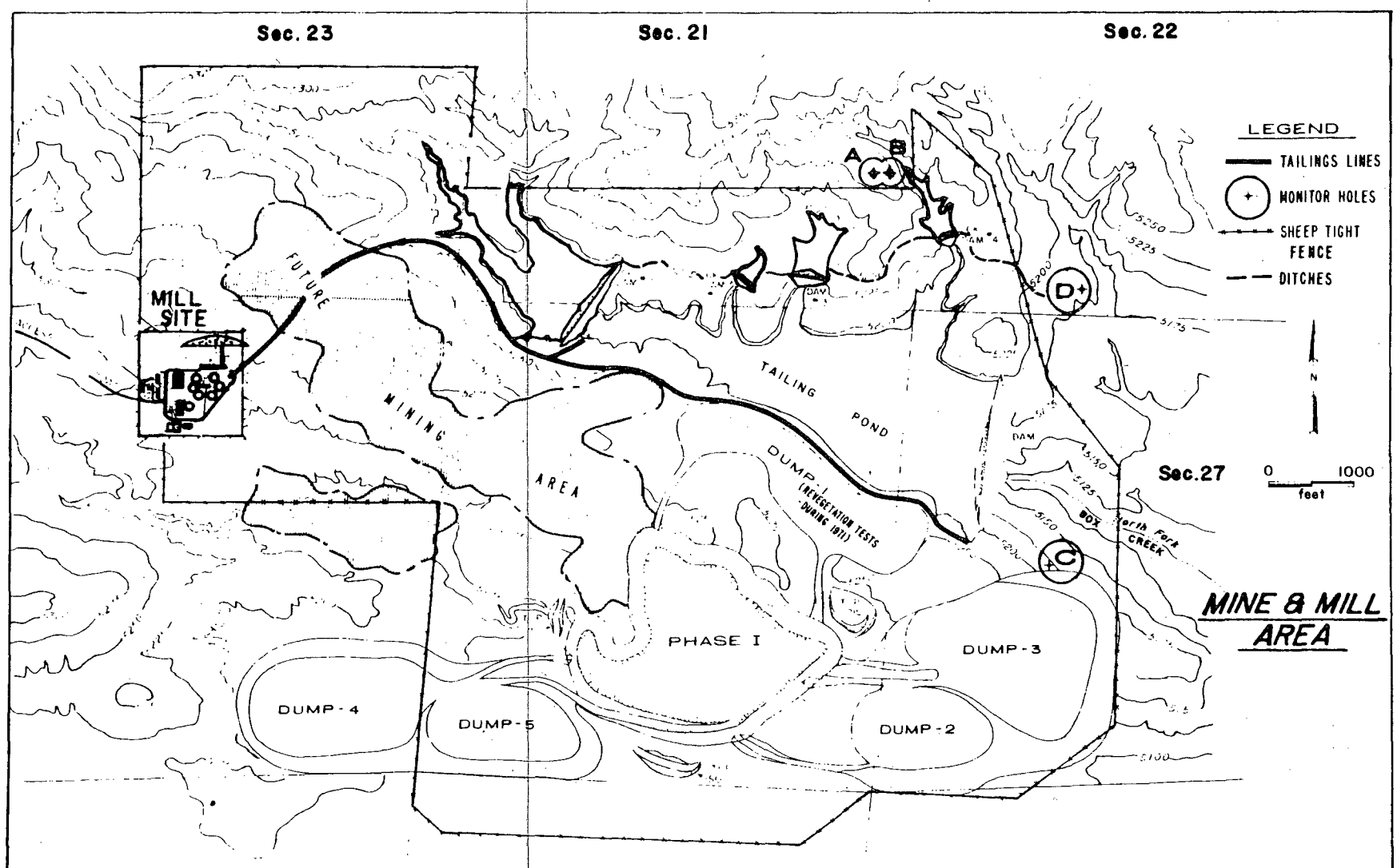

Sec. 23
Sec. 21
Sec. 22
Sec. 27
LEGEND
TAILINGS LINES
MONITOR HOLES
SHEEP TIGHT FENCE
DITCHES
N
0
1000
feet
MINE & MILL AREA
MILL SITE
FUTURE
MINING
AREA
TAILING
POND
DAM
DUMP 1 (REVEGETATION TESTS DURING 1971)
PHASE I
DUMP-3
DUMP-2
DUMP-4
DUMP-5
BOX
North Fork CREEK
A
B
C
D
5250
5225
5200
5175
5150
5125
5100

Figure 4

TABLE 2

POPULATION DATA

Actual Data	1970	Gain or (Loss) From 1960	% Gain or (Loss)
Casper	39,361	431	1.1
Converse County	5,938	(428)	(6.7)
Douglas	2,677	(145)	(5.1)
Glenrock	1,515	(69)	(4.4)
Converse County less Douglas and Glenrock	1,746	(214)	(10.9)
The Following are Estimates:			
Orpha	15		
Bill	1		
Vollman Ranch	2 (part time)		
Fowler Ranch	2 (part time)		

2. Land Use

Prior to the present activities undertaken by the applicant in the area, the only use of the land within a five mile radius of the site was sheep ranching and limited hunting. Several miles to the south of the site, limited farming activities are conducted on land irrigated by surface and ground water from the North Platte River drainage system. The production of oil and coal near Glenrock and natural gas near Shawnee east of Douglas constitutes other major utilization of land in the nearby vicinity of the site.

C. HISTORICAL SIGNIFICANCE & ARCHEOLOGICAL FINDS

The nearest historic landmark listed in the National Register of Historic Sites is Fort Fetterman about 15 miles south of the Highland site. The Glenrock Buffalo Jump, about two miles west of the Glenrock Interchange on I-25 is about 30 miles southwest of the Highland site. Neither landmark will be affected by the Highland uranium mill. A statement attesting to this fact has been offered by the Historian of the Wyoming Recreation Commission (Appendix C). Any historic or archeological finds will be protected by the applicant and the appropriate state office notified.

D. HYDROLOGY

1. Surface Waters

The local surface drainage area of the Highland site is about 30 square miles and is to the east of the site through the Box-Lightning-Lance Creek system into the Cheyenne River, a distance of about 70 miles. Because of the low precipitation in the area, the Box-Lightning-Lance Creek system does not constitute a continuously flowing system at any time during the year. The North Platte River, the only continuously flowing stream in the area, is 15 miles to the south of the site. Because of the local topography, surface drainage from the HUM does not reach the North Platte River.

2. Groundwater

Groundwater is present in the sand beds underlying the HUM and local area. Since there are no reliable sources of surface water at the HUM site, process and potable water will be obtained from subsurface deposits. The quality of the local subsurface water, which is potable, is shown in Table 3.

TABLE 3

Water Quality Data

Contaminate	Concentration
Uranium	1-100 parts per billion
Arsenic	<0.05 parts per million
Selenium	<0.02 parts per million
Ions	4.5-20 meq/liter
pH	6.2-8.0
Radium-226	4.2×10^{-10} µCi/ml
Thorium-230	9.9×10^{-8} µCi/ml

Water will be pumped from the mining area since the ore at the HUM is below the local water table. The applicant states that initially a water influx rate of approximately 900 gallons per minute was encountered, but since opening the first pit, the influx rate has declined to about 600 gallons per minute. A computer model[1] of the aquifer and mine system indicates that the rate of water influx will continue to decline and average about 450 gallons per minute for the lifetime of the mine. A settling pond has been constructed for the water pumped from the mine. The water is then pumped to the tailing reservoir. After the mill is fully operational approximately 500 gallons per minute will be utilized in the milling process. At this time the withdrawal from the pond will exceed the withdrawal from the mine. Mine drainage will be fully utilized in the mill and thus no discharge of mine water into the surface drainage system is anticipated.

Hydrological investigations (drilling, logging, and coring) indicate that the sandstone units penetrated by mining extend approximately 2 miles northeast of the mining area and outcrop in the stream bed of Box Creek over a range of 1 to 4 miles east of the mine. These same sandstone formations extend to a distance of approximately 5 miles to the northwest, west and southwest. The applicant states that the known minimum extent of the Highland aquifer has a volume equivalent to that of a cylinder of revolution having a radius of 10,000 feet, and an altitude of 120 feet in net sand thickness having a porosity of 0.3. The volume of water present in an aquifer of such dimensions would be 1.13×10^{10} cubic feet. The volume of water removed by the mining operation over the 14 year life of the mine, based on the average removal value of 450 gallons per minute, would be 4.43×10^{8} ft^3. Consequently the water removed from the aquifer by the mining operation would be approximately 3.9%. Pressure measurements of the wells in the Highland area indicate that the water in the sandstone formations penetrated by the mine is moving at a rate on the order of 20 to 30 feet per year in the updip direction causing a few springs to flow intermittently in the stream bed of Box Creek. It is believed that this natural recharge may have its origins in the Laramie Mountains to the southwest or from the Bighorn Mountains to the northwest. The drawdown of the water table at the mine walls is essentially complete and, therefore, the free water surface in the sands quickly rises with distance away from the pits. Computer simulations[1] show that the aquifer will remain fully water-saturated at the 10,000 foot radius during the entire mining life.

The quality of the underground water will be unaffected by the mining operation because underground water will always be flowing into the mine and no backflow of water from the mine into the sands will occur. Mine

[1]Applicant's response to agency comments on Draft Statement, August 1972.

water is collected in ditches and sumps in the mine and is not allowed to stand in the areas where mining equipment is operating. This water will be pumped to a storage pond for use in the milling operation. The water in the pond is monitored regularly as part of the environmental monitoring program. The quality of the water in the pond is essentially the same as that of water pumped from wells in the immediate area that are drilled to the sandstones penetrated by the mine. As the residence time for the water in the mine is to be transitory, deterioration of water quality, as a result of leaching of materials from exposed mining surfaces, should not be as great as if the water were allowed to stagnate in the mine before removal.

Ground water is present immediately beneath the tailing pond area. This water is not part of the normal water table as vertical communication is prevented by the tailing dam shale (see figures 6, 7, 8, 9). It has been reported that drill bores through this shale in the tailing pond area disclose dry sandstone layers immediately beneath the shale whether or not water was present above the shale.

E. GEOLOGY

The site is located at the eastern edge of a topographically high area known as Highland Flats. The outcrops of this area are composed of Tertiary rocks from the Wasatch formation. Underneath the Wasatch formation is the lower Fort Union Formation of the Paleocene Epoch (this formation is also present at the surface in some sections of the HUM area) which is estimated to be 2000 feet thick. It is characterized by sharp facies changes caused by channel sand deposits which have been incised into the finer grain clastics. Typically, it is a fine-grained, clay-rich sandstone and silty claystone. However, at HUM the host sandstones are fine-to-coarse grained and arkosic. No faulting has been detected on the surface or subsurface in the local area.

The applicant employed the services of a consulting engineering firm to study the geology of the area associated with the tailing embankment retention system. These studies reveal the following facts. The valley in which the tailing dam is located contains an intermittent stream known as the North Fork of Box Creek, a tributary of Box Creek. This stream flows with water only during periods of high rainfall or during periods of snowmelt in the spring, and drains a small area of about 1-square mile above the line of the dam. On the hillside the soils appear to be largely residual from the underlying rocks. A soil depth of 1 to 3 feet is the average at most locations except the valley bottoms. In the valley bottoms, considerable soil thickness has been built up by alluvial deposition. Near the axis of the tailing dam, the alluvial soils are about 10 feet deep in the stream bottom. These soils consist largely of brown,

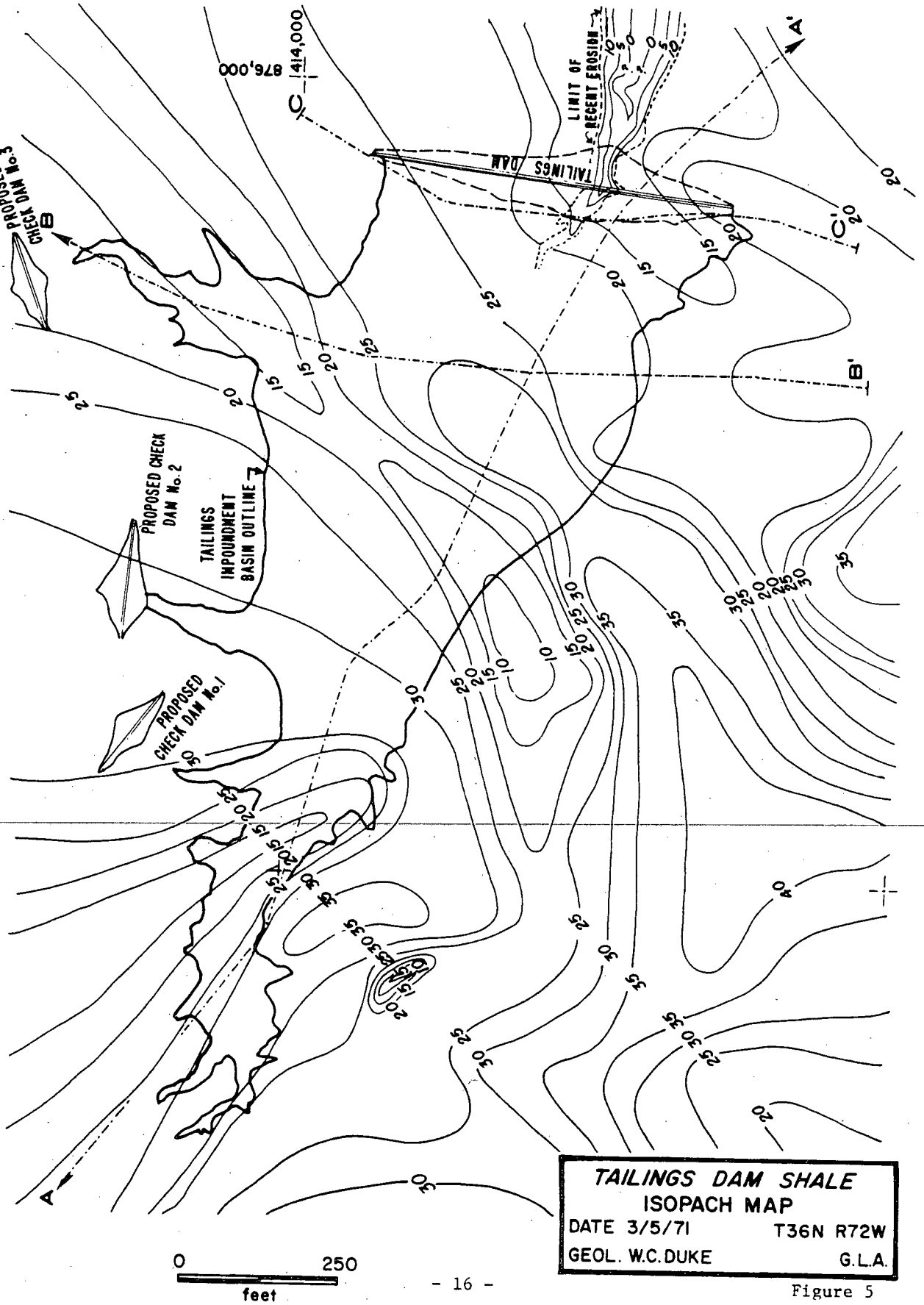

TAILINGS DAM SHALE
ISOPACH MAP
DATE 3/5/71
T36N R72W
GEOL. W.C. DUKE
G.L.A.
0
250
feet
PROPOSED CHECK DAM No. 1
PROPOSED CHECK DAM No. 2
PROPOSED CHECK DAM No. 3
TAILINGS IMPOUNDMENT BASIN OUTLINE
TAILINGS DAM
LIMIT OF RECENT EROSION
A
A'
B
B'
C
C'
414,000
876,000

Figure 5

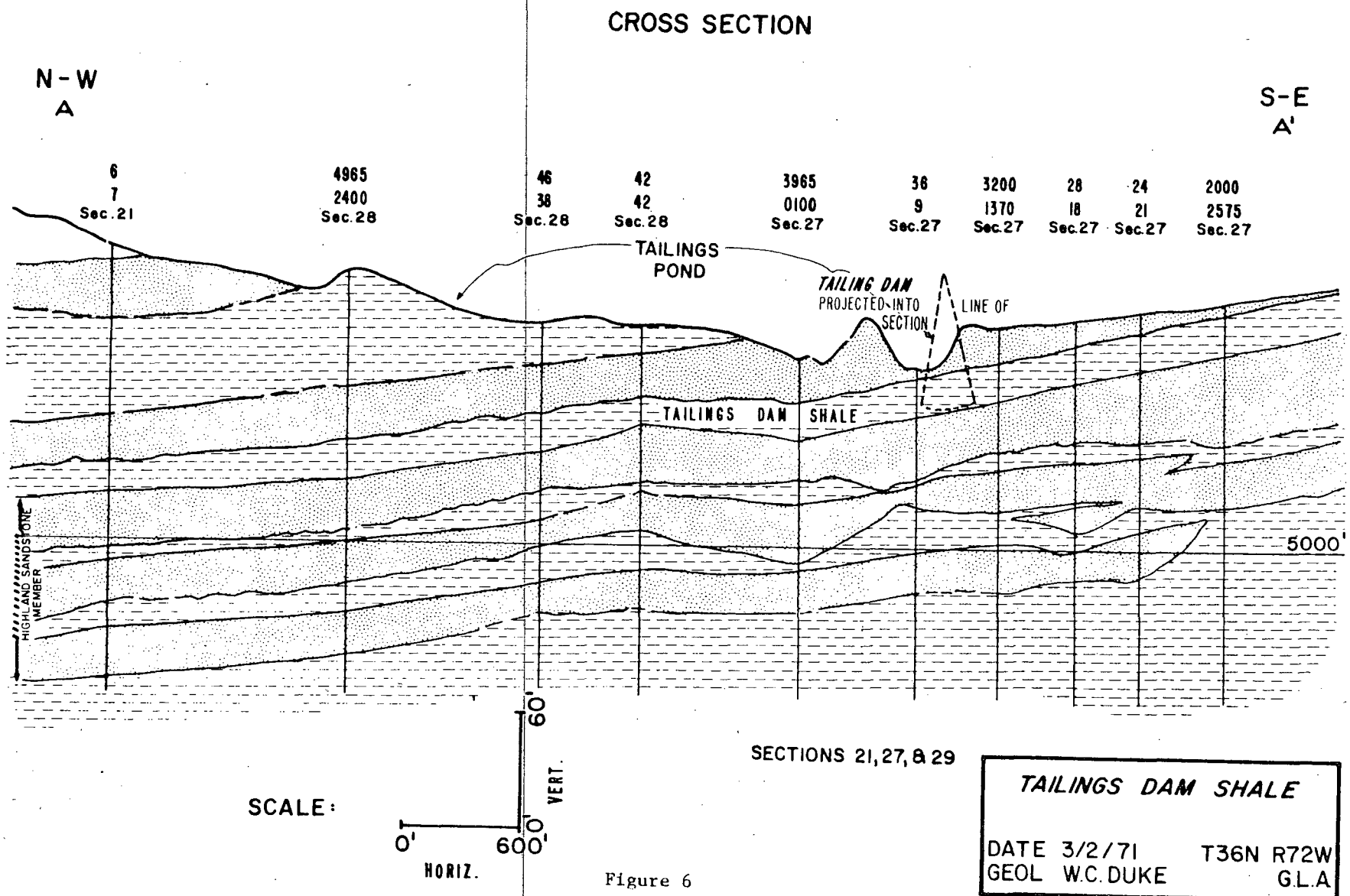

CROSS SECTION
N-W
A
S-E
A'
6
7
Sec.21
4965
2400
Sec.28
46
38
Sec.28
42
42
Sec.28
3965
0100
Sec.27
36
9
Sec.27
3200
1370
Sec.27
28
18
Sec.27
24
21
Sec.27
2000
2575
Sec.27
TAILINGS POND
TAILING DAM PROJECTED INTO SECTION
LINE OF
TAILINGS DAM SHALE
HIGHLAND SANDSTONE MEMBER
5000'
SCALE:
0'
600'
HORIZ.
60'
0'
VERT.
SECTIONS 21, 27, & 29
TAILINGS DAM SHALE
DATE 3/2/71
GEOL W.C. DUKE
T36N R72W
G.L.A.

