Responses to DNR comments on mining permit application. November 11, 1983

Rhinelander, Wisconsin: Exxon Minerals Company, November 11, 1983

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EXXON MINERALS COMPANY

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LOWER STACKS

November 11, 1983

Responses to DNR Comments on the Mining Permit Application

Mr. Gordon H. Reinke
Chief, Mine Reclamation Section
Wisconsin Department of Natural Resources
GEF II
P.O. Box 7921
Madison, WI 53707

Dear Mr. Reinke:

Enclosed are responses to DNR Comments contained in your letter dated October 10, 1983, on the Mining Permit Application. These responses also address the general comments on this permit application that were included in your letter of September 19, 1983. This submittal includes 44 copies of the responses and 24 copies of the attachments. Some of the attachments are the same as those included in our responses to DNR comments on Chapter 1.0 of the EIR; however, rather than reference these we have duplicated them in order to maintain a complete separate response package.

Pertinent information contained in these responses will be integrated into the revised Mining Permit Application following review and approval by the DNR on these responses. In some of our responses we have indicated that further discussion with the DNR will be necessary before reaching final resolution on the specific point in question. We will be making arrangements with you to discuss our responses to these particular comments in the near future.

By way of this letter, I am transmitting one copy of these responses and attachments to Mr. Terry McKnight, Environmental Impact Coordinator, North Central District Office of the DNR in Rhinelander.

If you have questions regarding this submittal, please contact me.

Very truly yours,

EXXON MINERALS COMPANY

B J Hansen

Barry J. Hansen
Permitting Manager

BJH:HSL:sjq

Attachments

xc: w/attachments
Mr. T. C. McKnight

DIVISION OF EXXON CORPORATION

Comment No. 1

Section A, Item 7 - This description of the mining site is inadequate. A breakdown of the site in a manner similar to that in Table A-8 would be more appropriate. What is the actual acreage to be covered by the mining permit?

Response:

The legal description of the mine site will be revised into a tabular summary (attached) similar to Table A-8. The actual area covered by the mining permit is 1607 ha (3971 acres) as defined in Chapter 1, subsection 1.1.2 of the EIR.

Comment No. 2

Section A, Item 8 - The description and table regarding land ownership should identify the State of Wisconsin as the owner of the lake beds in the area. Table A-8 states that a portion of Section 20, T35N, R13E is owned by Everett Rudlof but Figure A-8 shows Ernest Rudlof as the owner. Also, the table shows Gerald Solpers as an owner in Section 33, T35N, R13E, but the map shows Gerald Solper.

Response:

The tabluation of property ownership within the boundary of the Crandon Project has been revised to reflect the State of Wisconsin as owner of the lake beds (see attached Table A-8).

The land in Section 20, T35N, R13E, is owned by Everette E. Rudloff as shown in Table A-8. Figure A-8