Figure 6

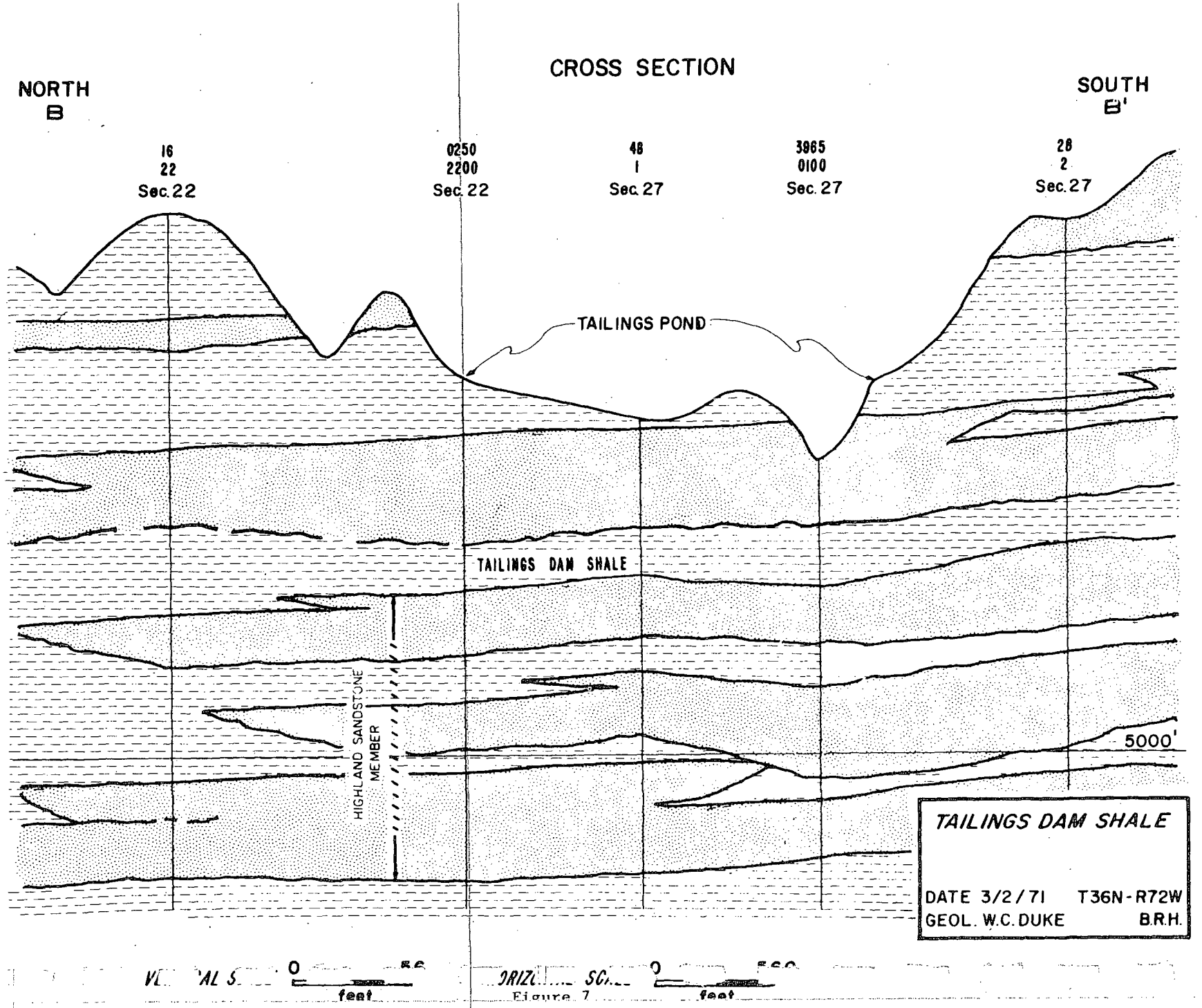
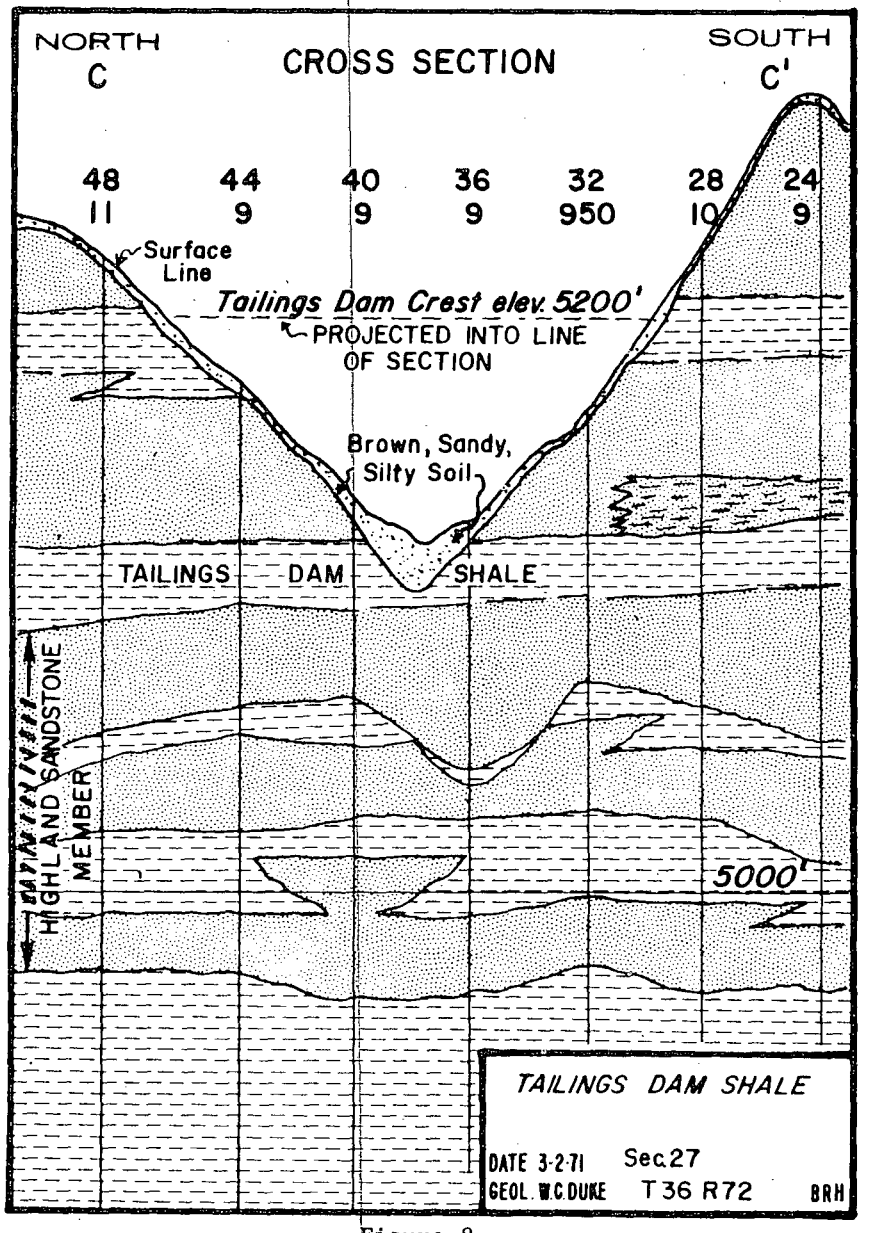

CROSS SECTION
NORTH
B
SOUTH
B'
16
22
Sec. 22
0250
2200
Sec. 22
48
1
Sec. 27
3965
0100
Sec. 27
28
2
Sec. 27
TAILINGS POND
TAILINGS DAM SHALE
HIGHLAND SANDSTONE MEMBER
5000'
TAILINGS DAM SHALE
DATE 3/2/71
T36N-R72W
GEOL. W.C. DUKE
B.R.H.
0
feet
0
feet

Figure 7


NORTH
C
CROSS SECTION
SOUTH
C'
48
11
44
9
40
9
36
9
32
950
28
10
24
9
Surface Line
Tailings Dam Crest elev. 5200'
PROJECTED INTO LINE OF SECTION
Brown, Sandy, Silty Soil
TAILINGS DAM SHALE
HIGHLAND SANDSTONE MEMBER
5000'
TAILINGS DAM SHALE
DATE 3-2-71
Sec. 27
GEOL. W.C. DUKE
T 36 R72
BRH

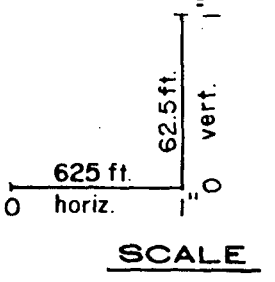

1"
62.5 ft.
vert.
0
625 ft.
0
horiz.
1"
SCALE

Figure 8

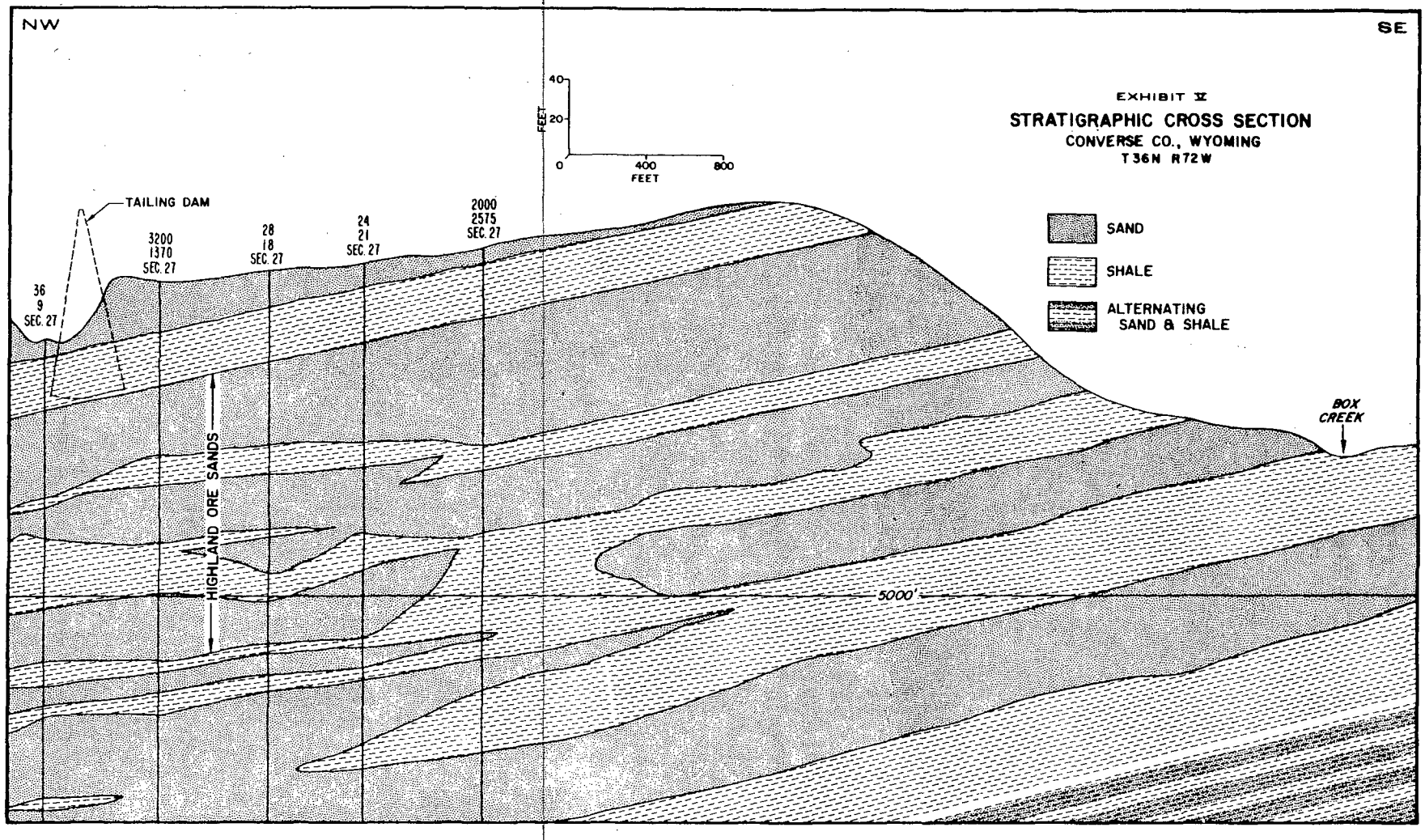

NW
SE
EXHIBIT V
STRATIGRAPHIC CROSS SECTION
CONVERSE CO., WYOMING
T36N R72W
SAND
SHALE
ALTERNATING SAND & SHALE
FEET
40
20
0
400
800
FEET
TAILING DAM
36
9
SEC. 27
3200
1370
SEC. 27
28
18
SEC. 27
24
21
SEC. 27
2000
2575
SEC. 27
HIGHLAND ORE SANDS
5000'
BOX CREEK

Figure 9

silty, fine sands and are similar to the residual soils found on the hillside. Adjacent to the stream channel on either side are located 10 to 20 foot high embankments composed of brown, fine, sandy silt.

Immediately beneath the surface soils, which vary from 1 foot to approximately 10 feet deep, across the site, are rocks of the Fort Union Formation. These rocks consist of poorly cemented, friable, and relatively unconsolidated sandstones, siltstones, and shales. The sandstones are generally medium to coarse grained, but occasionally 1 to 3 foot thick layers of well cemented, fine grained sandstones are encountered. Siltstone was only encountered in the borings located in the reservoir basin. The siltstone is moderately fractured, and some of the shales are slightly bentonitic.

The most consistent rock stratum encountered is reported to be located at an elevation of approximately 5,120 feet. This stratum is a shale and is referred to at the HUM as the "tailing dam shale." It outcrops in the valley floor at and below the location of the dam. This shale was reported to be in all borings that extended down to at least this elevation. The tailing dam shale member is continuous throughout the area except immediately below the dam in the creek bottom, see figures 5 through 9. In addition, the bedding is essentially horizontal dipping northward.

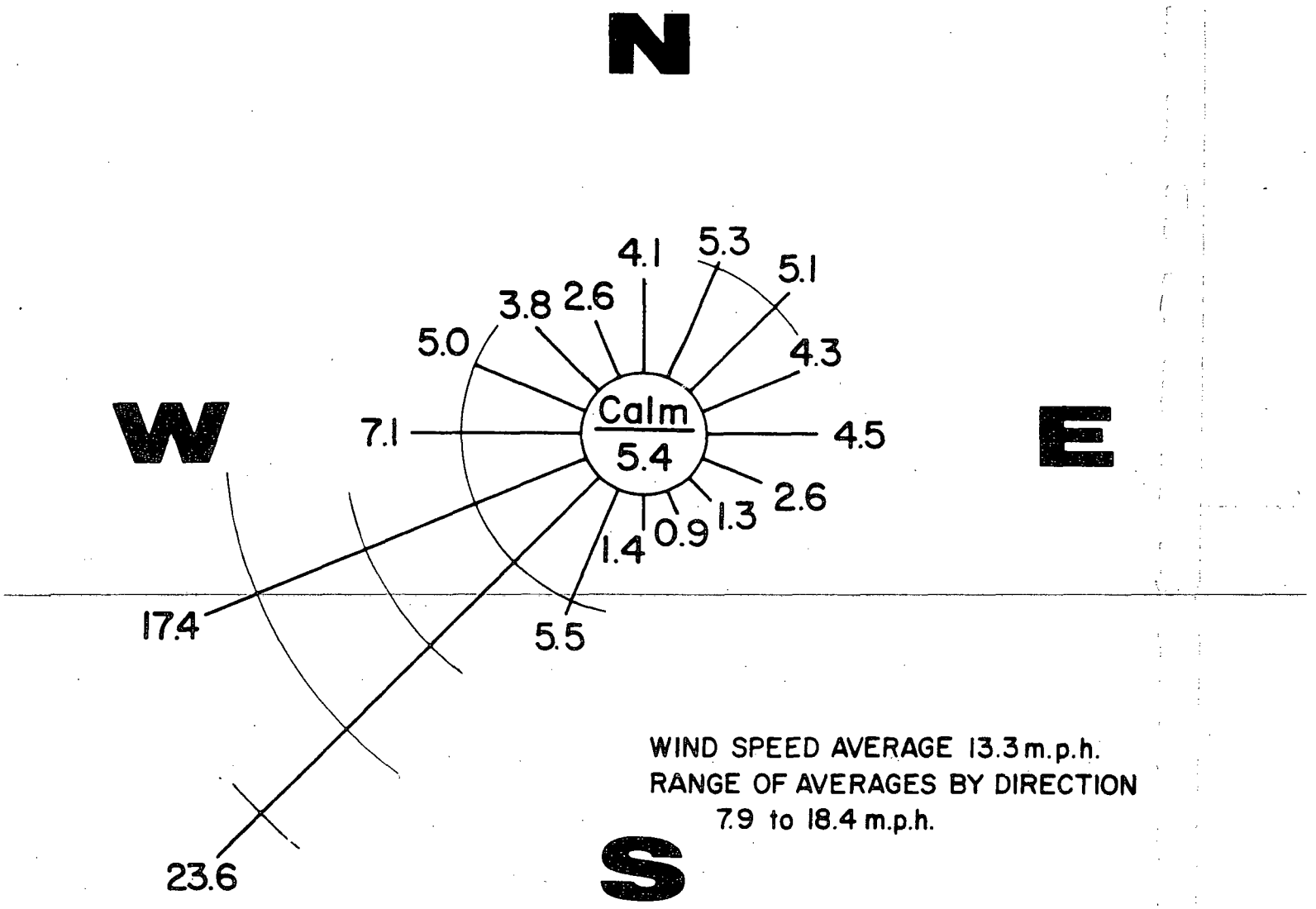
F. CLIMATE

There is no official weather station in the immediate vicinity of the HUM. However, the climate is probably not significantly different from that of the general area which is semi-arid and cool. Total precipitation averages about 12 inches per year with snowfall ranging between 35 and 65 inches per year. Average summer temperatures are in the high 60's and low 70's and average winter temperatures are in the mid 20's. Extreme temperatures may exceed 100° in the summer and -40° in the winter. The average growing season is approximately 120 days. The prevailing winds are estimated to be from the southwest about 24% of the time (see Figure 10) with an average wind speed of about 13-14 miles per hour. The weather stability category has been described as being typical of Class D. The average evaporation rate is about 50-60 inches per year.

G. ECOLOGY

A biota inventory of the HUM site was performed in the spring of 1972 by the Casper District of the Wyoming Game and Fish Commission. A copy of this report is attached as Appendix A. The United States Department of Agriculture Forest Service has advised that the Ferriginous Hawk frequents this area and has been proposed for classification as rare or endangered

Estimated Wind Rose For HIGHLAND MILL SITE (Actual Wind Rose For CASPER, WYOMING 1956-1960 Average of Hourly Observations)



ref. Climatography of the United States No. 82-48, Summary of Hourly Observations - Casper, Wyoming, (1963)

Figure 10

by the U.S. Bureau of Sports, Fisheries and Wildlife. The American peregrine falcon might also be found in this area and the trumpeter swan uses this area as a flyway and both are listed as rare species.

H. MINE AND MILL

1. The Mine

The ore body at the HUM site is thin, sinuous and located 100 to 450 feet below the ground surface. Mining will be conducted by the open-pit method which consists of overburden removal followed by removal of the ore. Topsoil is first removed and stored for future use during reclamation and restoration activities. Waste overburden, consisting mostly of poorly cemented sandstone and mudstone, is then broken and loosened with ripper-dozers. The broken material is loaded into scrapers using pusher-dozers. After the ore has been exposed, it will be removed using hydraulically controlled, diesel-powered shovels. The mining rate will be 1400 tons per shift, two shifts per day, five days per week.

The waste overburden (approximately one million cubic yards per month) will be initially stored in waste dumps (see dumps 1, 2, 3, 4, and 5 on Fig. 11) 2000 - 4000 feet away from the pit. These dumps are located away from water courses to minimize possible erosion. Also, the dumps are located to extend ridge lines of hills so that they blend naturally into the local topography rather than distract from it. After a dump contains the intended amount of waste, it will be covered with a layer of topsoil and planted with native grass.

During the life of the mining project approximately 600 acres of land (including 250 acres as waste dumps) and 120 million cubic yards of earth will be disturbed. The initial proposed mining area of about 160 acres is illustrated in Figure 11 as "Phase I" area. As mining progresses, the overburden will be used as backfill rather than being placed on dumps. Figure 12 depicts the anticipated final disposition of the local area upon termination of mining activities in 1984. The fence line, as shown in Figure 12, will be moved westward as use of the area is required. At the end of mining activities the fence will have been moved so as to enclose dump number 4, shown on Figures 11 and 12.

The ore at the HUM site is located beneath the local water table. This will necessitate lowering the local water level in order to operate the mine. The method for accomplishing this will be by the traditional method of allowing the water to drain into a sump via drainage ditches. From the pit, the water will then be pumped out of the mine to a settling pond for clarification. The water from the pond will be pumped to the tailing reservoir. After the mill is fully operational, mine drainage will be fully utilized in the mill.

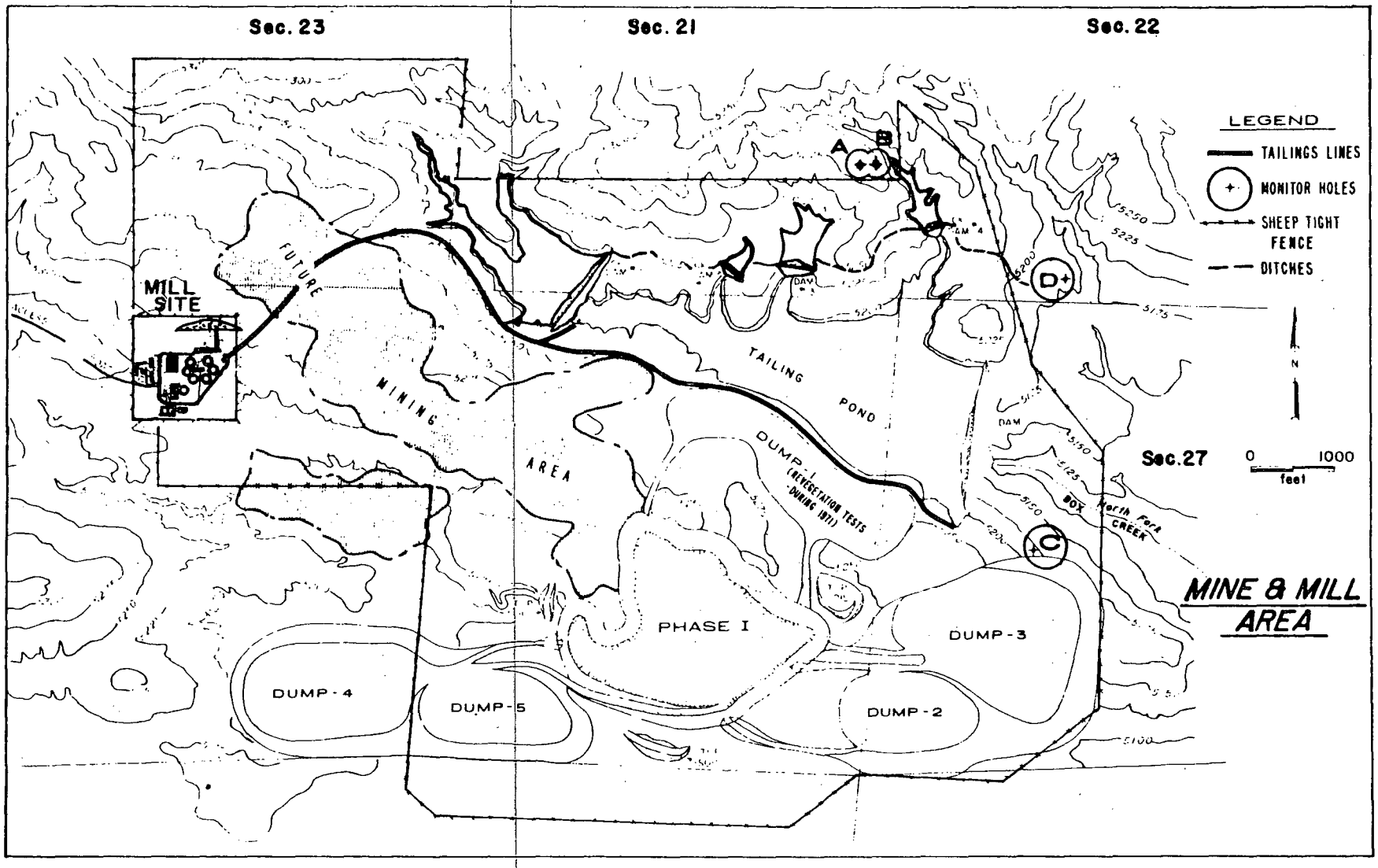

Sec. 23
Sec. 21
Sec. 22
Sec. 27
LEGEND
TAILINGS LINES
MONITOR HOLES
SHEEP TIGHT FENCE
DITCHES
N
0
1000
feet
MILL SITE
FUTURE
MINING
AREA
TAILING
POND
DUMP-1
(REVEGETATION TESTS DURING 1971)
PHASE I
DUMP-3
DUMP-2
DUMP-4
DUMP-5
DAM
BOX
North Fork
CREEK
A
B
C
D
MINE & MILL
AREA

Figure 11

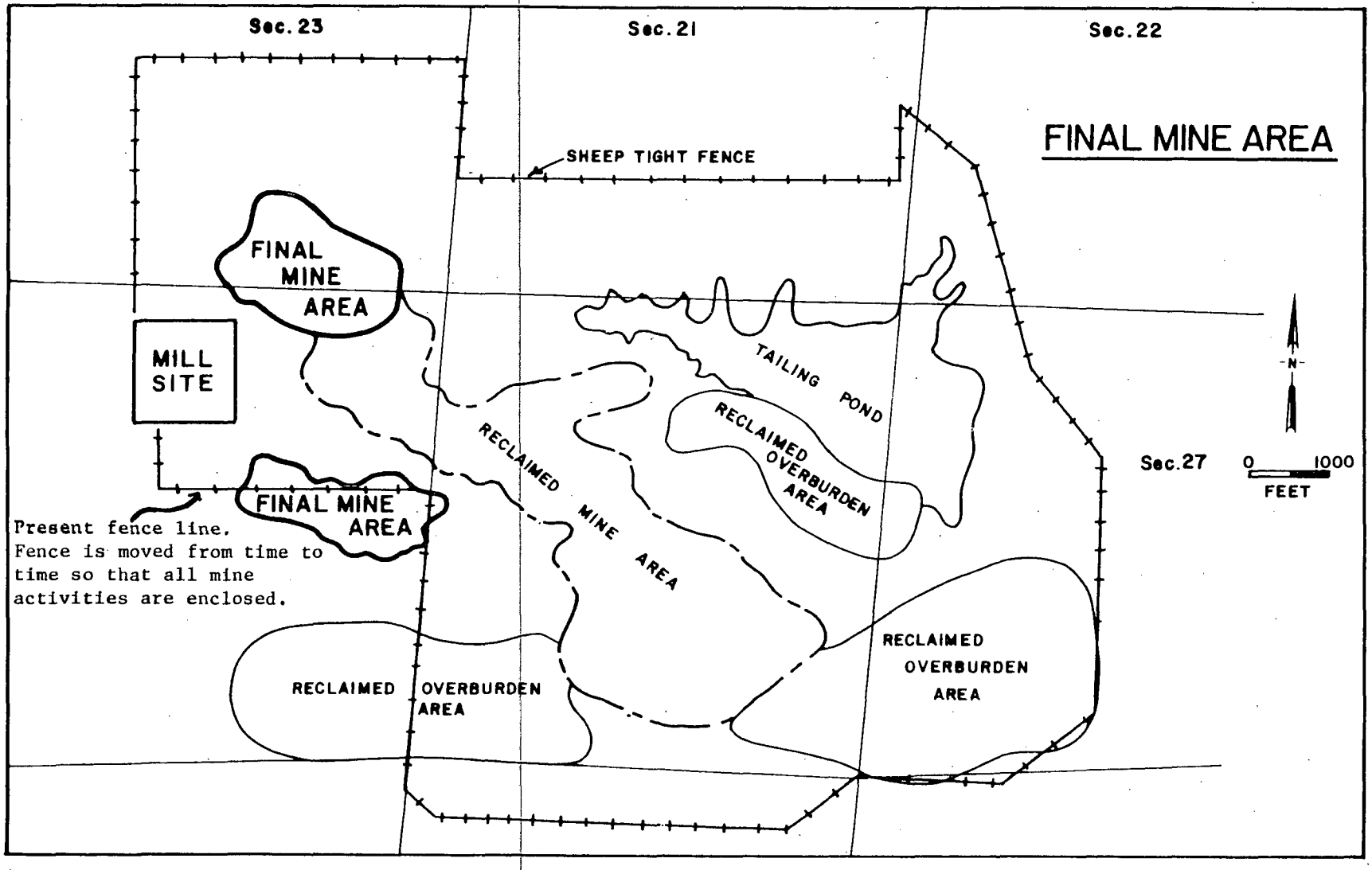

Sec. 23
Sec. 21
Sec. 22
FINAL MINE AREA
SHEEP TIGHT FENCE
FINAL MINE AREA
MILL SITE
FINAL MINE AREA
TAILING POND
RECLAIMED OVERBURDEN AREA
RECLAIMED MINE AREA
Sec. 27
N
0 1000
FEET
Present fence line. Fence is moved from time to time so that all mine activities are enclosed.
RECLAIMED OVERBURDEN AREA
RECLAIMED OVERBURDEN AREA

Figure 12

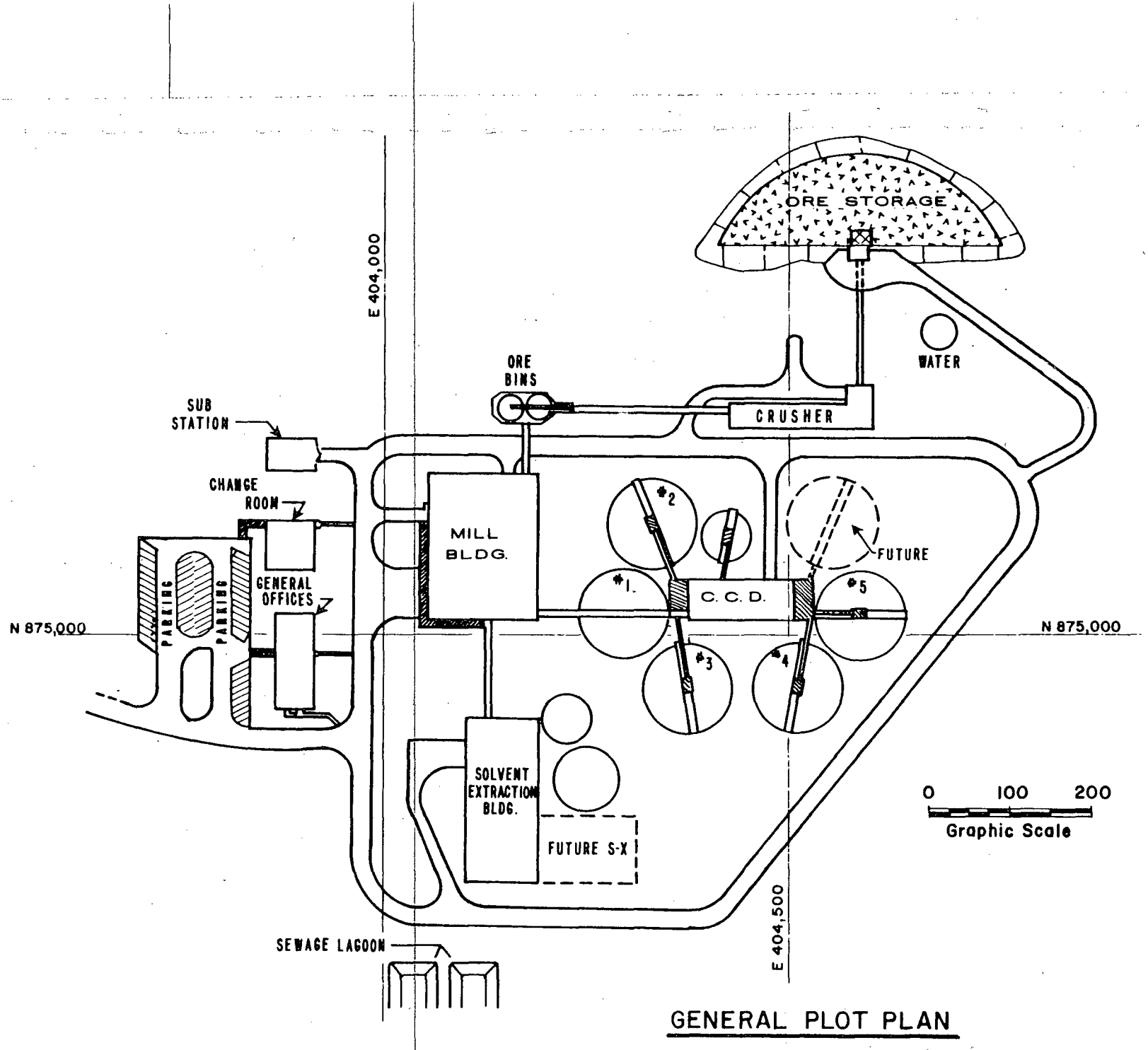
2. The Mill

The proposed facility is a conventional acid leach uranium ore processing plant. Its function is to extract naturally-occurring uranium from ores mined in the immediate vicinity of the plant. The nominal throughput of the mill is to be 2000 tons ore per day with an average uranium content of about 0.20 percent. Presently known reserves are estimated to be sufficient for plant operation through 1984 at the currently planned processing rate.

Major plant features include an ore storage and blending area; a crushing building; a mill building containing grinding equipment, leaching tanks, precipitation tanks and concentrate, drying and packaging equipment; a solvent extraction building; five thickeners located adjacent to the mill building; a tailings retention system; a sewage treatment system; and several ancillary buildings needed for offices, maintenance, etc. A general plot plan of the plant is shown in Figure 13. Although the location is remote, the slopes, silhouettes, and colors of the buildings were selected with appearance an important criterion. An artist's conception of the HUM is shown in Figure 14.

The proposed uranium extraction circuit utilizes the conventional acid-leach, solvent-extraction process for which the technology is well defined. Ores are initially blended and crushed to minus 3/4-inch size. This reduced ore is wet ground in a 9 x 15 foot wet rod mill to minus 28 mesh. The ground ore slurry is then pumped to leaching tanks where it is contacted with sulfuric acid and sodium chlorate oxidant. The leach tanks discharge to a five-stage countercurrent decantation (CCD) system where the uranium-depleted residues (tailings) are separated from the pregnant solution, washed counter-currently and pumped to the tailings retention system. The pregnant solution is clarified in sand filters before being pumped to the solvent extraction building. In the solvent extraction circuit the uranium is purified and concentrated by extracting it from the pregnant mill solution into an amine-kerosene organic solvent, then re-extracting from the organic into an aqueous ammonium sulfate strip solution. The phases are separated, the organic solvent is recycled, and the uranium is precipitated from the strip solution by ammonia addition. The resulting concentrate is centrifuged, dried at 600°F in a gas fired furnace, pulverized, and packaged for shipment. Figure 15 provides a simplified block diagram showing the major features of the milling operation.

During the life of the project, approximately 280 acres of land will be disturbed by the milling activities. The ore processing mill is located in the western portion of the fenced area and will occupy about 30 acres of land. The tailing or mill waste area is located in the eastern portion of the fenced area and over the life of the operation, will utilize approximately 250 acres of land.



GENERAL PLOT PLAN

Figure 13

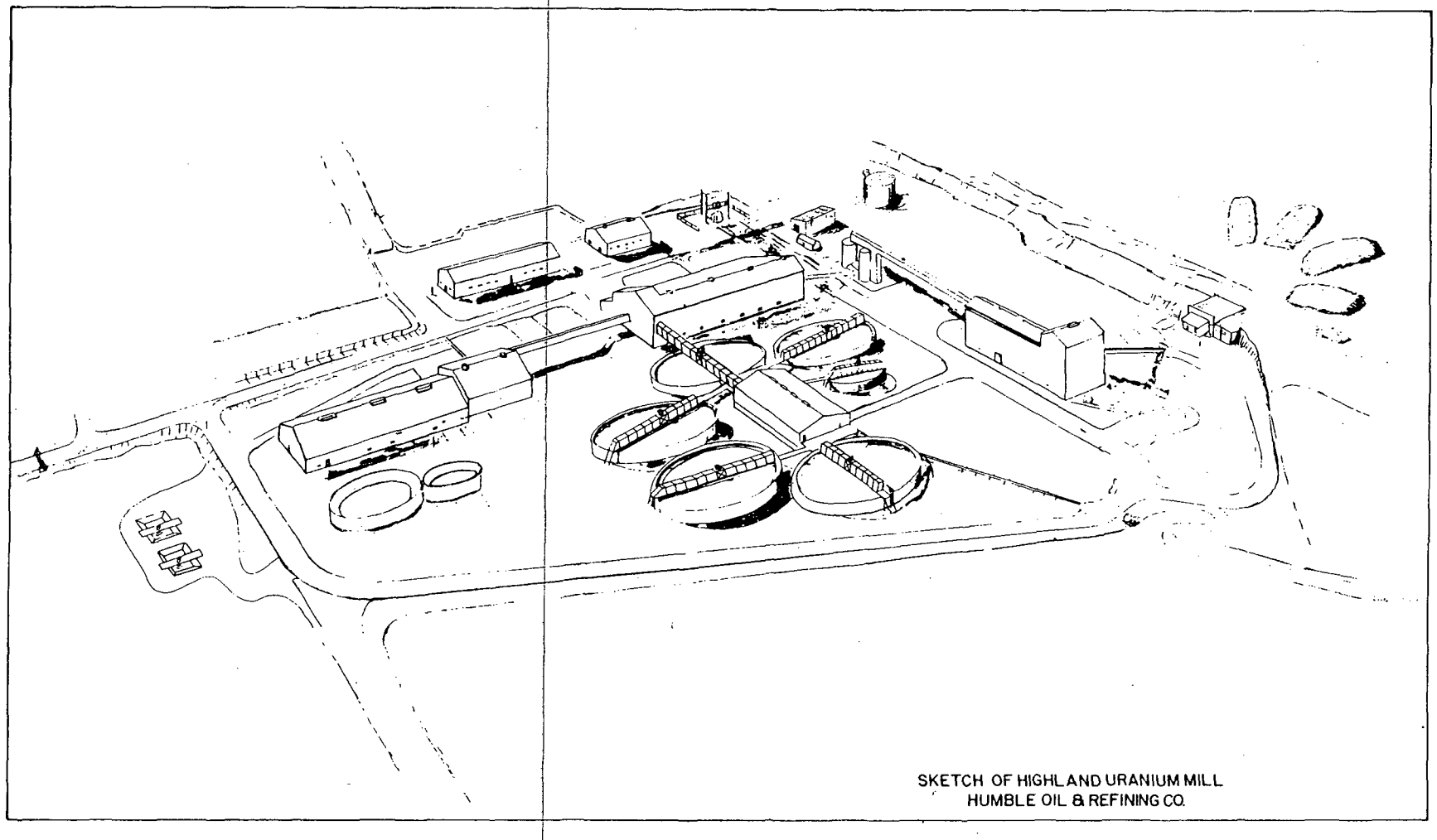


Figure 14

FLOW DIAGRAM
HUMBLE OIL AND REFINING CO. – HIGHLAND MILL

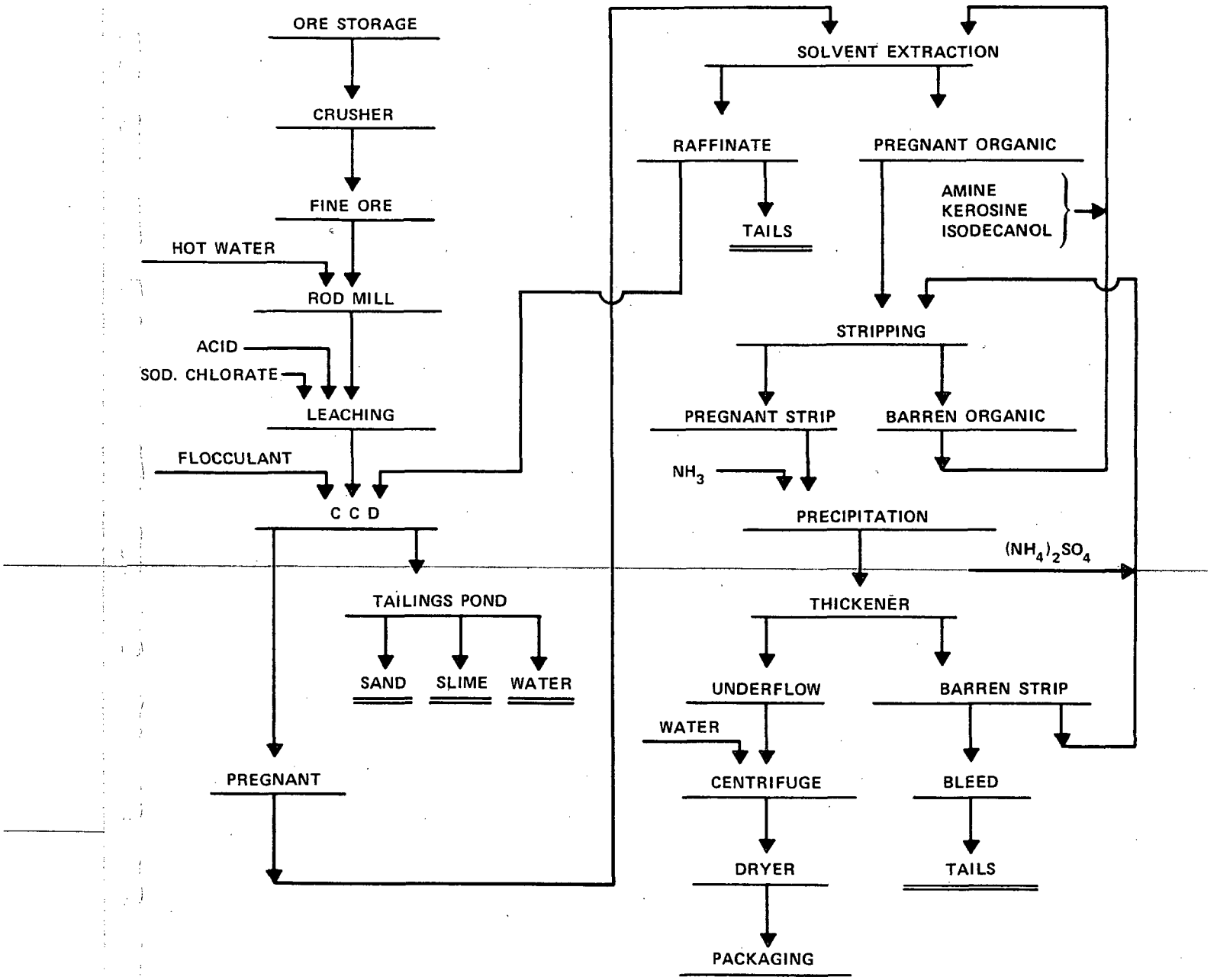


Figure 15

II. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

A. GENERAL

The radioactivity associated with uranium mining and milling results from natural uranium and its daughter products present in the ore. During the milling process, the radioisotope that is separated and concentrated is the natural uranium. The bulk of the radioactive uranium daughter products in the ore remain in the uranium-depleted pulp (tailings) that is pumped to the tailings retention system.

Since uranium milling deals only with low-level and dilute concentrations of radioactive materials, it is unlikely that operations or activities associated with the milling process could result in a serious radiation exposure to either mill employees or members of the general public even in the case of an accidental release of radioative materials. External radiation levels associated with uranium milling activities are low, rarely exceeding a few mR/hr, at surfaces of process vessels. Liquid and solid wastes from the milling operation contain low level concentrations of radioactive materials. However, the concentrations are greater than those specified for unrestricted areas. Therefore, these wastes are retained and stored in an earth-dam retention system on the HUM site. Concencrations of airborne radioactive materials escaping into the surrounding environs are not expected to be more than a few percent of limits specified in 10 CFR Part 20.

Even though the mine and plant are located in an isolated area, access to the mine, plant and tailings retention system will be controlled by the licensee. The entire mine and mill site is fenced, and there are mill employees on the HUM site at all times.

The Regulatory staff has evaluated the proposed criteria for the accumulation and storage of tailings and the applicant's methods and equipment for minimizing release of radioactive and non-radioactive materials to the surrounding environs of the proposed mine and mill and has concluded that the applicant's proposed criteria, methods and equipment are consistent with the state-of-the-art in uranium mining and milling technology. The Regulatory staff has also concluded, as outlined below, that the activities planned by the applicant are not expected to produce detectable biological effects on the biota in the vicinity of the proposed mill.

B. SOURCES OF WASTES AND EFFLUENTS

Solids, liquids and airborne wastes will be generated at the HUM site. The majority of solid wastes will be in the form of mine overburden and tailings (the finely ground waste sandstone and silica particles from

which the uranium has been chemically extracted). Other solid wastes will consist of refuse (such as chemical containers, cardboard, etc.) and sludges from the sanitary sewage system.

The applicant has selected a method of mine overburden storage which requires a larger area than if other techniques were utilized. However, by spreading the overburden over a larger area, approximately 250 acres at cessation of activities, the heights of the piles are reduced, thereby providing a storage site which blends the piles into the natural topography of the countryside. Reseeding has been started on these overburden piles.

Approximately 2000 tons per day of solid waste tailings (slurried in 3000 tons of waste milling solutions) will be generated at the HUM. These tailings will be stored in the tailings retention system and will contain the bulk of the radioactive uranium daughter products and other constituents originally in the ore. These wastes contain the unreacted portion of the sulfuric acid used as the leaching agent in the mill process and will initially have a pH of about 1.5 to 2. This solution will also contain calcium sulfate and other sulfates, as well as some silica as the primary dissolved solids; 0.01 grams of uranium per gallon of solution lost through the CCD system; traces of potassium chlorate, a polyacrylamide flocculant and amine-kerosine-decanol solvent; traces of other soluble metals which may be present in the ore; ~~radium-226 (3.5×10^{-7} μCi/ml); thorium-230 (2.2×10^{-5} μCi per ml):~~ and trace quantities of short lived radon daughter products.

The sewage treatment plant consists of two mechanically aerated lagoons which receive wastes from the mill sanitary sewer flow. The design and construction of the sewage lagoons were approved by the Wyoming Department of Health and Social Services. Any accumulation of sludge is to be removed from the basins and buried in the waste dumps in conformance with local, State and Federal regulations. The effluent from this system is to flow into the pond which serves as a collection basin for water pumped from the mine, which in turn is used as the primary source of process water for the mill.

All of the mill site construction waste has been buried under mine waste as it is produced. Refuse produced during operation of the mine and mill will be buried in a mine waste dump. No incineration of waste will occur except for a small amount of proprietary papers and maps.

The following items have been identified as the major sources of radioactive effluents: Crusher, Ore Bins, Yellow Cake Dryer, and tailings pond. The major radioactive effluents from each source have been identified as

uranium, thorium, radium, and radon from the Crusher and Ore Bins, uranium from the Yellow Cake Dryer, and radon from the tailings pond. Because of the moisture content of the ore, 10% to 15%, and sprinkling operations of site roads and ore piles when necessary, the contribution of airborne wastes from these sources to the atmosphere through wind erosion will be kept to a low level. The non-radioactive airborne contaminants are expected to be carbon dioxide, carbon monoxide, and nitrogen oxides from the natural gas fired boiler discharge and vaporized reagents, kerosine, amine and ammonia from the solvent extraction building vents. A contribution of silica through wind erosion at the site may be anticipated.

C. CONTROLS OF WASTES AND EFFLUENTS

An earth fill, clay core dam retention system, will serve as a collection and storage system for the liquid and solid process wastes generated in the milling circuit. It will permit the evaporation of most of the contained waste liquids and serve as a permanent receptacle for the residual solid tailings. The design of this system was based upon engineering studies by a consulting firm who studied the surface and subsurface characteristics of the area through surface and drill hole geology. The system was constructed by erecting an earth fill, clay core dam across a natural basin, see Figure 5 through 9 and 16 through 18 for details. Basically the dam is described by the applicant as consisting of an outer shell composed of compacted friable sandstone surrounding an impervious core, and an impervious cutoff constructed of compacted clayey weathered shale and compacted silt with topsoil and seed placed on the crest and downstream slope. After site preparation an impervious cutoff blanket was constructed in order to assure that the placement of the clay core would not disrupt the tailing dam shale in the area where thinning of the shale due to erosion had been noted. A five foot thick blanket of compacted clay and shale was placed over the area where the top of the tailings dam shale outcropped after the site preparation had been completed. This blanket is only placed beneath the core location and upstream for the purpose of assuring that no leaks exist through or under the dam. The core was laid down to serve as a continuation of the blanket and is made up of clay and shale laid down in 8 inch lifts with each lift compacted to 90% of its maximum dry density. The upstream side of the dam was constructed of compacted friable sandstone with the exception of the top 5 to 10 feet. This top section was built out of the same material and compacted in the same manner as the core. The main portion of the face was compacted to 95% of the maximum dry density. The downstream slope is constructed of friable sandstone material which was compacted to 95% of maximum dry density. The applicant has calculated the factors of safety for this dam by the Taylor slip circle method and has found them to be 2.04 for an earthquake coefficient of 0.00 and 1.65 for a 0.05 earthquake coefficient for the upstream face. Factors of

safety for the downstream slope were computed to be 1.9 for 0.00 earthquake coefficient and 1.6 for 0.05 earthquake coefficient. The initial dam is approximately 85 feet high, 1800 feet long, has a top width of 20 feet and will hold approximately 1,500,000 tons of solid tailings. At a later date the applicant proposes to raise the dam approximately 40 feet to hold about 11,000,000 tons of tailings with a minimum freeboard of 5 feet and enclosing an area of about 250 acres. The Department of the Army, South Pacific Division, Corps of Engineers has raised a question concerning the proposed methods used to raise dams. The Commission proposes to resolve the question with the Corps of Engineers before authorizing the applicant to raise the dam. Subsequent licensing actions will be conditioned with respect to raising the dam.

Tailings will be initially discharged at the bottom of the toe of the upstream face of the dam. The discharge will always be onto existing tailings and not onto the embankment and will be discharged such that the mass is added to the face of the dam while forcing the ponded water upstream and away from the face. As additional tailings are discharged into the system, the larger sand particles will settle out of the slurry near the dam and the slimes and liquids will drain away from the face of the dam. Initially, 80 gallons per minute is expected to seep from the tailing basin walls and 20 gallons per minute through the face of the dam. These seepage rates were calculated by the applicant's consultant using field test data and Darcy's equation and are reported to represent the worst possible case of a reservoir full of water containing no solids. In actual practice, the tailings will contain fine solids which should become trapped in the interstitial spaces between the sandstone grains thereby causing a decrease in permeability and rate of seepage. Seepage from the tailing reservoir is expected to be confined principally to the tailing dam sand unit immediately above the tailing dam shale member. The tailing dam sand unit, overlying the tailing dam shale, is only partially saturated with water. The water levels observed in the borings to obtain engineering data for the design of the tailings dam indicated that the water present in the sand overlying the tailing dam shale generally follows the surface contours. No natural water flow pattern in this member can be determined, other than the natural flow under the influence of gravity from structurally high areas toward lower ones. Monitor wells, described in Section II.E, have been located to monitor for seepage. It is the opinion of the engineering consultants that it is doubtful that the seepage rate will ever reach 100 gallons per minute, and that seepage will eventually diminish to about 1 to 10 gallons per minute over a period of 2-1/4 years[1,2] because of the sealing effect

[1]Reporting of Tailings Dam Study, Highland Uranium Mine near Casper, Wyoming, Dames & Moore, October 28, 1970.

[2]Consultation Tailings Disposal System Highland Uranium Mine, Converse County, Wyoming, Dames & Moore, August 10, 1972.

between the sandstone grains. The tailings dam shale which underlies the reservoir is stated to be impermeable, as determined by an engineering study and field test data submitted in support of the operating license application. Consequently, little seepage should occur out of the bottom of the tailings impoundment. Seepage that will occur through the dam is expected to evaporate as soon as it reaches the surface. Estimates of the amounts of uranium, thorium, and radium which would seep through the basin have been calculated based on the initial rate of 80 gallons per minute and the estimated concentrations of these isotopes in the tailings. The results are shown in Table 4.

TABLE 4

Estimates of quantities of isotopes seeping through the basin initially and at 2-1/4 years

Radionuclide	Initial Seepage per day	Seepage per day after 2-1/4 years
Uranium	350 μCi	35 μCi to 3.5 μCi
Thorium-230	9600 μCi	960 μCi to 96 μCi
Radium-226	150 μCi	15 μCi to 1.5 μCi

No appreciable migration of waste chemicals or radioactive materials from the seepage from the retention system is expected because of the ability of most soils to remove contaminants from liquids through ion-exchange, adsorption and chemical reactions. Laboratory measurements by the applicant of the consumption of acid by highland sandstone show that one ton of the highland sandstone consumes about 60 pounds of sulfuric acid. Based on this information they have calculated that one ton of sandstone (17 cubic feet) would neutralize the residual sulfuric acid in about 15,000 gallons of tailings solution with a pH of 2. At an initial seepage rate of 80 gallons per minute, approximately 5 cubic yards of sandstone would neutralize the daily leakage. Included in this calculation was an estimate that under the unlikely condition that seepage continued at the rate of 80 gallons per minute the acid content of the seepage over the entire life of the project would be depleted by the first 18 inches of sandstone under the tailings impoundment.

The ability of the clay particles to attract ions, especially positive ions, to their surfaces is one of the most important properties which results in the binding of soil elements in ionic form. It is estimated that a cubic foot of loam will have total a surface area of approximately 500,000 ft^2. Consequently, the opportunities for ion exchange are very

extensive. The ability of a given soil to adsorb cations is usually stated in terms of its exchange capacity and expressed as milliequivalents of cations required to neutralize the negative charge of 100 g of soil at pH 7. Montmorillonite clay has a cation-exchange capacity of approximately 100 milliequivalents per 100 grams as compared to Kaolin-type soils (less than 100 milliequivalents per 100 grams). There are 18,000 grams of montmorillonite clay per ton of ore, based on an assumed value of one-half of the 4% clay is montmorillonite, and, therefore, an adsorptive capacity of 18,000 milliequivalents or 18 equivalent weights per ton of ore. Consequently one ton of ore has the theoretical capability of adsorbing 2,000 grams of radium. Another factor to be considered is that the precipitation-evaporation ratio is very low (i.e., on the order of 0.3). Therefore, leaching into the soil should also be low. Consequently, the probability of radioactive materials reaching a viable aquifer as a result of seepage from the reservoir should be low because of the apparent capacity of the immediate soils to store substantial amounts of nuclides and of the minimal leaching action expected because of the attendant climate. The applicant has designed a tailing dam monitoring program to detect seepage. The monitoring program is described in Section II.E of this statement.

The applicant's consultant for the tailings dam reservoir has concluded, through engineering studies of the tailings disposal reservoir, that a catch basin to collect and return seepage effluent from the reservoir is not necessary. However, Exxon has stated that a seepage collection basin would be installed below the dam if seepage occurred in such an amount that it could be effectively measured, collected and pumped. Their approach to this problem would be as follows. The quality of the water in the monitor well E (see section on environmental monitoring for details on monitor wells) will be observed. If the water samples at this monitor well are near to MPC for discharge to an unrestricted area, a trench will be dug across the bottom of the creek to allow a measurement of the flow. If the flow is great enough to be pumped effectively, the trench will be enlarged to form a collection basin and the water will be pumped back behind the dam. The tailing dam will be inspected one time on each operating shift for signs of erosion resulting from a malfunction of the filling operation.

The natural watershed area above the tailings basin is 640 acres. The normal water level within the initial 125 acre tailings area will be maintained at least 5 feet below the crest of the dam. In addition diversion dams above the tailing pond will divert 340 acres of runoff from the total 640 acres, thus producing a drainage area of 300 acres. The soil conservation service has estimated that the two-year rainfall within six hours is 1.3 inches and the fifty-year rainfall is 2.8 inches. An extrapolation of this data indicates a 100 year rain of 3.1 inches in 6 hours or a 1000-year rain in 6 hours of 4.2 inches. With an initial holding area of 125 acres and a 5 foot minimum freeboard, the reservoir

has a capacity to accommodate more than a 4.2 inch rainfall for a 6 hour period.[1] Based on these figures, it appears improbable that there could be a failure of the retention system due to flooding.

The tailings retention system will be operated in such a manner so as to keep the tailings inundated with waste solution to minimize wind erosion of the tailings. If this proves unworkable, during operation the dust will be controlled by the installation of a sprinkler system, chemical stabilization, or covering of the tailings with topsoil.

The release of airborne particulate contaminants to the surrounding environs from the milling operations will be minimized by utilizing fan powered wet collection systems having efficiencies of 95% for some areas and 99.3% for the yellow cake barreling operations. Wyoming law specifies a minimum efficiency of 95% for dust. Dusts from ore crushing, which are expected to be minimal because of the high moisture content (10-15 percent) of the ore, are passed through a fan powered wet collection system with a 95% collection efficiency. Dust will be collected at all conveyor transfer and loading points and both screen-housings. The fine ore bins are equipped with a dust collector located at the platform level above the bins. The bin tops and the reversing conveyor which diverts the ore are enclosed to contain the dust generated. Dust collection points include the transfer from the incline to the reversing conveyor, the space under the decks at the top of the bin to collect the air displaced during bin filling, and the loading point of the feeders under the bins onto the rod mill feed conveyor. The roaster off gas with its entrained dust and yellow cake dust produced during the barreling operation are treated together in a wet dust-collector system having a design efficiency of 99.3% in removing solids. The discharge slurry from the dust collectors is recycled through the milling process for recovery of the solids. The leach tank fume system will not include a collection system but will be vented directly to the atmosphere since only minor quantities of acid fumes and radon are expected to be released in the wet leach process. Also, the average velocity of air movement across the tops of the leach tanks will only be about one-half foot per second. This results in only minor quantities of fumes being removed.[2] The air from the solvent extraction building will not be cleaned or filtered since only a small amount of kerosine vapor is expected to escape from the building.[2]

The concentration of particulates in the effluents from the crusher dust collector system and ore bin system is expected to be less than 0.26 grains of dust per cubic foot, and less than 0.005 grains per cubic foot for the yellow cake dryer discharge. This will result in concentrations of dust less than the EPA primary and secondary air quality standards for particulates at the boundary in the direction of the prevailing wind.

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[1]See Section II.G.
[2]See table 8 of this document.

D. ENVIRONMENTAL CONCENTRATIONS AND EFFECT ON LOCAL BIOTA

1. Radiological

The quantity of airborne radioactive effluents released into the unrestricted environs will be maintained below the limits specified in 10 CFR Part 20 and at levels consistent with the present state-of-the-art in uranium mining and milling technology.

The calculated quantities of each airborne radioactive effluent identified in Section B are tabulated in Table 5 below.

TABLE 5

Estimated Quantities of Radioactive Effluents Emitted from the Major Sources

Source	Effluent	Quantity in μCi/day
Crusher	Uranium-Natural	154
	Thorium-230	154
	Radium-226	154
	Radon-222	154
Ore Bins	Uranium-Natural	31
	Thorium-230	31
	Radium-226	31
	Radon-222	31
Yellow Cake Dryer	Uranium-Natural	254
Tailings Pond	Radon-222	7.4×10^5 to 1.2×10^6

Meterological data supplied by the applicant indicate that the prevailing wind direction at the mill is from the southwest throughout the year. The predominant wind speed for the direction is 8.2 meters per second, and the weather stability for the site has been described as Class D (neutral or average atmospheric dispersion conditions). To obtain a first approximation of the environmental concentrations of radioactive materials resulting from the sources identified in Table 5, estimates were made for points at which the maximum concentrations were expected to occur, concentrations from those sources which would contribute to a Dose Equivalent at the boundary in the direction of the prevailing wind, concentrations from those sources which would contribute to a Dose Equivalent at the Fowler Ranch, concentrations from those sources which would contribute to a Dose Equivalent at the boundary due East of the mill site when the wind is from the West, and concentrations from those sources that would contribute to a Dose Equivalent

at the boundary due West of the mill site when the wind is from the East. In performing the calculations, Class D weather stability was assumed in all cases. Additionally, wind frequency data and wind speeds were utilized for the directions of interest. The point where the maximum concentration is expected to occur for effluents from the stacks from the Crusher and Yellow Cake Dryer and Ore Bins is 1150 feet and 1840 feet respectively. These distances are well within the boundary of the mill and concentrations encountered at these points are all below the allowable restricted area MPC's. Estimates of airborne concentrations for the four locations considered to be of major impact are shown in Table 6. For a visual representation of these locations, see Figure 19.

TABLE 6

Estimates of Radioactive Concentrations

Location	Concentration U-Natural μCi/ml	Concentration Th-230 μCi/ml	Concentration Ra-226 μCi/ml	Concentration Rn-222 μCi/ml
Boundary, 8450 feet Northeast of mill	2.15×10^{-15}	8.84×10^{-16}	8.84×10^{-16}	8.84×10^{-16}
Fowler Ranch 14,800 feet Northeast of mill	7.63×10^{-16}	3.23×10^{-16}	3.23×10^{-16}	3.23×10^{-16}
Boundary, 2600 feet west of mill	3.35×10^{-15}	1.36×10^{-15}	1.36×10^{-15}	2.60×10^{-12}
Boundary, 12,700 feet East of mill	4.25×10^{-16}	1.75×10^{-16}	1.75×10^{-16}	1.1×10^{-11}
Unrestricted Area MPC	2×10^{-12}	8×10^{-14}	2×10^{-12}	3×10^{-9}

Estimates of the potential Dose Equivalents for an individual located continuously for a year at one of the areas specified in Table 6 have been calculated and are shown in Table 7.

TABLE 7

Range of Estimates of Dose Equivalents in mrem/year for Points of Interest[1]

Location	Kidney	Bone	Lung
Boundary, 8450 feet Northeast of mill	0.1 to 1.0	9.1 to 33.2	0 to 2.1
Fowler Ranch, 14,800 feet Northeast of mill	0 to 0.4	3.4 to 12.1	0 to 0.8
Boundary, 2600 feet West of mill	0.1 to 1.7	15.0 to 51.0	3.5 to 5.8
Boundary, 12,700 feet East of mill	0 to 0.2	1.8 to 6.6	0.4 to 2.4

In comparison, whole body exposures from natural background radiation for the State of Wyoming are estimated to average about 150 millirems per year. Dose Equivalent estimates were not calculated for the Volman Ranch because it is located at a greater distance than the Fowler Ranch and in a direction in which the wind frequency is less than in the direction of the Fowler Ranch, i.e., 4.5% for the Volman Ranch versus 23.6% for the Fowler Ranch. Consequently, the concentrations and dose equivalents would be expected to be less than those calculated for the Fowler Ranch. Both of these ranches are reported to be occupied for only about 60% of the year.

The area surrounding the mine and mill is uncultivated and used only for grazing by a small number of sheep and wildlife. Though the tailing reservoir is not an ideal body of water for migratory waterfowl to feed or drink from, it is anticipated that waterfowl may land on the pond because it is located near the central fly-way between Canada and the United States. It is believed that the waterfowl would only use the pond as a resting place because the pH of the water is of such a value that food plants will not develop or survive. Experiments on the gustation

[1]Because of the remoteness of the site and the low population density of 0 to 0.04 persons around the mine and mill, it is not anticipated that Dose Equivalents shown in the table will be experienced.

properties in several species of avian suggest that gustatory stimuli probably are present in birds which provide them with a rejection threshold which influences their choice of drinking water. These experiments suggest that migratory birds would not normally drink the sour tasting tailing pond water, but rather would land there only for resting purposes, then move on to water which is more palatable to their taste. Should the tailing pond attract migratory waterfowl or other animals, the applicant will request the assistance of the Wyoming Game and Fish Commission to resolve the problem. There are no other aquatic bodies near the mill which could contribute to the transport of radionuclides to the food chain. Consequently, biological uptake of radionuclides and subsequent entry into the food chain from the aquatic system should be of little consequence. Exposures from uptake through the food chain are expected to be negligible in view of the small quantities of effluents released and the fact that the surrounding area is uncultivated and used only for grazing by a small number of sheep and wildlife. The applicant's environmental sampling program should provide data which will serve as an indicator of the possible entry of radionuclides into the food chain from soil to man.

2. Non-Radiological

Considering the air cleaning and ventilation equipment installed by the applicant to control effluents, the methods of release and amounts of material involved, it is not expected that quantities of non-radioactive materials being released to the environment will exceed those values listed in Table 8. Buildup in the environment is not expected in view of the chemical and physical characteristics of the contaminants and the quantities involved. Therefore, such release of non-radioactive materials is not expected to have a significant impact on the environment. Furthermore, the applicant will conduct an environmental monitoring program for non-radioactive contaminants.

TABLE 8

Estimates of Annual Emissions of Particulate and Non-Radioactive Effluents Emitted from the Major Sources

Source	Pollutant	Quantity
Crusher and Ore Bin Dust Collectors	Dust	2.6×10^5 lbs/year
Yellow Cake Dust Collector	Dust	842 lbs/year
Leach Tank Vents	SO_2	285 lbs/year
S-X Building Vents	Kerosine	365 lbs/year
Boilers	Solids	1750 lbs/year
	SO_2	175 lbs/year
	NO_2	35000 lbs/year
	Hydrocarbons	7000 lbs/year
	Organic Acids	10500 lbs/year
	Aldehydes	1752 lbs/year
	NH_3	3500 lbs/year

The applicant is required to maintain the concentrations of non-radioactive effluents at levels consistent with the present state-of-the-art in milling technology and may not exceed the standards established by the State of Wyoming as listed in Table 9.

TABLE 9

Wyoming Air Effluent Standards

Pollutant	Concentration	Sample
SO_2	0.02 ppm	Maximum annual average
Sulfuric acid fumes	4 micrograms/M^3	Allowable maximum annual average
Oxides of Nitrogen	0.05 ppm	Annual arithmetic mean
Others	Specified by EPA	Specified by EPA

Based upon the yearly emission rates of chemical effluents, concentrations of SO_2, NO_2 and NH_3 on the order of 0.0013 ppm for SO_2, 0.056 ppm for NO_2 and 0.015 ppm for NH_3 may be anticipated to occur downwind at ground level within the restricted area.

One of the essential functions of stomata is to regulate evaporation. Therefore, it follows that moisture stress in the leaves due to dry climates will cause stomatal closure. Plants in an arid environment may be more resistant to the SO_2 than plants and vegetation common to areas of high humidity and low evaporation rates. Furthermore, the translocation of SO_2 from leaves of vegetation is less effective than uptake through the root system.

Studies have been conducted that show that sulfuric acid aerosol is only toxic to vegetation under special circumstances. It has been postulated that the small droplets do not wet the leaf surfaces or diffuse through the stomata into the interior of the leaf.

Concentrations of NO_2 on the order of 25 ppm have been identified as causing blades of grain plants and needle tips of conifers to assume a bright yellow color.

A variety of plants have been exposed to high concentrations of ammonia gas (8.3 ppm) in which slight or no injury occured. Concentrations of 16.6 ppm were necessary before the plants showed slight injuries.

The concentrations of SO_2 from the milling operation would be below the sensitivity concentration for numerous plants, i.e., 0.1 to 1 ppm. Injury to vegetation caused by emission of SO_2, NO_2 and NH_3 is not expected because concentrations of these products are expected to be less than that which will cause injury to vegetation. The effect of the above mentioned effluents on animals grazing or foraging the area should be of no consequence since cattle have been known to graze on vegetation that suffered 25 percent damage to its leaves by exposure to SO_2 without suffering any ill effects.

In desert-like areas the annual net primary productivity has been estimated to be 400 k-cal/m^2/yr. Initially approximately 315 acres or 12.73×10^5 m^2 will be removed from the terrestrial energy productivity ecosystem. This will amount to approximately 50.92×10^{10} calories for the first year of operation. Prior to the end of the life of the mine

and mill approximately 880 acres or 35.6×10^5 m^2 of the terrestrial ecosystem will be removed from energy productivity, or 142.2×10^{10} calories for the last year of operation. After reclamation procedures are put into effect only 100 acres of the terrestrial ecosystem will be non-productive, i.e., 16.2×10^{10} calories for the year. However, this will be compensated for by the aquatic ecosystem which will be established, i.e., two 50 acre lakes.

The inventory of wildlife resources in the Highland Flats area of Converse County indicates that there has been an increase in the trend of the antelope population, so that at the present time the area is supporting an optimum population level for the current habitat conditions. The report also states that mule deer are present within the area but are less numerous than the antelope. The present density of the antelope is between 5 and 6 animals per square mile and less than two mule deer per square mile. Towards the end of the mine and mill operation approximately 880 acres, 1.4 square miles, will be disturbed. This means that on the order of 7 to 8 antelope and 2 mule deer may be shifted into adjacent surroundings. It is also believed that the home range of these animals would be greater than the area involved. Consequently, it is not anticipated that this shift of 9 to 10 animals will cause a substantial change in the carrying capacity of the adjacent areas. Other smaller wildlife species were described as occupying the general area. However, data on population density for these animals are not available. As a result, the impact on these smaller animals is difficult to assess. However, it is believed that the home range for these smaller animals is much less than that of the larger animals, e.g., cottontail rabbits approximately 14 acres, meadow mouse about 1/15 of an acre. Consequently, the impact on these smaller animals and birds is expected to be more than for the larger animals. After reclamation and restoration procedures are completed, all but 100 acres of the terrestrial ecosystem will be available for use by the wildlife. Depending upon the types of vegetation used in the reclamation effort, some species changes in the wildlife inventory may occur.

E. ENVIRONMENTAL MONITORING

1. Preoperational Monitoring Program

The applicant's Environmental Monitoring Program can be separated into three categories, i.e., Chemical, Radiological and Seepage. The pre-environmental sampling program consisted of the monthly sampling of 6 wells and water holes in the Highland area, see Figure 19 for locations. No base line air samples have been taken. However, the applicant has stated that control samples will be taken at the time dust samples are taken during the operational phase of the monitoring program. Base line

soil and vegetation samples have been taken from six locations indicated on Figure 19. Three soil samples have been taken across the tailing dam creek 500 feet above the intersection with Box Creek, and three soil samples across Box Creek 200 feet below the junction with the tailing dam creek. Water samples were analyzed for uranium, radium, thorium, arsenic, selenium, anions and cations and pH. Soil and vegetation samples were analyzed for uranium, radium-226, thorium-230 and lead-210.

2. Operational Monitoring Program

The airborne effluents from the various processes will be monitored for dust and those chemical pollutants required by the Wyoming standards, i.e., SO_2, NO_2, H_2SO_4 mists, CO_2, CO, NH_3 and saturated and unsaturated hydrocarbons. The initial samples are to be taken soon after startup and will continue on a monthly to a yearly basis depending upon the results obtained during the beginning of the program. The airborne radionuclide sampling program consists of sampling at four locations shown on Figure 19. These samples will be analyzed for dust content, uranium, thorium and radium. Sampling frequency is to be on a quarterly basis. In addition the effluents from the stacks will be monitored for thorium-230, radium-226, randon-222, and uranium.

The soil and vegetation program will consist of a spring and fall sampling of soils and of plant species grazed by the large indigenous animal species. These samples will be analyzed for uranium, thorium-230, radium-226 and lead-210. The spring and fall sampling is to continue until a seasonal variation pattern in radionuclide content is determined. Subsequent sampling will then be accomplished annually. Sampling sites will include areas predominantly downwind of the mine and mill as shown in Figure 19. Additional samples will be taken in the Box Creek Bed.

Samples of rodents captured in the mine and mill area each spring and fall will be analyzed for body content of uranium and radium-226.

The water monitoring program will consist of the monthly sampling of the 6 water wells and holes shown in Figure 19. These samples will be analyzed for uranium, radium-226 and thorium-230. In addition, ground water monitor wells have been drilled in 4 locations around the tailing storage basin, see Figure 20, to detect subsurface seepage of tailing solution. In addition to the four wells shown in Figure 20, an additional well has been completed between wells labeled C and D approximately in the center of the dry stream channel below the dam. One of the wells labeled A in Figure 20 will penetrate the continuous tailing dam shale and will sample the entire 50-foot thickness of the sandstone layers immediately below the shale. The other three wells, B, C and D in Figure 20, will be completed to the

top of the shale. Monitor well B is downdip from the pond and will detect downdip seepage. Monitor wells C, D and the new previously described well between C and D are completed in the sand above the Tailings Dam shale and will monitor leakage through the top of the dam and around the abutments if it should occur. The rationale for the placement of the wells is contained in the applicant's Environmental Report, dated July 1971. It states that the locations for wells C, D and the new well between C and D were selected because the sandstone beds above the shale constitute a possible route for seepage from the basin. Seepage into the sandstone layers results in the same condition as excess local recharge. The pressure gradient from the excess water will cause flow. If it goes downdip, it will be detected by well B. If the present downdip flow is the maximum amount which the sands can handle, extra water will be forced updip and be detected by well C or D. Figure 12, 13, 14 and 15 depict the geological formations lying under the tailings storage reservoir. More recent data supplied by the applicant state that the seepage from the tailing reservoir will be confined principally to the Tailing Dam sand unit immediately above the Tailing Dam Shale member. The Tailing Dam Shale is said to be essentially impermeable, and no seepage through this stratum into the Highland Sandstone is anticipated. The applicant further states that the Tailing Dam Sand unit overlying the Tailing Dam Shale is only partially saturated with water. The water levels observed in the borings made to obtain engineering data for the design of the tailings dam indicate that the water present in the sand overlying the Tailing Dam Shale generally follows the surface contours. No natural water flow pattern in this member can be determined, other than the natural flow under the influence of gravity from structurally high areas toward lower ones. Hence, the probability of detecting significant seepage into the sandstone walls of the reservoir is highest when the intercepting well is located downdip of the seepage. The Commission believes that from a geological viewpoint adequate precautions have been taken to minimize the effect of the operation on the ground water system and that any effects will be undetectable beyond the near environs of the operation.

The applicant's environmental monitoring program will be audited periodically by the Commission's Directorate of Regulatory Operations during routine inspections of the applicant's milling activities. The results of findings during such audits will form the basis for Regulatory action on a timely basis if corrective action or change should be required.

F. MISCELLANEOUS

The project to be conducted by the applicant at the Highland site will not cause any real conflict in land use. Only 3200 acres of land in a vast, relatively uninhabited area, will be restricted for about 12-14 years. The limited sheep ranching and hunting formerly conducted in the area will

be restricted on the site but the availability of vast nearby substitute lands will preclude any measureable impact on either activity. There will be a significant change in the local topography involving about 600 acres and 120 million cubic yards of earth from open-pit mining. The land will be reclaimed and restored so that it will be difficult to differentiate the mined area from other nearby areas.

Significant changes in population distributions associated with the project will not occur. About 170 jobs will be created in connection with mill and mine operations, most of which will be filled by local residents already living in Douglas, Glenrock and Casper. However, a small overall increase in the county population might occur.

A sewage treatment plant has been constructed at the HUM site to serve the needs of mining and milling employees. The system consists of two mechanically aerated lagoons and was designed for a population of 180 people. The design and construction of the system have been approved by the Wyoming Department of Health and Social Services. Each basin is lined with rubber to assure that untreated or partially treated water cannot seep into the ground. Any accumulation of sludge will be removed from the basins and buried in the waste dumps. The treated effluent from the system will flow into a pond which serves as a collection basin for mill process water pumped from the mine. The only release from this pond other than process water is into the tailings pond. Therefore, the proposed sewage treatment system is not expected to produce any environmental effects.

Even though the mill is located in an isolated area, the mill process buildings have been designed to be as aesthetically pleasing as possible. Figure 14 shows an artist's concept of the plant buildings as they will essentially appear when construction is completed. Aesthetically, the mining activity will create an adverse impact until such time as the site has been reclaimed.

Exxon's entrance road was designed and constructed to state secondary highway specifications. As the development of the mine continues, various site roads will be constructed. The site roads will provide access for the mining oprations and are to be constructed and maintained to minimize dusting and the effects of water erosion. At the present time there are approximately four miles of these roads. Approximately two miles are semipermanent wide dirt-surface roads, which are maintained by regular sprinkling and grading, and two miles of less permanent mine roads from the pit to the overburden storage areas. Though these less permanent roads change frequently in length and direction, they are maintained by grading and watering and designed to produce minimal erosional effects. As soon as practicable after their use is ended, the roads will

be blended into the local topography and replanted with native grasses. The design criteria for the roads call for a minimum number and size of cuts and fills, thereby reducing the potential for soil erosion and amount of reclamation when the use of the road has terminated.

Noise pollution associated with the mine and mill will include noticeable but faint sounds of mining equipment. On those occasions when the calcified layers in the mine resist ripping, blasting will be required. However, this is only expected to be an occasional operation. Engines on mining and milling equipment are muffled to reduce noise levels. The hammer mill, screens, and rod mill will produce noise which is discernible on the site near the mill building, but not noticeable offsite. Noise levels are now being measured in the mine, and noise dosimeters are being used to evaluate exposure of equipment operators. Noise levels in the mill will be surveyed after milling operation commences.

G. UNPLANNED AND NONROUTINE EVENTS

We have considered potential accidents associated with the mill which could disperse radioactive materials, and the environmental impact associated with the accident. The accidents considered are a tailings dam failure, a fire in the solvent extraction building and a transportation accident involving the shipment of the uranium product.

There are three potential types of accidents which could occur in connection with the tailings dam. Two of these are related to natural phenomena, i.e., failure due to flooding and failure due to an earthquake. Failure to a far lesser degree could also result from an equipment malfunction (such as the rupturing of a tailings distribution line) or operating mistake. Failure due to an earthquake is extremely remote since the site is in the Zone One seismic risk category. This zone is defined as "minor damage." This damage would not be sufficiently severe to cause failure of the system based on the engineering assessment of the structural integrity of the dam. Failure by flooding is also extremely remote in view of the semi-arid climate of the area, the limited drainage area above the system and a required 5-foot minimum freeboard to be maintained during use of the system by the applicant. Of the 640 acre watershed, approximately 340 acres of runoff is controlled or prevented from reaching the tailing pond reservoir by use of 3 check dams. If all the check dams were to fail simultaneously and allow the runoff from 640 acres to drain into the tailing reservoir, the capacity of the reservoir is such that it would be able to contain the accumulation of water resulting from a 9.6 inch rainfall. The highest rate of rainfall on record by NOAA since 1896 for Casper and vicinity is 3 inches in 24 hours. An operating error or equipment malfunction could occur but the entire system will be inspected daily by the applicant,

thereby minimizing the possibility of this type of occurrence. Should an accident occur, the stored solids will be transported down the local drainage system for a relatively short distance and be deposited in accordance with the laws of sedimentation. Liquids will also flow down the drainage system an undertermined distance until they are lost by seepage and evaporation. However, the quantity of liquids stored at any one time in the system would be too small for waste liquids of significant quantities to reach flowing streams. Should such an accident occur, the affected drainage system would be surveyed and all waste solids and contaminated soils would be removed and buried or returned to the tailings system. Thus, the residual environmental impact, if any, would be small.

The solvent extraction (S-X) building, where about 60,000 gallons of kerosene containing about 600 lbs of uranium as U_3O_8 is used in the refining process, represents the greatest potential in the plant for a prominent fire. Special precautions to reduce the possibility of a fire include the prohibition of smoking or open fires in the S-X building, issuance of special instructions to personnel concerning fire safety and permitting maintenance in the building only after a permit is issued by a supervisor. In the event of a fire in the S-X building, all mixers and pumps will be de-energized to prevent the advance of the organic and the possible spread of the fire. In addition a water-flooding system has been installed which will displace the kerosene through an overflow system. The system will be trapped to prevent fire propagation in either direction. Ultimately, the organic will be collected in an open basin outside of the S-X building which will remove most of the fuel from the fire. By applying the meteorological information used for the calculation of concentrations of radionuclides and assuming that the heat of combustion will cause a plume, the point at which the maximum concentration of uranium is expected to occur is approximately 1150 to 1840 feet depending upon the height of the plume. If it is assumed that the total 600 lbs of U_3O_8 is available for release over a five hour period, concentration on the order of 6.8×10^{-11} μCi/ml to 1.7×10^{-10} μCi/ml, i.e., approximately MPC (restricted area) to 2.4 times MPC (restricted area) may be expected at distances at which the maximum concentration is expected to occur. However, it is not believed that the total 600 pounds of U_3O_8 would be available for dispersion for the following reasons: (1) The building containing the S-X circuit is equipped with an automatic sprinkler system. (2) In the process of burning, a portion of the uranium would concentrate in the aqueous layer and be unavailable for dispersion. (3) Operational tests have been performed on the burning of radioactive process solvents which indicate that most of the solvents' radioactivity remains in the immobile residue that is left after the bulk of the solvent has oxidized and dispersed to the atmosphere. (4) Investigations, by AEC Regulatory Operations, of fires that have occurred in the

S-X portions of existing plants indicate that dispersion of uranium was negligible. If such a fire should occur, the surrounding area would be surveyed for uranium and contaminated soils removed and buried or recycled in the mill circuit, thereby minimizing any environmental impact.

The vehicle transporting uranium concentrates from the mill to a UF_6 refinery could be involved in an accident. The severity of an accident would determine the amount of concentrates (packaged in 55 gallon 18-gauge drums) which might be released. Inasmuch as the only radioactive material that would be involved is natural uranium which has a low radioactive specific activity (one curie per 6615 pounds) no severe radiological safety hazard is possible. The area surrounding the accident would be surveyed and any concentrate or contaminated soils removed and returned to the plant. It appears that any environmental impact from such an accident would be small.

H. RECLAMATION AND RESTORATION

When milling activities are terminated, the building and equipment will be removed from the site and the terrain essentially restored to its original state. The major areas requiring reclamation and restoration include the overburden storage areas, tailings disposal area and mine pit.

Reclamation activities are already in progress for the overburden areas. Overburden storage areas were placed so as to blend into the existing terrain. The shape, slopes and revegetation are of such a nature that erosion is reduced. After a storage area is completed it will be covered with topsoil and planted with native grasses. During the 1971 growing season a revegetation test was conducted on one of the overburden areas. The Local Office of the Soil Conservation Service of the United States Department of Agriculture assisted the applicant in the test design. Because of difficulties encountered in disking and drilling grass seed into the slopes the area was seeded by hand. It was determined that future overburden storage areas should be contoured with lesser slopes in the 2-1/2 to 1 and 3 to 1 range, rather than a 2 to 1 slope. The test consisted of two thicknesses of topsoil cover, two types of grass, with and without mulching and fertilizing, and finally, reseeding overburden which has not been covered with topsoil. The results of this testing will be used to determine future reclamation procedures. Currently, two grass mixtures, recommended by the upper Cheyenne District of the Soil Conservation Service, are under test. Mixture Number 1, consisting of Western Wheat Grass and Yellow Clover, have been planted on four areas of ore overburden storage area and on the top and downstream face of the tailings dam. Mixture Number 2,

consisting of Western Wheat Grass, Crested Wheat Grass, Yellow Clover, and Russian Wild Rye, have been planted on four areas of one overburden storage area. The Wyoming Game and Fish Commission has indicated a need for shrubs and forbs for animals. The applicant will investigate the possibility of seeding these types of plants.

The State of Wyoming has an Open Cut Land Reclamation Law which provides for the reclamation and conservation of land subjected to surface disturbance by open-cut mining. Basically the law requires a permit for open-cut mining and the posting of a bond to assure that the provisions of the law are carried out. As a result of the mining and backfilling techniques, there will not be enough waste from mining operations to fill the final mine area. The mining operation will produce steep sides on the pits which may be unstable over a long period of time and which would be too steep to support vegetation. Consequently, the slope of the pit walls will be reduced to about a two-to-one slope so the sides can be prepared for revegetation and erosion control. A blasting and dragging technique will be utilized for this phase of the reclamation, see Figure 20. Since water pumping will have ceased, the water table will return to its normal level producing two lakes with ground water and rainfall. The northernmost of the two lakes is located on a topographic high and will therefore collect no runoff or sediment. The lake created to the south is in a drainage path and would collect sediment. The drainage area from which water will flow into the southernmost lake was measured to be 2,500 acres. Assuming a yearly precipitation rate of 12 inches per year, 50% runoff, solids content of runoff of 1.91%, a solids content available for deposition of 68%, and a 50 acre lake having a depth of 250 feet, the life of the reservoir would be on the order of 347 years before it is filled with sediment. The quality of water of these lakes is expected to be of the same quality as the ground water in the area. A buildup of radioactivity is not expected to occur in these lakes for the following reasons: (1) The ore-grade material is to be completely mined and removed from the pit. (2) No water accumulation will be in the pits at the time the upper part of the pit walls is blasted. (3) Exposed uranium minerals will be covered by several feet of rock and soil blasted down from the pit walls. Consequently, no large areas of uranium minerals in the pit walls will be exposed to the atmosphere for oxidation or weathering. The applicant's ground water and mine watering program will detect tendencies to leaching of radionuclides and allow decisions to be made regarding appropriate reclamation procedures.

The tailing basin reclamation, approximately 250 acres, will be carried out by stages. As soon as an area of the tailing pile surface is in a condition that will permit the use of equipment necessary to accomplish the stabilization, and is in a state that will accept the stabilization

procedure, covering with soil will begin. The soil covering will consist of first placing 18 inches of sandstone and siltstone and then 6 inches of top soil over the pile. These soils will be graded, fertilized, and seeded with perennial grasses so that any future runoff will flow slowly toward an overflow weir. The overflow weir will be riprapped to reduce erosion. In addition riprap will be used to prevent erosion in areas where runoff from the surrounding areas could occur. The basin will be protected from major amounts of runoff by the diversion system described in an earlier part of this report. If the applicant's monitoring program indicates a hazardous or obnoxious dust problem developing during the reclamation procedure, the dried surface will be treated so as to control the dust. Radiation levels around the reclaimed tailing basin at Monticello, a former operating mill, have been reported to be near background readings. Depending upon the condition of the tailings pile, i.e., undisturbed and unsaturated soil or wet soil, a hundredfold decrease of radon concentration could be expected to occur through distances of 9 feet to 1/3 feet. Although the two feet of cover on the tailing pile will not be fully water saturated at all times, the selection of siltstone-sandstone mix plus compacting should provide low diffusional permeability and consequently concentrations of radon below MPC at the surface. The applicant will prevent the capillary transport of acid to plant root systems by selecting grasses that have a root system long enough to stabilize but not so long as to penetrate and extract radionuclides from the stored tailing and by modifying the depth of cover or mixing sufficient limestone with the initial covering to neutralize any acid that may enter the root zone of the vegetation. As was noted earlier in the report, the soil itself is basic and, therefore, would tend to have a neutralizing effect. The cost of this reclamation has been estimated to be $1000 per acre. In order to guarantee that funds will be available for reclamation of the tailings area when milling activities are terminated, the applicant is posting a surety bond with the Wyoming Land Commissioner at an initial rate of $1000 per acre of tailings. This bond is subject to an annual review by the Commissioner whereby the rate per acre may be increased or decreased depending on the then current methods and rates for stabilizing tailings. Thus, should cost estimates increase in the future, adjustments can be made in the bond to insure that sufficient funds are available for tailings stabilization upon termination of this project.

Also, the applicant will subject the land on which the tailings are stored to the following restrictions in the form of a land covenant.

> The owner will not permit the exposure and release of the tailings material to the surrounding area.

- No structures which man or animals can occupy may be built on the covered surface.

- The covered surface may not be subdivided.

- No private roads, trails, or rights-of-way may be established across the covered surface.

These restrictions will be binding on the applicant while it owns the land, and on successive owners thereafter, for a period of 50 years or until such time prior to the expiration of the 50-year period as government regulations are instituted to control disposition of uranium mill tailings. The applicant has further stated that their obligations under the above provisions are as follows: During the restriction period, if Exxon continues to own the land on which uranium tailings are stored, Exxon will comply with the restrictions. If during the restriction period Exxon sells or disposes of any land on which uranium tailings are stored, and the purchaser or successive owner fails to comply with the restrictions, Exxon will be obligated to comply with the restrictions until the end of the restriction period. The applicant has further stated that he intends the first deed of restriction to include the following responsibility: On a regular basis and when required by abnormal weather occurrences, the owner will inspect for physical damage to cover. On an annual basis, the owner will perform a radiometric survey of the covered tailing impoundment basin and the creek bottom of the North Fork of Box Creek immediately below the dam. If the whole body external gamma radiation rate is more than 0.05 mR/hr. (milliroentgen per hour), the area of excessive radiation will be covered with additional nonradioactive soil to reduce the level to 0.05 mR/hr. or less. The fifty-year restriction period was established because it is believed to be an adequate time period for the tailing problem to be fully studied and resolved. The Commission intends to further discuss these proposed restrictions with the applicant as well as State and EPA officials in order to insure control over the tailings pond for 50 years, if required.

III. ADVERSE IMPACTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

The environmental effects which cannot be avoided are:

- The release of small quantities of radioactive and non-radioactive materials into the environs surrounding the plant.

- The relocation of approximately 120 million cubic yards of earth resulting in a permanent change in the local topography.

- The creation of a stabilized tailings retention system covering about 250 acres which will be subject to restrictions in the form of a land covenant for a period of 50 years.

- The withdrawal of approximately 3200 acres of land from other possible uses for the next 12-14 years.

- The disturbance of the local ground water system due to the mining operation for a period of 12-14 years.

- A temporary removal of terrestrial energy productivity from the ecosystem of approximately 51 x 10^{10} calories per year initially to approximately 142 x 10^{10} calories for the last year of operation.

- Temporary shifting of a small population of antelope (7 to 8) and mule deer (2) and an undetermined number of smaller wildlife species into adjacent surroundings.

IV. ALTERNATIVES TO THE PROPOSED ACTION

1. Alternate Mining Method

It is possible and physically practical to mine the ore at the HUM site by underground mining techniques. This involves sinking shafts and developing an underground system of tunnels for access to the ore and for ventilation. The short-term advantages would include reducing the quantity of earth that would have to be moved and the amount of land surface that would have to be disturbed. The land surface area required for underground mining would be quite small, measured in tens of acres as compared to hundreds of acres for open-pit mining. Also, the total amount of earth that would have to be relocated would be only a small fraction of that which must be relocated by open-pit mining. From a long-term standpoint, however, the applicant's restoration and reclamation program will minimize these advantages.

Even without considering the cost of amortizing the mine surface plant and the underground development cost, underground mining is estimated to cost 20 to 30 percent more per pound of concentrate than open-pit mining. To offset this higher cost, the cut-off grade between ore and waste will be higher. Thus, about 20 percent of the ore that will be mined by open-pit methods could not be mined economically if underground methods were used. Moreover, underground mining is more hazardous than open-pit mining and the radon health hazard to underground miners is greater than to open-pit miners.

2. Alternate Mill Site

The mill could be built at another site even though the mining activities would have to be conducted at Highland. This would shift any environmental impact resulting from milling activities to another site. However, it appears unlikely that another site could be found in the United States where the milling activities would produce a lesser environmental impact than at the Highland site.

Milling the ore at an alternate site would increase the cost of the uranium concentrate. The cost would depend on the location of the alternate site but the unit cost for transporting ore is about five cents per ton-mile. There would also be an increased probability of a transportation accident involving ore carrying vehicles.

3. Alternate Mill

The ore from the HUM site could be milled at an existing mill at another location. This would completely eliminate the potential impact at the HUM site associated with milling activities.

However, the nearest mill to the HUM site is over 100 miles away. This means that the milling cost of a pound of concentrate would be increased from less than $1.00 to about $2.25 (i.e., an increase of about 40 million dollars for the 32 million pounds of concentrate to be produced). Furthermore, there would be an increased environmental impact at the alternate mill site due to increased production plus the increased probability of transportation accidents involving vehicles transporting the ore.

4. Alternate Mill Process

The use of a carbonate leach process is a possible alternative. The potential environmental impact and the operating costs would be essentially the same. The most significant disadvantage of the carbonate leach process would be a lower recovery rate of uranium of approximately five percent.

5. Alternate Tailings Location and Disposal Alternatives

Local alternate sites for the tailings retention system have been considered in connection with minimizing potential releases of radioactive and non-radioactive contaminants into the environment by seepage and wind erosion. However, there are no other natural basins in the area with sufficient capacity. So, a system at another location would require construction of a 3 to 4 sided structure. This type of structure is more expensive to build, more difficult to maintain, more prone to wind erosion and would be harder to reclaim. Since the subsurface of other potential sites were no more likely to result in less seepage and in view of other less desirable characteristics, alternate sites were rejected. No other methods of disposition of radioactive wastes produced in bulk quantity that would provide any greater degree of control or assurance that the waste would not reach or affect some vital portion of the ecosystem is known at this time.

6. Alternate Equipment and Operating Procedures

Additional ventilation and air cleaning equipment and modifications in operating procedures (such as the elimination of ore blending) might result in a minor reduction in the amount of effluents escaping from the mill. However, the applicant's dust emission control procedures are considered to be consistent with the present state-of-the-art in uranium mining and milling technology. In view of the efficiency of the proposed controls for waste and effluents (see Section II.C), the low environmental concentrations of contaminants anticipated, and the minimal improvement which would be expected from such changes, it does not appear justified to require the additional capital expenditure necessary to make these changes.

V. RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The local short-term effects of the proposed activities are those associated with the construction and operation of any large ore refining facility. Releases of radioactive and non-radioactive materials will be maintained at low levels, i.e., only a few percent of applicable limits. A continuing environmental monitoring program will provide a basis for detecting and assessing any environmental impact that might lead to long-term effects so that timely corrective action can be taken if required.

In the long-term, most local areas influenced by the mining and milling activities will be reclaimed. Except for the two small lakes and the stabilized tailings pile, the appearance of the reclaimed site will be little different from the surrounding area.

VI. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

About 32 million pounds of natural uranium will be removed from ore for use in power generators. In addition, about 250 acres of land will be covered with tailings and probably removed from any further productive use.

VII. BENEFIT-COST ANALYSIS

A. Benefits

The benefits expected to be associated with the HUM are itemized below. These benefits are quantified insofar as possible.

1. The project will result in the direct employment of about 170 persons in Converse County over the next 12-14 years plus the employment of about 150 construction workers over a 15-month construction period. Gross annual wages and benefits of employees at Highland are expected to be about 2.5 million dollars. Employment opportunities in the area are low and the population has been decreasing over the past several decades. Therefore, the project should provide an important economic boost to local nearby communities.

2. The project will generate about 400-500 thousand dollars per year in tax revenues for local and state governments. These taxes could be used to provide improved community services such as improved schools, roads, sanitary facilities, and other public benefits.

3. Approximately 32 million pounds (16,000 tons) of uranium concentrates will be produced during the next 12-14 years for use in generating electricity in the United States. Assuming present technology and efficiency of nuclear power plants, this amount of uranium could be converted into sufficient fuel to generate 2.3×10^7 megawatt days of electricity. This would be sufficient to supply about one-fourth of the electrical energy annually consumed in the United States at the present time.

4. Other natural resources (gas, oil, coal) will be conserved for use in other applications. The amount of uranium to be produced at Highland represents nearly 200 million tons of coal, 1 billion barrels of oil or 4.3 trillion cubic feet of natural gas based on present technology of generating electricity.

5. The one or two small lakes to be created at the site will provide a fresh water source in a semi-arid region. These lakes will probably be used as a source of fresh water for livestock in the future and may also improve the long-term recreational value of the area.

6. Several Governmental agencies have expressed an interest in acquiring title to the site after completion of the mining and milling operation. The State of Wyoming Game and Fish Commission has indicated that they would develop a Biological Reconnaissance of the area which is to be used for determination of feasibility of an agreement to assume

ownership of the area after completion of the HUM site operation. In addition, the Forest Service of the U.S. Department of Agriculture has expressed an interest in acquiring title to the 2400 acres of land with its two lakes for grazing and wildlife habitat improvement after the planned operational life of the mine and mill. The Thunder Basin National Grassland is located within nine miles of this property.

B. COSTS

The expected social and environmental costs, associated with the HUM are itemized below. For the most part these costs are not quantifiable.

1. The Land

There will be a temporary reassignment of use of about 3200 acres of land normally used for grazing sheep. This amount of land at the Highland location is estimated to represent a profit of about $0.75 per acre per year as pasture land for sheep.

There will also be a change in the topography of the site involving approximately 600 acres and 120 million cubic yards of earth resulting from overburden removal during open-pit mining. In view of the restoration and reclamation program (Section H) to be carried out by the applicant, the 1500 acre site (excluding the tailings retention system) is expected to be restored to its former productivity upon completion of HUM activities. Thus the land costs are considered to be essentially those associated with removing 3200 acres of land from grazing for approximately 12-14 years.

There will be created a stabilized tailings pile covering about 250 acres and involving 11 million tons of tailings containing solidified waste chemicals and dilute concentrations of radioactive uranium and its daughter products. This land will be restricted from use except for grazing for an indeterminable length of time.

2. Cultural and Social Considerations

There will be a slight increase in population and additional traffic generated in connection with the HUM project. Whether any real value can be assigned to resulting changes in the cultural and social factors of the area is debatable. However, the staff's judgement is that the financial benefits to the area will outweigh the possible social and cultural costs connected with the project.

3. Ecological

The proposed activities by the applicant will result in small releases

of chemicals and radioactive materials into the environs surrounding the site. Because of the small quantities of materials involved and the dilution and dispersion that will occur, the potential environmental impact is not considered measurable. Thus, the environmental and ecological costs are expected to be indeterminably small.

4. Depletion of Natural Resources

The project will result in a permanent depletion of 32 million pounds of natural uranium as a natural resource.

C. BENEFIT-COST BALANCE

The ultimate costs resulting from the licensing of the Highland Uranium Mill are found to be: minor changes in certain social and cultural circumstances in nearby communities; a temporary reassignment of land use; the creation of a stabilized tailings retention system which may have to be restricted for an indeterminable length of time; depletion of a natural resource; a temporary (12-14 years) adverse aesthetic impact from open-pit mining; and the discharge of small amounts of chemical and radioactive effluents into surrounding environs.

The benefits are expected to be: the recovery of 32 million pounds of natural uranium for use in generating electricity; stimulation of the local economy through taxes and direct employment; and the conservation of other natural resources (gas, oil, coal) for use in other applications; and the creation of two small lakes in a semi-arid region.

While the summing up of the costs and benefits cannot have a purely quantitative basis, the anticipated benefits appear to be substantially greater than the environmental costs, which for a significant part have already been incurred. Because the applicant must apply the necessary precautionary measures to minimize releases of effluents in accordance with Commission regulations and must restore and reclaim the land affected by his operations, adverse environmental effects are expected to be far outweighed by the benefits to be derived from the project.

VIII. SUMMARY OF COMMENTS RECEIVED FROM FEDERAL, STATE, AND LOCAL AGENCIES, PRIVATE ORGANIZATIONS, AND INDIVIDUALS

A. COMMENTS FROM FEDERAL AGENCIES

1. Environmental Protection Agency, National Water Quality Laboratory

The Environmental Protection Agency has indicated that the mine and mill will not discharge liquid or solid materials into any permanent streams and therefore no impact is expected.

2. Dept. of Health, Education, and Welfare, Denver Regional Office

The Department of Health, Education and Welfare has no comments.

3. Advisory Council on Historic Preservation, Washington, D. C.

This agency has stated that the final statement should contain evidence of contact with the Historic Preservation Officer from the State of Wyoming.

4. Department of the Army, Omaha District, Corps of Engineers

This agency has stated that the proposed project would not affect any existing projects, or projects under consideration by the Omaha District Corps of Engineers, and expressed the opinion that the environmental impacts associated with the operation of the mill and mining operation were well covered.

5. Department of Commerce

This agency has suggested that the accumulation of mildly radioactive concentrated waste should be discouraged, and that other alternatives for disposal be discussed along with their associated safeguards. It is the opinion of the agency that if the radioactive source terms are correct, the concentrations of airborne radioactive effluents would not have an impact beyond the site boundary.

6. Department of Agriculture

The Forestry Service, an agency of this department, has indicated an interest in acquiring title to the 2,400 acres of land. The Soil Conservation Service, another agency of this department, has indicated that several classes of birds may be found in this area which are classified as rare. The question has also been raised regarding the

effect of the water quality of the tailing pond on water fowl and the food chain. This agency also asked about the reasonableness of the 50 year period for restricting and monitoring the area, and inquired about the provisions for preventing wind erosion of the tailings pond while the pond is drying up. A question was also raised regarding the safety factor associated with the side slope ratio of 2 to 1 of the dam. It is also the opinion of the Soil Conservation Service that sheep ranching is on the decline in this area and that though, the area may not be significantly damaged, it probably will not be enhanced either.

7. National Oceanic & Atomospheric Administration, Air Resources Laboratories

There were two areas of meteorological concern in the applicant's environmental report. These dealt with the radiation exposure from the dust collection discharges and from the radon released to the atmosphere by the tailing pond.

8. Environmental Protection Agency, Washington, D. C. 20460

EPA's primary concern with the proposed action is with the regulations which will be applied to the control and stabilization of the mill tailings and how legally enforceable requirements will be applied. In addition to these concerns, this agency requested that additional information be provided regarding the effects of the operation on the ground water in the area, water quality in the mining area, and the method of dewatering the mine and its effects. Objections were raised to the use of the term, "low level" concentrations in describing the concentrations of radioactive material generated in the milling process. It was suggested that the draft statement did not fully define the pre and post operational environmental sampling program and that an inventory of both radioactive and nonradioactive emissions be provided and that Dose Equivalent information to the surrounding area be presented in tabular form. Information and clarification was requested on seepage characteristics of the tailing reservoir, environmental monitoring of seepage from the tailing pond, and on hydrological and geological information pertinent to the tailing reservoir. Design information and construction criteria for the tailing reservoir dam was requested. Concern was expressed regarding the perpetual maintenance and surveillance procedures for the tailings pile and the arrangements providing for long term control measures. Additional information was solicited with regard to land reclamation and stabilization procedures for the mine and mill site. It was also suggested that the final statement include a biota inventory for the area, discuss noise from the mining and milling operation and address the subject of sanitary and construction wastes.

9. Department of Transportation, United States Coast Guard

This organization made the determination that the impact of the HUM project upon transportation would be minimal and they had no objection to the issuance of a license.

10. United States Department of Interior

Comments were offered with regard to the mine dewatering procedures and possible consequences of discharging mine water to the environment. It was requested that the noise levels from the mill and mine operations be discussed. A quantitative evaluation of wildlife displacement from the project was requested to be included in the final statement as well as historical and archeological considerations including documentation showing evidence of consultation with the State Historic Preservation Officer.

B. COMMENTS FROM STATE AGENCIES

1. Texas State Department of Health, Division of Occupational Health and Radiation Control

This agency questions the usefulness of the small lakes that will be created as a result of the incomplete mine backfill. It has been their experience that lakes created as proposed may contain radium 226 in concentrations exceeding those in the National Bureau of Standards Handbook 69.

2. Wyoming Recreation Commission

This agency stated that, "our evaluation is that this mill site will not have any adverse environmental impact on any presently known Wyoming historic site property."

3. State of Wyoming Game and Fish Commission

This agency stated that because of the local topography any surface drainage from the HUM would not reach the North Platte River thus precluding an impact on fisheries and surface related water resources in the area. Information about the ground water quality will be useful to the agency in evaluating the future uses of the two lakes formed in the Reclamation Program. It was suggested that consideration be given to determining the best types of vegetation to be used in the stabilization program for the purpose of supporting the resident wildlife population such that the loss of the area to wildlife will be mitigated. It was

also pointed out that the restrictions placed on the tailings reservoir are such that it should be listed as an adverse impact which cannot be avoided. This agency suggested that a long range acquisition program should be considered such that the lakes will support a fishery, and that a revegetation program be established which is in the best interest of resident wildlife of the area. This agency also requested that they be permitted to review and comment on the biota inventory of the HUM site.

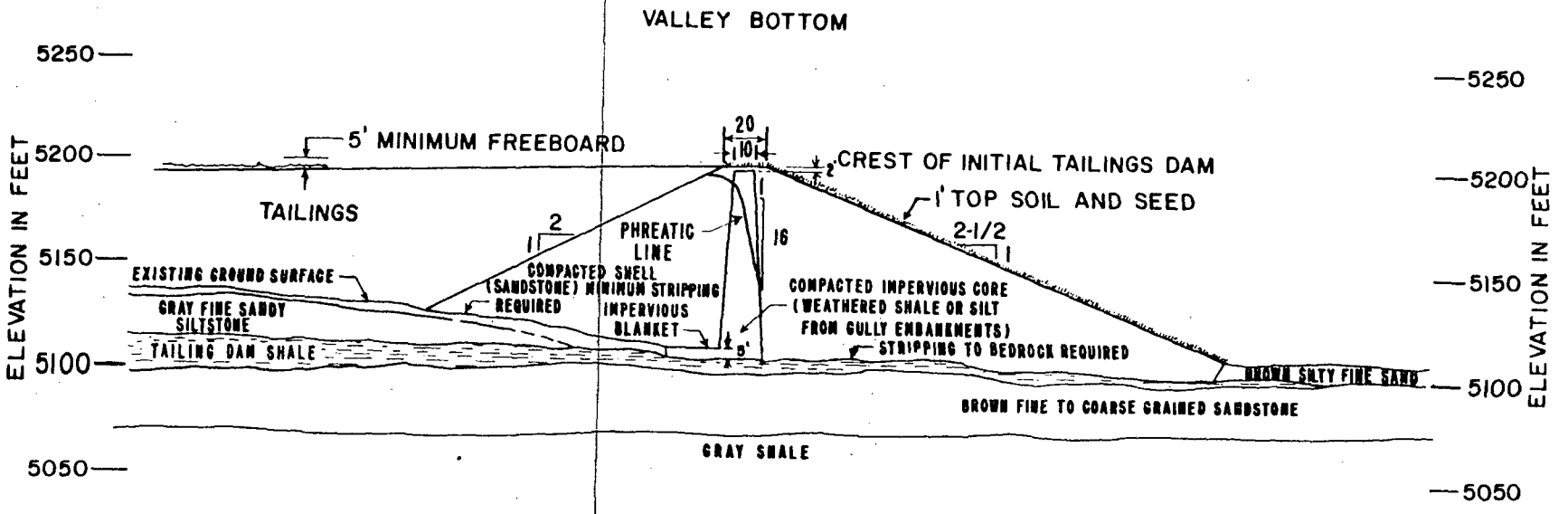
C. COMMENTS FROM LOCAL AGENCIES, PRIVATE ORGANIZATIONS AND INDIVIDUALS

1. Dr. A. C. Wilbraham, Associate Professor in Chemistry, Southern Illinois University, Edwardsville, Illinois

Dr. Wilbraham inquired about several aspects of the inplant radiation safety considerations such as the concentrations of radon-222 in the immediate working environment and what safety precautions would be used to minimize radon inhalation by workers. In addition Dr. Wilbraham asked for an analysis of the potential hazards resulting from accidents, in particular, the accident situation involving a fire in the S-X circuit. A question was raised regarding the beneficial use of the lakes formed in the reclamation process.

D. DISPOSITION OF COMMENTS

All questions relating to the contents of the AEC Draft Detailed Statement have been addressed in this Final Statement. Questions raised by Dr. Wilbraham relating to safety within the plant were considered separate and apart from the environmental issues, by letter to Dr. Wilbraham dated October 30, 1972. Questions relating to the environment are addressed in this final statement.

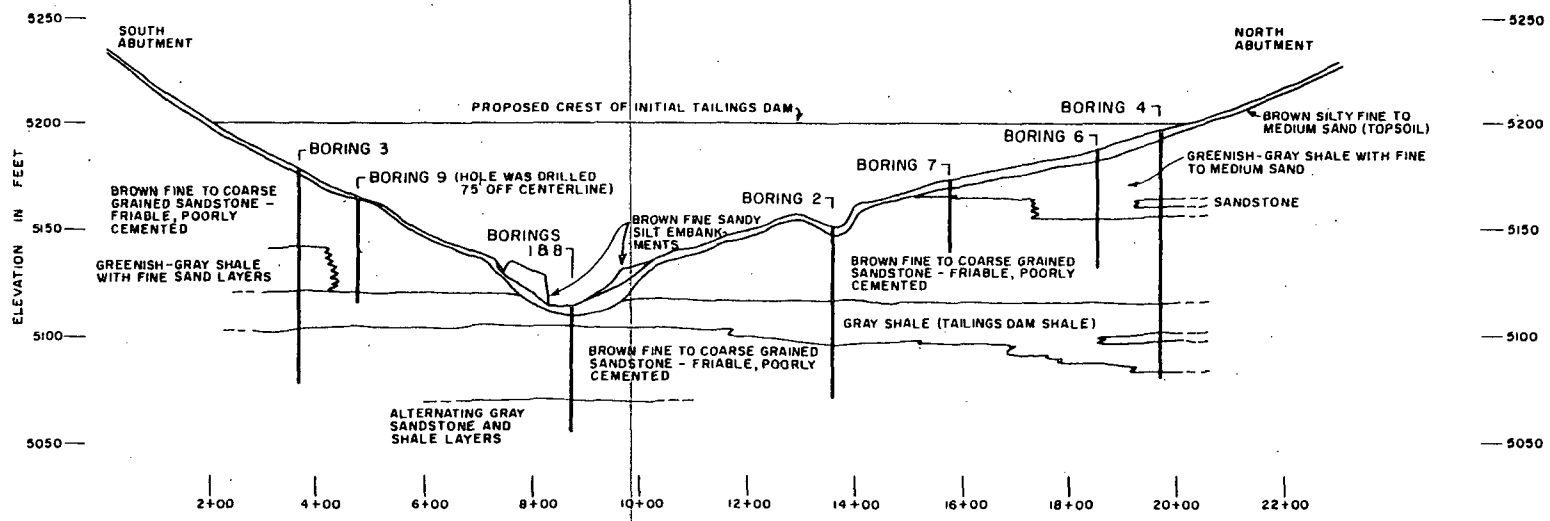


HORIZONTAL SCALE 0 300 feet

VERTICAL SCALE 0 75 feet

TYPICAL INITIAL DAM SECTION

Figure 16



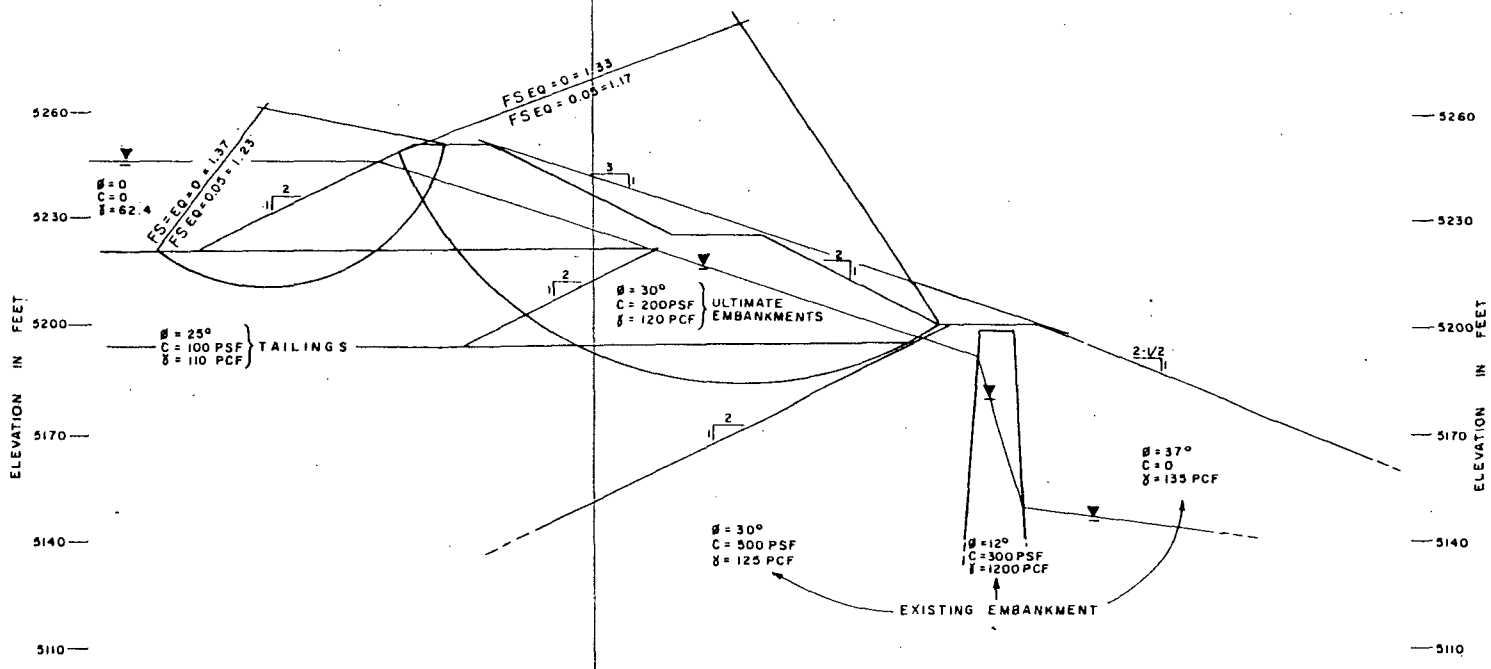
NOTE:
THE DEPTH AND THICKNESS OF THE SOIL STRATA INDICATED ON THE SUBSURFACE SECTION WERE OBTAINED BY INTERPOLATING BETWEEN EXPLORATION BORINGS. INFORMATION ON ACTUAL SOIL CONDITIONS EXIST ONLY AT THE EXPLORATION BORINGS AND IT IS POSSIBLE THAT THE SOIL CONDITIONS BETWEEN EXPLORATION BORINGS MAY VARY FROM THOSE INDICATED.

SUBSURFACE SECTION
(THRU INITIAL DAM CREST)

DAMES & MOORE

PLATE I

Figure 17



SLOPE STABILITY DATA

DAMES & MOORE

PLATE 2

Figure 18

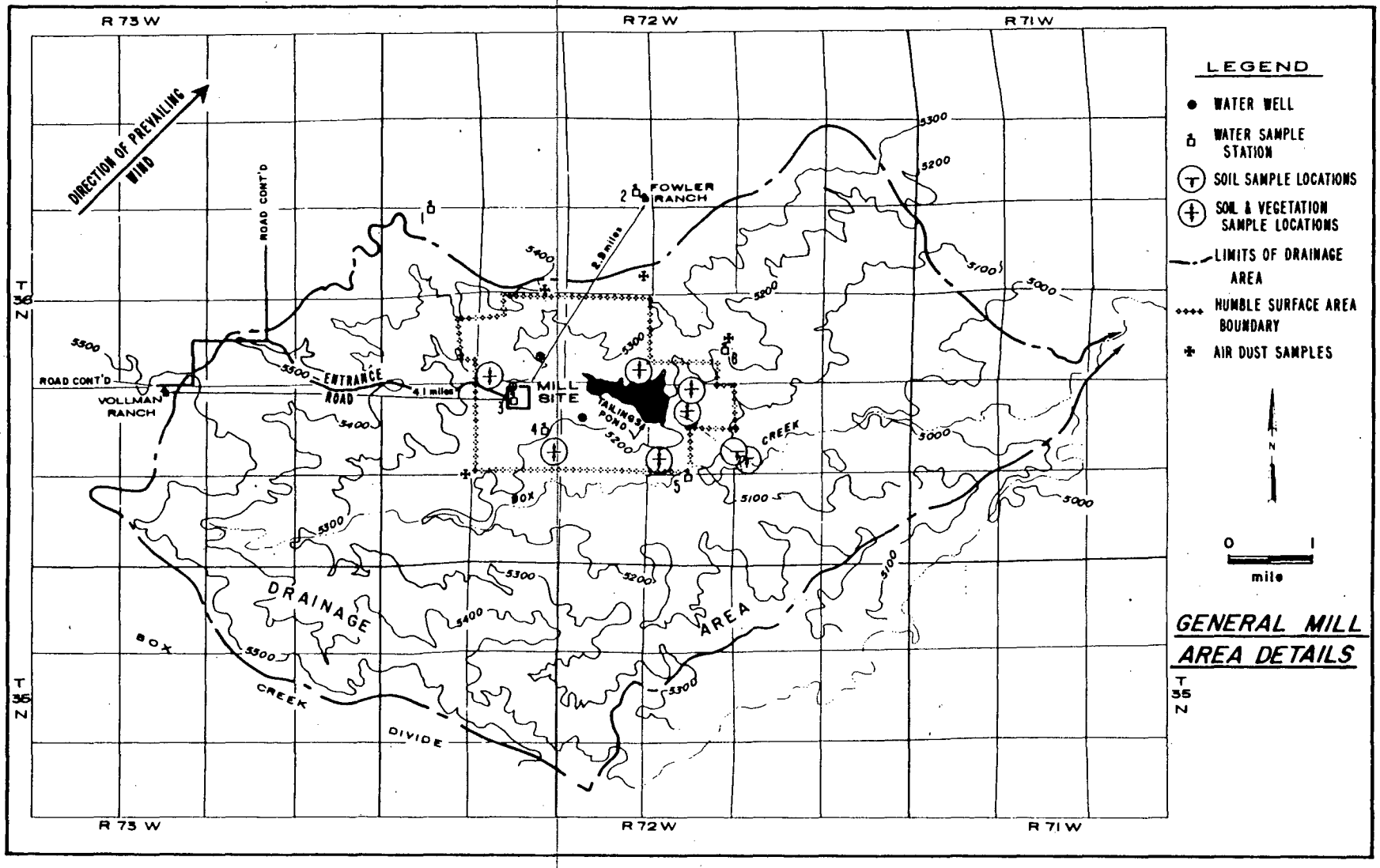
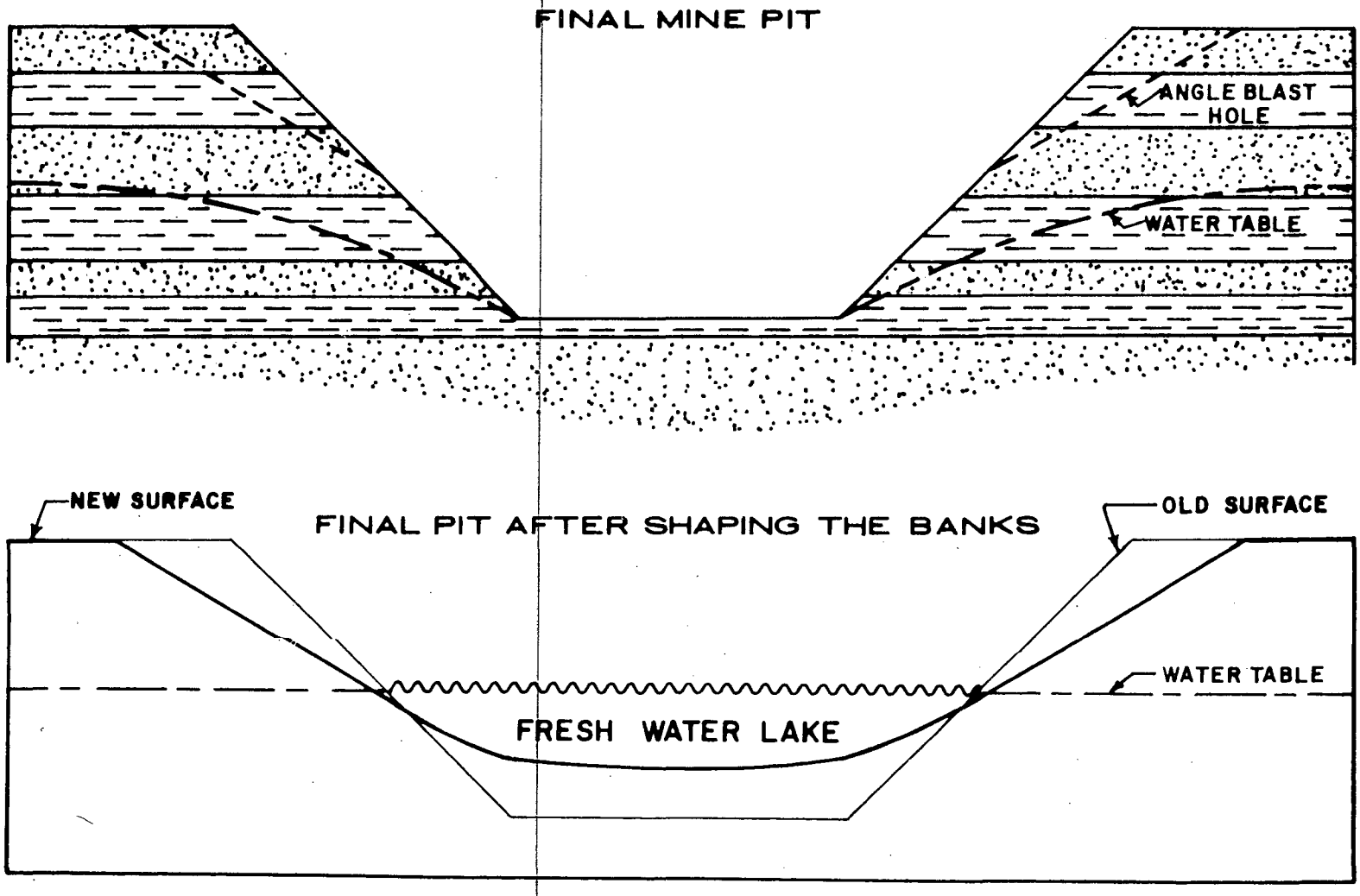

R 73 W
R 72 W
R 71 W
T 36 N
T 35 N
DIRECTION OF PREVAILING WIND
ROAD CONT'D
ROAD CONT'D
VOLLMAN RANCH
ENTRANCE ROAD
4.1 miles
2.8 miles
FOWLER RANCH
MILL SITE
TAILINGS POND
BOX CREEK
DRAINAGE AREA
DIVIDE
5500
5400
5300
5200
5100
5000
LEGEND
WATER WELL
WATER SAMPLE STATION
SOIL SAMPLE LOCATIONS
SOIL & VEGETATION SAMPLE LOCATIONS
LIMITS OF DRAINAGE AREA
HUMBLE SURFACE AREA BOUNDARY
AIR DUST SAMPLES
N
0
1
mile
GENERAL MILL AREA DETAILS

Figure 19



FINAL PIT RECLAMATION

Figure 20

APPENDIX A

A Brief Inventory of the Wildlife Resources in the Highland Flats Area of Converse County

Rec'd w/ltr. dtd. 6-27-72

A BRIEF INVENTORY OF THE WILDLIFE RESOURCES IN THE HIGHLAND FLATS AREA OF CONVERSE COUNTY

Prepared by: Larry Pate, Big Game Biologist,
Casper District, Wyoming Game and Fish Commission

Date Submitted: June 27, 1972

A BRIEF INVENTORY OF THE WILDLIFE RESOURCES IN THE HIGHLAND FLATS AREA OF CONVERSE COUNTY

Introduction:

This inventory pertains mainly to the area within T.36N., R.72W. in Converse County, Wyoming. This inventory includes the present status of wildlife present i the area. Occurrence and importance of any species in this report may change in the future, as wildlife populations are not static but subject to change with changing environmental conditions. Only the current status of the wildlife populations found within the area have been included and the report is not intended to exclude the possibility of occurrence of other species.

The vegetal species list is not all-inclusive of plants found within the area but rather includes the most common.

Current Status:

The most important wildlife species in the area under consideration in this report are pronghorn antelope and sage grouse. Lesser species present include mule deer, cottontail rabbits, hungarian partridge, mourning doves, waterfowl and shorebirds, coyotes, bobcats, red fox, badgers, a variety of song birds and a variety of avian predators. Each major species will be discussed below.

Pronghorn Antelope:

The Highland area is located on the boundary of antelope management areas numbers 26 and 28. The area is used throughout the year by a resident population of antelope with very little seasonal migrational movements taking place through the area. During the past five years, there has been an increase in the antelope population trends in the above management areas so that at the present time the areas are supporting optimum population levels for the current habitat conditions.

Th present density of antelope in the area is between five and six animals per square mile.

Sage Grouse:

Sage grouse populations within the area are directly tied to the availability of big sagebrush (Artemisia tridentata) and the occurrence of free water for watering an brood rearing. At the present time the area supports a sizeable population of birds year-around. The annual harvest of birds in Converse County has been approximately 500 birds. The county could support more hunting pressure for this species than it has received in the past.

Mule Deer:

Although mule deer are present within the area they are less numerous than the pronghorn antelope due to the lack of suitable habitat. They are found mostly along Box Creek in the southern part of the area. Population density of this species would be less than two animals per square mile for the habitat.

Waterfowl and Shorebirds:

Waterfowl and various shorebirds utilize the potholes on the highland flats as production and brood rearing areas. Ducks to be found in the area include mallards, teal, gadwall, and pintails. The importance of the area for waterfowl production varies from year to year with the amount of precipitation received in the area and collected in the ponds.

Other Wildlife Species:

Several species of wildlife occupy the general area concerned within this report. Although they are not as abundant as the species above, they should be noted. These include hungarian partridge, mourning doves, cottontail rabbits, prairie dogs, several species of song birds, and small predators including coyotes, red fox, bobcats and badgers. Also found are avian predators, including marsh

hawks, red tail, ferruginous and sparrow hawks and prairie falcons. Peregrine falcons could possibly be found within the area. Golden and bald eagles utilize the area as a wintering area with some golden eagles using the area year-around.

Vegetal Species List - Highland Mine Site

Shrubs and Trees	Binomial
Cottonwood	*Populus spp.*
Big Sagebrush	*Artemisia tridentata*
Silver Sagebrush	*Artemisia cana*
Fringed Sagebrush	*Artemisia frigida*
Small Soapweed	*Yucca glauca*
Rabbitbush	*Chrysothamnus spp.*
Rose	*Rosa spp.*
Prickly Pear	*Opuntia polyacantha*
Grasses and Grass-like	
Indian Rice Grass	*Oryzopsis hymenoides*
Needle and Thread	*Stipa comata*
Prairie Sandreed Grass	*Calamovilfa longifolia*
Western Wheatgrass	*Agropyron smithii*
Bearded Bluebunch Wheatgrass	*Agropyron spicatum*
Blue Grama	*Bouteloua gracilis*
Cheat Grass	*Bromus tectorum*
Sandburg Bluegrass	*Poa secunda*
Threadleaf Sedge	*Carex filifolia*
Forbs	
Russian Thistle	*Cirsium rothrockii*
Prairie Sunflower	*Helianthus petiolarius*
Eriogonum - Perenial Buckwheat	*Eriogonum spp.*
Common Dandelion	*Taraxacum officinale*
Goats Beard	*Tragopogon pratensis*
Indian Paintbrush	*Castilleja coccinea*
Death Camas	*Zygadenus spp.*
Hooded Phlox	*Phlox spp.*
Milkvetch	*Astragalus spp.*
Penstemon	*Penstemon spp.*
Prairie Clover	*Melilotus spp.*
Winterfat	*Eurotia lanata*
Pepperweed	*Lepidium spp.*
Onion	*Allium spp.*

APPENDIX B

State of Wyoming Acceptance

of Base-Line Biota Inventory

COPY

August 23, 1972

Mr. Gerald D. Ortloff
Environmental Advisor
Humble Oil & Refining Company
P. O. Box 2180
Houston, Texas 77001

Highland 7-1-6

Dear Mr. Ortloff:

In reply to your letter of August 1, 1972, we concur that Mr. Pete's report is suitable for a base-line biota inventory of the Highland Flats Area of Converse County.

Your expressed intent to use our comments and information to maximize beneficial effects and minimize any potentially adverse impacts is very commendable.

Based on the current cooperative attitudes and relationships, we too, look forward to a beneficial end result in the interest of the public.

Sincerely,

/s/ James B. White
State Game and Fish Commissioner

JBW:HBM:jah

cc: Don Tennant, BSFW
James C. Malaro, A.E.C.

COPY

APPENDIX C

Evidence of Contact with the Wyoming Recreation Commission Regarding Impact of the HUM on Wyoming Historic Site Property

DOCKET NO. 40-8102

Environmental File

)4 st 25th Street, Box 309, Cheyenne, Wyo. 82001

Telephone: Area Code 307 — 777-7695

STANLEY K. HATHAWAY
Governor

PAUL H. WESTEDT
Director

August 2, 1972

RECEIVED
AUG 8 1972
U.S. ATOMIC ENERGY COMMISSION
Mail Section

Mr. Leland C. Rouse
Chief, Technical Support Branch
Directorate of Licensing
U.S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Rouse:

A Mr. John Kendick (if I caught his name correctly over the telephone) called this office regarding National Historic Preservation Act clearance on the proposed Highland Uranium Mill Site to be built by Humble Oil and Refining Company in Converse County, Wyoming.

We had already answered this question in a letter to Mr. M. T. Worley, Mine Manager for the Humble Oil Company. Mr. Kendick asked that I send a copy of that correspondence to you. This letter serves as a cover for that purpose.

Sincerely,

Ned Frost

Ned Frost
Historian

NF/mr

Enclosures

DOCKETED USAEC
AUG 9 1972
REGULATORY MAIL SECTION DOCKET CLERK

"Dedicated to the Development of Public Outdoor Recreation"

July 14, 1972

Mr. M. T. Worley, Mine Manager
Humble Oil and Refining Company
Highland Uranium Operations
Post Office Box 3020
Casper, Wyoming 82601

Dear Mr. Worley:

We have received your July 3, 1972 communication relative to your company's mill site in Section 29, T 36 N, R 72 W of the 6th P.M.

Our evaluation is that this mill site will not have any adverse environmental impact on any presently known Wyoming historic site property.

Sincerely,

Paul H. Westedt
Director
Ned Frost
By: Ned Frost
Historian

PHW:NF:mr

bcc: RF:

HUMBLE OIL & REFINING COMPANY

CASPER, WYOMING 82601

HIGHLAND URANIUM OPERATIONS

July 3, 1972

POST OFFICE BOX 3020
TELEPHONE (307) 358-3244

Mr. Paul Westedt
Director of Wyoming Reclamation Commission
Box 309
Cheyenne, Wyoming

Dear Mr. Westedt:

As we discussed on the telephone Friday, I am transmitting a location map of the Highland Uranium Operations showing proximity to the towns of Douglas and Glenrock. You will notice that the mill site is in Section 29, T36N, R72W.

I am also enclosing for your information, 2 pages reproduced from our Environmental Report which describes the history of the area as we know it.

If we can be of further assistance to you in your evaluation of the environmental impact of the Highland Operations, please do not hesitate to call.

Very truly yours,

M. T. Worley

M. T. Worley
Mine Manager

MTW:ld

Enclosures: Location Map
Reproduction

Ned
Will any Historic facilities be affected in this area?
P

RECEIVED
JUL 5 1972
Wyo. Recreation Commission

APPENDIX D

Comments Received

DOCKET NO. 40-8102

Texas State Department of Health

JAMES E. PEAVY, M.D., M.P.H.
COMMISSIONER OF HEALTH

L. B. COPELAND, M.D.
DEPUTY COMMISSIONER

AUSTIN, TEXAS

May 10, 1972

Mr. C. T. Edwards
Assistant to the Director
Division of Material Licensing
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Edwards:

We have read the "Draft Detailed Statement on the Environmental Considerations" relating to the Highland Uranium Mill to be constructed in Wyoming, Docket No. 40-8102. We find it necessary to question the usefulness of the small lakes to be created as a result of the incomplete mine backfill. It has been our experience that lakes created in this manner, below the water table, may contain Radium 226 in concentrations exceeding those in NBS Handbook 69. The Felder #1 Mine near Three Rivers, Texas, is a lake created in this manner, and it has been determined that the concentration of Radium 226 exceeds the NBS Handbook 69 value of 100 pCi/l. Two samples analyzed for ^{226}Ra had 192 and 155 pCi/l for samples collected in April 1971, and November 1971, respectively. Alpha activities of these samples were 3281 $\pm$ 9% and 1679 $\pm$ 7% for the dissolved fractions. Another mine, the McLean #1 Mine, has been assayed at 63 pCi/l and 3113 pCi/l for ^{226}Ra and gross alpha in the dissolved fraction. This is a shallower mine which may have a higher percentage of rainwater than the Felder #1 Mine.

The water seeping into the mines may (and, in Texas, does) show lower activities than this. It is our theory that oxidation and other weathering of the residual ore in the mines is responsible for these high amounts of radioactivity. Our Water Quality Board has told us that this water exceeds their discharge requirements.

There is one mine, the Korzekwa Mine, which does contain good water. This mine is above the water table and drains a large area. Dissolved alpha activity of this water has been measured at 6 and 7 pCi/l in February 1972.

We believe that the plans for these lakes whould be reviewed, or that the lakes be closely monitored after their creation.

Thank you for the opportunity to comment on this document. We hope our experience in these matters has been helpful.

Sincerely,

Martin C. Wukasch, P.E., Director
Division of Occupational Health
and Radiation Control

cc: Wyoming State Health Department
cc: Mr. Gene Blanc

DOCKET NO. 40-8102

Extra

DEPARTMENT OF THE ARMY
OMAHA DISTRICT, CORPS OF ENGINEERS
7410 U.S. POST OFFICE AND COURT HOUSE
OMAHA, NEBRASKA 68102

MROED-PE

18 May 1972

RECEIVED MAY 22 1972

Mr. C. T. Edwards
Division of Materials Licensing
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Edwards:

Reference is made to your letter of 25 April 1972, transmitting the draft Detailed Environmental Statement related to Humble Oil and Refining Company's Highland Uranium Mill.

The project would not affect any existing projects, or projects under consideration by the Omaha District Corps of Engineers. The environmental impacts associated with the operation of the mill and mining operation were well covered.

Sincerely yours,

for R. G. BURNETT, P. E.
Chief, Engineering Division

DOCKET No. 40-8102

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (GWS)
400 SEVENTH STREET SW.
WASHINGTON, D.C. 20590
PHONE: 202-426-2262

21 JUN 1972

Mr. C. T. Edwards
Assistant to the Director
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Edwards:

This is in response to your letter of 25 April 1972 addressed to Mr. Herbert F. DeSimone, Assistant Secretary for Environment and Urban Systems, concerning the draft environmental impact statement and supplement relative to the Humble Oil Refining Company's Highland Uranium Mill, Converse County, Wyoming.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material presented and we have no comments to offer. It is our determination that the impact of this project upon transportation is minimal and we have no objection to the issuance of a license for this project.

The opportunity to review and comment on the draft statement and supplement for the Highland Uranium Mill project is appreciated.

Sincerely,

W. M. BENKERT
Rear Admiral, U. S. Coast Guard
Chief, Office of Marine Environment
and Systems

THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

Extra

DOCKET NO. 40-8102

June 8, 1972

Mr. C. T. Edwards
Assistant to the Director
Division of Materials Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Edwards:

The Draft Detailed Statement on the Environmental Considerations by the U. S. Atomic Energy Commission Related to the Proposed Issuance of an Operating License to the Humble Oil and Refining Company for the Highland Uranium Mill, Docket Number 40-8102, which accompanied your letter of April 25, 1972, has been received by the Department of Commerce for review and comment.

The Department of Commerce has reviewed the draft environmental statement and has the following comments to offer for your consideration.

Accumulation of concentrated waste, even if it is mildly radioactive should be discouraged. It is suggested that other alternatives for disposal be discussed along with their associated safeguards.

Providing that the radioactive source terms listed in Table V on page 22 are accurate, even the most pessimistic meteorological diffusion assumptions will result in concentrations at the nearest occupied dwelling (2.9 miles to the northeast) which are a factor of 1000 below maximum permissible concentrations. Consequently, we conclude that there will be no radiological impact from airborne effluents beyond the site boundary.

We hope these comments will be of assistance to you in the preparation of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

DOCKET NO. 40-8102

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20250

JUN 19 1972

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REGULATORY FILE CY

Mr. C. T. Edwards
Assistant to the Director
Division of Materials Licensing
Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Edwards:

We have had the draft environmental impact statement for the Humble Oil and Refining Company's Highland Uranium Mill in Wyoming reviewed in the relevant agencies of this Department. Comments from the Soil Conservation Service and the Forest Service, both agencies of the Department, are enclosed.

Sincerely,

Fred H. Tschirley

FRED H. TSCHIRLEY
Acting Coordinator, Environmental
Quality Activities

Enclosures

DOCKETED USAEC
JUN 20 1972
REGULATORY MAIL SECTION DOCKET CLERK

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Re: Draft Environmental Statements - Humble Oil and Refining Company, Highland Uranium Mill

Our only comment is that after the 12-14 years of operational life planned, the Forest Service might be interested in acquiring title to the 2,400 acres of land with its two lakes for grazing, wildlife habitat improvement and recreational opportunities (Supplement, page 22). The Thunder Basin National Grassland is within nine miles of this property.

Soil Conservation Service, USDA, comments on draft environmental statement prepared by Division of Materials Licensing for Humble Oil and Refining Company for the Highland Uranium Mill.

Our review of the impact statement indicates that you have presented the information in a factual manner. The information appears to be complete. There may be a need to more fully explain the following points:

1. Is there supporting data to show that 50 years is a reasonable period of time to provide for restricted use and monitoring of the area? Perhaps it should be a longer or shorter period.

2. Page 11, G. of the green report from U.S. Atomic Energy Commission: Ecology - The ferruginous hawk (Buteo regalis) frequents this area. It has been proposed for classification as rare or endangered by the U.S. Bureau of Sports, Fisheries and Wildlife.

   The American peregrine falcon (Falco peregrinos) might also be found in this area. It is listed as "rare" in the above book.

   The trumpeter swan (Olor buccinator) uses this area as a flyway and is listed as rare.

3. The consideration of water fowl use of the tailing pond should be expanded. During migration, waterfowl may use the area. What effect will the quality of the water, radiation, etc., have on these birds? How will the material affect the food chain?

4. In 12 to 14 years when the operation is being phased out and while the pond is drying up, what provisions will be made for prevention of wind erosion? There will be a considerable amount of time involved before equipment can be used to cover the area. Perhaps some temporary measures could be used.

5. Page 3 of the supplement, paragraph 2 - are 2:1 side slopes safe to people and animals? Will they be stable? This will depend on many factors.

6. It appears the feeling is that sheep ranching will continue on this area. This is opposite to the seeming present trend in Wyoming.

7. The statement regarding sheep ranching seems quite optimistic. While the area may not be damaged very much, it probably will not be enhanced either.

We appreciate the opportunity to review and comment on this impact statement.

Sincerely,

George W. Danielson
acting

H. W. Cooper
State Conservationist

A·C

DOCKET NO. 50-81-2

ADVISORY COUNCIL
ON
HISTORIC PRESERVATION

WASHINGTON, D.C. 20240

MAY 10 1972

RECEIVED MAY 15 1972

Dear Mr. Rogers:

This is in response to your request for comments on the environmental impact statement identified by a copy of your cover letter attached to this document. The staff of the Advisory Council has reviewed the submitted impact statement and suggests the following, identified by checkmark on this form:

_____The final statement should contain (1) a sentence indicating that the National Register of Historic Places has been consulted and that no National Register properties will be affected by the project, or (2) a listing of the properties to be affected, an analysis of the nature of the effects, a discussion of the ways in which the effects were taken into account, and an account of steps taken to assure compliance with Section 106 of the National Historic Preservation Act of 1966 (80 Stat. 915) in accordance with procedures of the Advisory Council on Historic Preservation as they appear in the Federal Register, March 15, 1972.

_____In the case of properties under the control or jurisdiction of the United States Government, the statement should show evidence of contact with the official appointed by your agency to act as liaison for purposes of Executive Order 11593 of May 13, 1971, and include a discussion of steps taken to comply with Section 2(b) of the Executive Order.

✓ The final statement should contain evidence of contact with the Historic Preservation Officer for the State involved and a copy of his comments concerning the effect of the undertaking upon historical and archeological resources.

_____Specific comments attached.

Comments on environmental impact statements are not to be considered as comments of the Advisory Council in Section 106 matters.

Sincerely yours,

Robert R. Garvey, Jr.

Robert R. Garvey, Jr.
Executive Secreatary

DOCKETED
USAEC
MAY 16 1972
REGULATORY
MAIL SECTION
DOCKET CLERK

2616

cc: Mr. Paul H. Westedt, Director, Wyoming Recreation Commission, 604 East 25 Street, Box 309, Cheyenne, Wyoming, 82001 w/inc.

UNITED STATES GOVERNMENT

Memorandum

DEPARTMENT OF HEALTH, EDUCATION, AND WELFAR
REGIONAL OFFICE
9017 Federal Bldg., 1961 Stout St., Denver 80202

DOCKET NO. 40-8102

TO : C. T. Edwards, Assistant to the Director, Division of Materials Licensing, AEC, Washington, D. C. 20545

DATE: June 1, 1972

FROM : ROFEC, Region VIII

REFER TO:

SUBJECT : Draft Environmental Impact Statement
Highland Uranium Mill, Converse County, Wyoming
Docket No. 40-8102

We have reviewed the referenced Statement for DHEW, Regional Office, Region VIII, Denver, Colorado.

We do not have any adverse comments to make.

Thomas E. Moore
Regional Engineer
ROFEC

By Elwyn Holtrop
Elwyn Holtrop, P.E.
General Engineer, Environmental and Inspection, ROFEC

cc:
Mr. Robert Lanza

3066

HELP ELIMINATE WASTE HEW COST REDUCTION PROGRAM

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

DOCKET NO. 40-8102

UNITED STATES GOVERNMENT

Memorandum

ENVIRONMENTAL PROTECTION AGENCY
National Water Quality Laboratory
6201 Congdon Boulevard
Duluth, MN 55804

TO : Mr. William Cawley, Deputy Director
Program Management Division, EPA

DATE: April 28, 1972

FROM : Director, NWQL

SUBJECT: Review of Draft Environmental Impact Statement for Highland Uranium Mill, Converse County, Wyoming. Review by Brungs.

This mine and mill will discharge no liquid or solid materials into any permanent streams and no impact is expected of the plant operation on these waterways. We are assuming that other people will comment on the strip mining processes themselves.

Don

Donald I. Mount, Ph.D.

cc:
C. T. Edwards, Div. of Materials Licensing, AEC, Washington, DC

RECEIVED
APR 28 1972
U.S. ATOMIC ENERGY COMMISSION
Regulatory Mail Section

DOCKETED USAEC
JUN 9 1972
REGULATORY MAIL SECTION DOCKET CLERK

3151

State of Wyoming

GAME AND FISH COMMISSION
CHEYENNE 82001

June 27, 1972

James C. Malaro
Assistant Chief, Materials Branch
Division of Materials Licensing A.E.C.
Washington, D. C. 20545

SUBJECT: Review Of Draft Detailed Statement On The Environmental Considerations By The U. S. Atomic Energy Commission Division Of Materials Licensing Related To The Proposed Issuance Of An Operating License To Humble Oil And Refining Company For The Highland Uranium Mill
Docket Number 40-8102 Dated: April 5, 1972

Gentlemen:

The Subject Draft, indicates the purpose of the impact review to determine the issuance of a permit for a Uranium Mill Operation in Converse County. On Page 2, of The Draft. It is stated that the impact statement is to cover both the operation of the Mill and related Mining activities. This is considered a plus in the completeness of subject statement in that impact on Fisheries and Wildlife is often compounded by one particular form of impact in another area of impacts.

On Page 3, paragraph 3 under II. Site. A.) Location. It is stated that a 1500 acre site on which the Mine and Mill is located, is fenced with sheep-tight fence. This would not exclude some forms of Wildlife from the area, some of which is apparently considered hazardous.

On Page 9 under D.) Hydrology. 1.) Surface Waters. It is stated that the North Platte River, the only continously flowing stream in the area, is 15 miles to the south of the site. Because of the local topography, surface drainage from the HUM does not reach the North Platte River. This would preclude an impact on fisheries and surface related water resources in the area. 2.) Groundwater. It is stated, "process and potable water from the operation will be obtained from subsurface deposits, at the approximate rate of 500-1500 gallons per minute," with complete groundwater quality information included on Page 10. This information should prove useful in our evaluations of possible future uses on two lakes to be included in the Reclamation Program outlined on Page 35. No. 5 of the listed benefits.

On Page 11 under G.) Ecology. It is stated that "A biota inventory of the HUM site will be undertaken by the applicant in the spring of 1972." Our question in this matter is related only to assurance that the inventory would be made by a qualified ecologist and that we as a responsible state agency be permitted to review and comment on said inventory.

On Page 12 under III Mine and Mill. It is stated that the Mine will disturb approximately 600 acres as waste dumps. We can only assume that this includes the tailings pond which is described as covering 250 acres on Page 20.

Also On Page 12, paragraph 2. It is stated that waste dumps will be covered with a layer of top soil and planted with native grasses as part of the Reclamation Program. We suggest that consideration be given to a cooperative determination of vegetative types that would be best suited to growth on the exposed soil and at the same time replace the loss of Shrubs and Forbs currently present in the area and supporting the resident Wildlife populations.

On Page 14 under B.) The Mill. It is stated that presently known uranium reserves within the area, would substain the planned operation through 1984. It indicates that the planned operation would end at that time and that the area would be totally reclaimed within a given period after 1984. This period of time is described as the impact period, elsewhere throughout this draft statement. However, it is indicated on Page 22 of [1] Supplement To Applicant's Environmental Report. That the area of 250 acres containing the tailing pond, would be subject to controls over all uses of the land except grazing, for a period of 50 years. This information is also included on Page 27 of The Subject Draft. However, it is not listed on Page 30, of said draft as an adverse impact which cannot be avoided. In summary, our concern can be listed as follows:

1. There is no apparent concern for opportunities for mitigation of the loss of the included area to Wildlife use. However, in the Applicant's Environmental Report on Page 22, is suggested that the applicant has considered granting title to 2,400 acres of land, including two groundwater lakes to appropiate governmental agencies for such agencies of responsibility for maintaining vegetative cover over the tailing area. It might well be that we should consider this in a long range acquisition program subject to the following conditions:

    a. That the groundwater source from which the lakes will be supplied, is such that a fishery could be supported.
    b. That the applicant would agree to a revegetation program

1. "Supplement To Applicant's Environmental Report Highland Uranium Mill Converse County", Wyoming Humble Oil and Refining Company Minerals Department, P. O. Box 2180, Houston, Texas 77001.

which we will determine to be in the best interest of Resident Wildlife of the area.

In all, I would say that combined draft impact statement by the A.E.C. and the Applicant's Environmental Report represent one of the better efforts of developing environment considerations, that I have reviewed to date.

Our Field personnel have agreed to develop a Biological Reconnaissance on the area to be used for determination of feasibility of an agreement to assume ownership of the area after completion of the HUM site operation.

Thank you for the opportunity to review this impact statement.

Sincerely,

James B. White
State Game and Fish Commissioner

JBW/cmw

(HUM Site - - - - Humble Mills Site Including The Mine Operation.)
(HUM - - - - - - Humble Uranium Mills .)

Rec'd w/ltr. dtd. 6-27-72

A BRIEF INVENTORY OF THE WILDLIFE RESOURCES IN THE HIGHLAND FLATS AREA OF CONVERSE COUNTY

Prepared by: Larry Pate, Big Game Biologist,
Casper District, Wyoming Game and Fish Commission

Date Submitted: June 27, 1972

A BRIEF INVENTORY OF THE WILDLIFE RESOURCES IN THE HIGHLAND FLATS AREA OF CONVERSE COUNTY

Introduction:

This inventory pertains mainly to the area within T.36N., R.72W. in Converse County, Wyoming. This inventory includes the present status of wildlife present in the area. Occurrence and importance of any species in this report may change in the future, as wildlife populations are not static but subject to change with changing environmental conditions. Only the current status of the wildlife populations found within the area have been included and the report is not intended to exclude the possibility of occurrence of other species.

The vegetal species list is not all-inclusive of plants found within the area but rather includes the most common.

Current Status:

The most important wildlife species in the area under consideration in this report are pronghorn antelope and sage grouse. Lesser species present include mule deer, cottontail rabbits, hungarian partridge, mourning doves, waterfowl and shorebirds, coyotes, bobcats, red fox, badgers, a variety of song birds and a variety of avian predators. Each major species will be discussed below.

Pronghorn Antelope:

The Highland area is located on the boundary of antelope management areas numbers 26 and 28. The area is used throughout the year by a resident population of antelope with very little seasonal migrational movements taking place through the area. During the past five years, there has been an increase in the antelope population trends in the above management areas so that at the present time the areas are supporting optimum population levels for the current habitat conditions.

The present density of antelope in the area is between five and six animals per square mile.

Sage Grouse:

Sage grouse populations within the area are directly tied to the availability of big sagebrush (Artemisia tridentata) and the occurrence of free water for watering and brood rearing. At the present time the area supports a sizeable population of birds year-around. The annual harvest of birds in Converse County has been approximately 500 birds. The county could support more hunting pressure for this species than it has received in the past.

Mule Deer:

Although mule deer are present within the area they are less numerous than the pronghorn antelope due to the lack of suitable habitat. They are found mostly along Box Creek in the southern part of the area. Population density of this species would be less than two animals per square mile for the habitat.

Waterfowl and Shorebirds:

Waterfowl and various shorebirds utilize the potholes on the highland flats as production and brood rearing areas. Ducks to be found in the area include mallards, teal, gadwall, and pintails. The importance of the area for waterfowl production varies from year to year with the amount of precipitation received in the area and collected in the ponds.

Other Wildlife Species:

Several species of wildlife occupy the general area concerned within this report. Although they are not as abundant as the species above, they should be noted. These include hungarian partridge, mourning doves, cottontail rabbits, prairie dogs, several species of song birds, and small predators including coyotes, red fox, bobcats and badgers. Also found are avian predators, including marsh

hawks, red tail, ferruginous and sparrow hawks and prairie falcons. Peregrine falcons could possibly be found within the area. Golden and bald eagles utilize the area as a wintering area with some golden eagles using the area year-around.

Vegetal Species List - Highland Mine Site

Shrubs and Trees	Binomial
Cottonwood	*Populus spp.*
Big Sagebrush	*Artemisia tridentata*
Silver Sagebrush	*Artemisia cana*
Fringed Sagebrush	*Artemisia frigida*
Small Soapweed	*Yucca glauca*
Rabbitbush	*Chrysothamnus spp.*
Rose	*Rosa spp.*
Prickly Pear	*Opuntia polyacantha*
Grasses and Grass-like	
Indian Rice Grass	*Oryzopsis hymenoides*
Needle and Thread	*Stipa comata*
Prairie Sandreed Grass	*Calamovilfa longifolia*
Western Wheatgrass	*Agropyron smithii*
Bearded Bluebunch Wheatgrass	*Agropyron spicatum*
Blue Grama	*Bouteloua gracilis*
Cheat Grass	*Bromus tectorum*
Sandburg Bluegrass	*Poa secunda*
Threadleaf Sedge	*Carex filifolia*
Forbs	
Russian Thistle	*Cirsium rothrockii*
Prairie Sunflower	*Helianthus petiolarius*
Eriogonum - Perenial Buckwheat	*Eriogonum spp.*
Common Dandelion	*Taraxacum officinale*
Goats Beard	*Tragopogon pratensis*
Indian Paintbrush	*Castilleja coccinea*
Death Camas	*Zygadenus spp.*
Hooded Phlox	*Phlox spp.*
Milkvetch	*Astragalus spp.*
Penstemon	*Penstemon spp.*
Prairie Clover	*Melilotus spp.*
Winterfat	*Eurotia lanata*
Pepperweed	*Lepidium spp.*
Onion	*Allium spp.*

REGULATORY FILE CY 46-102

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

RECEIVED AUG 1 1972

ER-72/489

JUL 26 1972

Dear Mr. Edwards:

This is in response to your letter of April 25, 1972, requesting our comments on the Atomic Energy Commission's draft detailed statement, dated April 5, 1972, on environmental considerations for Highland Uranium Mill, Converse County, Wyoming.

General

In general, the statement adequately assesses the environmental impacts of the proposed action. We are particularly pleased with the plans to reduce long-term impacts with the land restoration program.

DOCKETED USAEC AUG 3 1972 REGULATORY MAIL SECTION DOCKET CLERK

Specific comments are presented in the following paragraphs according to the format of the statement or according to specific subjects.

Hydrology

The water analysis shown on page 10 may not be indicative of the quality of all waters that will be pumped in dewatering the mine. Experience in the Gas Hills and Shirley Basin indicates that the water quality differs widely. Discharge of the mine water to the Box - Lightning - Lance Creek drainages will result in flow for short distances before it percolates underground. Some of the constituents in solution will remain on or near the land surface because of evaporation and will become concentrated with time. Areas of the stream channel wetted by waters discharged from the mine should be monitored to determine if concentrations of radioactive and toxic constituents dangerous to wildlife and cattle occur. The discharging-well tests to be conducted near the strip mines will give a basis for computing radius of effect of water withdrawals and impact on groundwater resources.

Noise

The noise levels from the mill and mining operations should be discussed in the final statement.

Impacts on Wildlife

A quantitative evaluation should be made in regard to wildlife which would be displaced and possibly eventually lost as a result of the project. In general, displaced wildlife should be considered lost if the habitat and wildlife involved were in approximate equilibrium. This discussion should also include an evaluation of the restoration program in regard to wildlife after the operation is completed.

Historical and Archeological Significance

The final statement should show evidence of consultation with the State Historic Preservation Officer. He is the Director, Wyoming Recreation Commission, 604 East 25th Street, Box 309, Cheyenne, Wyoming 82001.

The final statement should also indicate the effect that the combined mining and milling project will have on archeological resources. Such effects cannot be determined until an archeological survey has been made by professional archeologists. We suggest that Dr. George C. Frison be contacted concerning protection of archeological resources which may exist at the mine and mill site. His address is: Department of Anthropology, University of Wyoming, Box 3431, University Station, Laramie, Wyoming 82070.

We hope these comments will be helpful to you in the preparation of the final environmental statement.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Mr. C. T. Edwards
Assistant to the Director
Division of Materials Licensing
Atomic Energy Commission
Washington, D. C. 20545

DOCKET NO. 40-8102

Southern Illinois
University

EDWARDSVILLE, ILLINOIS 62025

Science and Technology Division
DEPARTMENT OF CHEMISTRY

Environmental File

August 10, 1972

United States
Atomic Energy Commission
Division of Materials Licensing
Washington, D.C. 20545

Dear Sir:

I have recently studied the draft copy of an AEC environmental statement on a project entitled HIGHLAND URANIUM MILL (Docket #40-8102).

I would like you to address yourself to the following points:

p. 19 Airborne wastes

What concentrations of radon 222 (half-life 3 days) do you anticipate will be released and possibly accumulate in the immediate working environment? Will any safety precautions (i.e. filters, masks, etc.) be used to minimize radon inhalation by workers in certain areas of the operation?

p. 25 Accidents

The docket addresses itself to those accidents that would have a potential impact on the environment. What are the potential hazards to personnel - i.e. is radon gas inhalation among such hazards?

p. 26 Kerosine fire

It would appear that a kerosine fire of some 60,000 gallons of kerosine containing about 600 lbs of uranium would be capable of releasing radioactive material over an area far exceeding the few hundred feet stated in the docket (second paragraph p. 26). Please comment on this.

p. 35 Benefit #5

Is the beneficial use of the lakes i.e. providing livestock with drinking water, to become effective within the 12-14 years time span? If so what levels of radioactivity do you anticipate will be present in the water? Would you expect much levels to have any detectable effect upon the livestock?

Your prompt attention to these questions will be appreciated.

Sincerely yours,

A. C. Wilbraham
Associate Professor in Chemistry
Radiological Control Officer

cc: Oliver A. Houck, Counsel
National Wildlife Federation
1412 16th St. N.W.
Washington, D.C. 20036

DOCKET NO. REGULATORY FILE CY 40-8102

ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Environmental File
Environment

OFFICE OF THE ADMINISTRATOR

14 JUL 1972

Mr. Julius H. Rubin
Assistant General Manager
of Environmental Safety
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Rubin:

This is in response to Mr. C. T. Edwards' letter of April 25, 1972, transmitting the Atomic Energy Commission's Draft Environmental Statement related to the issuance of an operating license to Humble Oil and Refining Company for the Highland Uranium Mill - Docket No. 40-8102. We have reviewed this statement and enclose our detailed comments.

Our primary concern with the proposed action is with the regulations which will be applied to the control and stabilization of the Highland mill tailings. The State of Wyoming, in our opinion, does not have adequate tailings control regulations at the present time. The EPA region VIII office has prepared model regulations which are available. Until an adequate set of state regulations are promulgated by Wyoming, we are concerned about how legally enforceable requirements, stringent enough to protect the environment, will be applied and by whom.

We would be pleased to discuss any of our comments. If we can assist you further in this matter, feel free to contact us.

Sincerely yours,

Sheldon Meyers
Director
Office of Federal Activities

Enclosure

DOCKETED USNRC JUL 18 1972 REGULATORY MAIL SECTION DOCKET CLERK

ENVIRONMENTAL PROTECTION AGENCY COMMENTS

ON THE

HUMBLE OIL AND REFINING COMPANY'S HIGHLAND URANIUM MILL

INTRODUCTION AND CONCLUSIONS

This report summarizes an evaluation of the draft statement for the Highland Uranium Mill submitted by the Atomic Energy Commission for formal review on April 25, 1972. This facility is being constructed in east-central Wyoming for the purpose of mining and milling uranium ore found at one site in the Highland Flats area, Converse County, Wyoming.

The major area of concern to EPA is the lack of official state regulations governing the control and retention of the tailings which will be produced. Additional information is necessary, and is requested in this report, to allow a comprehensive evaluation of the anticipated environmental impact. The cessation of Humble's responsibility following a 50 year period is important in light of the fact that the impact of tailings upon the environment and public health extends beyond 10,000 years. The AEC and Humble Oil and Refining Company should make every effort to assure perpetual maintenance and surveillance of the tailings retention system. Such assurance would be provided if the State of Wyoming adopted regulations for the stabilization of radioactive mill tailings.

MINING

Additional information should be provided concerning the effects of the planned mining and milling activities on the ground water in the area. Water obtained from the mine will be discharged into a dry surface stream bed whereby it will evaporate or reenter the ground water. As a result of mine dewatering, the following questions should be addressed in the final statement.

1) What are the expected differences in the water quality caused by accelerated leaching as the result of agitation and increased surface area to water volume ratio in the mining area?

2) What are the recharge areas for the ground water?

3) Will dewatering of the mine affect other ground water users in the area?

4) What is the extent of the aquifer?

Although some of these questions are answered in the applicant's Environmental Report, July 1971, they should be addressed in the final AEC-prepared statement. The method of dewatering as mentioned on page 12 of the draft statement should be specified in the final statement. Also, measures that will be taken to avoid stream bank erosion resulting from mine dewatering discharge, if and when it occurs, should be discussed in the final statement. This discussion should include consideration of the susceptibility of the local soils to erosion.

The final statement should include a provision whereby the effluent from the open pit mine would be routinely monitored for radiological and stable chemical constituents prior to its anticipated discharge to the Box Creek bed.

MILLING

The descriptive reference on page 18 of the draft statement to liquid and solid wastes generated in the course of milling operations, i.e., "liquid and solid wastes from the milling operations contain only low level concentrations of radioactive materials," is misleading to the public. Admittedly, the total radioactive concentrations of the waste produced fall within the low level category of accepted classification schemes. However, the general public, to whom the draft statement is addressed, views the label of low level as being of little or no public health concern. Considering the radionuclides involved with their long half-lives, this is certainly not the case.

ENVIRONMENTAL MONITORING

The draft statement does not fully define the pre and post operational environmental sampling program. The applicant's Environmental Report indicates that samples of soil and biota will be collected yearly, during the month of August. Pre and post operational soil and biota samples should be obtained more often to detect the influence of seasonal weather patterns. The final statement should give additional information as to frequency of collection of environmental samples.

The final statement should include information resulting from the biota inventory mentioned on page 11 of the draft statement.

It is desirable to establish the magnitude of non-radioactive air pollutant emmissions resulting from the use of this facility. Therefore, the final impact statement should provide estimates of the annual inventory of both radioactive and nonradioactive emmissions from the Highland facility.

Information on page 11 of the draft statement concerning prevailing winds should be expanded to include data for the populated areas of Casper, Glenrock, and Douglas. Data such as that listed in Ehibit H, Figure 4 of the applicant's Environmental Report, July 1971, would be very helpful in determining the true significance of radiation dose commitment to the local population in the area surrounding the Highland site.

TAILINGS RETENTION

In his April 29, 1971 letter to the Humble Oil and Refining Company, Mr. George C. Toland of the Dames and Moore Consulting Engineers, writes, "In this report ('Report of Tailings Dam Study, Highland Uranium Mine, near Casper, Wyoming, for Humble Oil and Refining Company,' dated October 28, 1970), we stated...and that in two to three years the seepage losses plus evaporation losses will hold the free water pond at near constant area." This quote, which considers seepage losses for up to 3 years, conflicts with the draft statement which, on page 20, implies that seepage of about 80 gallons per minute will occur only initially and that the liquid losses will be entirely by evaporation. This apparent conflict should be clarified in the final statement by evaluating the seepage and/or percolation through all surfaces of the retention area. Soil analysis data should also be provided to substantiate the claim on page 24 of the draft statement that most soils have the ability to remove contaminants from liquids by absorption and ion exchange.

It is stated that a collection basin will be installed at the toe of the dam and the seepage pumped back into the pond if significant seepage occurs. The term "significant" should be quantitated in the final statement. An alternate to this approach which would be more acceptable would be installation of the collection basin prior to startup to allow for the pumping of seepage back into the retention pond when the basin's freeboard limit is reached.

Page 24 of the draft statement indicates that four sampling wells around the tailings pile will be used to monitor for seepage into the water table. However, the hydrological and geological information in the draft statement is not detailed enough to evaluate the adequacy of the number of wells or the probability of detecting seepage into the ground water table by the chemical and radioactive wastes anticipated to accumulate in the tailings retention system. Additional information, including a ground water flow pattern, should be included in the final statement to allow evaluation of the adequacy of the sampling well network.

The pictorial representation (Exhibit C, Figure 8) in the applicant's Environmental Report, July 1971, describing future plans to extend the present 100 foot retention dam to 160 feet, does not provide enough information to enable an independent evaluation. The need for design information and construction criteria is considered important at this stage of HUM's operation since the additional 60 feet extension will hold eight times more tailings than the original design. These additional data should include information on the extension of the present clay core to the entire 160 foot height and any expected increase in the seepage rates beyond that currently anticipated for the present dam.

The Humble Oil and Refining Company in their letter of April 10, 1972, to the Atomic Energy Commission indicates that, "If the whole body external gamma radiation rate is more than 0.05 mR/hr, the area of excessive radiation will be covered with additional nonradioactive soil to reduce the level to 0.05 mR/hr or less." It should be pointed out that the entire uranium mill tailings containment area represents a hazard to public health which goes beyond the implications of the 0.05 mR/hr gamma exposure rate. In addition to the gamma hazard, the release of radon-222 gas can pose a public health problem. It is the combination of the gamma hazard with the escaping radon gas which requires that this tailings retention reservoir be classified as a controlled area. As such, access to the 250 acre tailings area would be restricted and perpetual maintenance and surveillance of this area would be required.

Page 27 of the draft statement indicates that the Humble Oil and Refining Company or successive owners will be bound by land covenant to control the uranium mill tailings for 50 years or until tailings control measures are prescribed by official regulations. In light of past experience with uranium tailings control at Grand Junction, Colorado and Riverton, Wyoming, to name a few, it is apparent that long range perpetual care arrangements are badly needed. Discussions resulting from the Grand Junction incident have indicated that the AEC accepts limited responsibility in the area of tailings control, thus delegating the major responsibility to the state in which the milling takes place. The Humble Oil and Refining Company's 50 year restriction period agreement has been precipitated by the lack of applicable enabling legislation and control regulations in the State of Wyoming. It is clear that official regulations governing uranium tailings stabilization and long term control are needed. We believe that the AEC, in cooperation with EPA, should work with the State of Wyoming in this regard.

RECLAMATION

Page 27 of the draft statement indicates that land reclamation efforts will include grading and revegetation on slopes up to 26.5 degrees (2 horizontal - to one vertical.) The U.S. Department of Interior publication "Surface Mining and Our Environment" states that stabilization of slopes in excess of 20 degrees is quite difficult in light of the occurrence of major land slides. The final statement should, therefore, give additional information concerning the stabilization, i.e., revegetation, rip-rapping, etc., of slopes in excess of 20 degrees. This information should also include the stabilization of the dam face, including the additional 60 feet of dam to be constructed at a later time.

GENERAL

The draft statement does not discuss noise impact caused by the mining and milling facilities. It is reasonable to assume that there will be little, if any, noise impact on the offsite area. However, the final statement should consider both offsite and onsite exposure levels of noise associated with the mining and milling facilities, e.g., the ore crusher, the rod mill, backup diesel generator, and the earthmoving equipment.

The final statement should provide information regarding measures that are and will be taken for the management of construction waste generated at the mill site.

Page 19 of the draft statement reads, "Other solid wastes will consist of trash (such as chemical containers, cardboard, paper, etc.) and sludges from the sanitary sewage system." It should be stated that these wastes will be disposed of in such a manner as to conform to all applicable state, local, and federal regulations.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL RESEARCH LABORATORIES
Silver Spring, Maryland 20910

Date: October 22, 1971

Reply to Attn of: R323

Subject: Review of Environmental Report, Hihgland Uranium Mill, Converse County, Wyoming.

To: Don F. Harmon, Division of Materials Licensing, USAEC

The two areas of meteorological concern in the report are the calculation of radiation exposures from the radioactive dust collector discharges (Exhibit H, figure 1) and from the radon released to the atmosphere by the Tailing pond (Exhibit I, pages 3-5).

We have checked the Exhibit H calculations by a different method which is widely used and accepted in reactor licensing procedures. Our results show, for example, that at a distance of 10 stack heights downwind from the crusher discharge, the resultant concentration of U_3O_8 would be 1.5×10^{-12} gU/ml as compared to the applicant's value of 8.3×10^{-13}, thus a difference of a factor of 2. However, at a distance of 8000 feet from the crusher discharge we compute a concentration of 8×10^{-14} gU/ml using a stack height of 60 feet, a wind speed of 10 mph and average (neutral) diffusion conditions. This compares to the applicant's value of 4.65×10^{-15} which is a factor of 17 lower than ours. Thus, the exposures listed at the bottom of figure 1, Exhibit H should be multiplied by a factor of 17. They should also be divided by a factor of 10 since it is unreasonable to assume, as did the applicant, that the wind blows 100 percent of the time towards one direction. A 10 percent value would be more realistic.

The computations with regard to the Tailing pond as shown on page 4 of Exhibit I are in error in a number of places due in part to typographical errors and also to a misinterpretation of the problem referenced on page 3 of Exhibit I. The numerical solution to the equation on page 4 should read:

$$C = \frac{(1.42 \text{ Ci/sec})\ (10^{-6} \text{ m}^3/\text{ml})}{(250\text{m})\ (52\text{m})\ (5\text{ m/sec})} = 7 \times 10^{-12} \text{ Ci/ml.}$$

The result compares to the value of 1.81×10^{-12} shown on page 5 which is a factor of 4 lower than our calculation.

In summary, our calculations of radioactive air concentrations are a factor of from 2 to 4 higher than that of the applicant. This difference may be purely academic in light of the fact that the estimates are many orders of magnitude below MPC values.

I. Van der Hoven

Isaac Van der Hoven, Chief
Air Resources Environmental Laboratory
Air Resources Laboratories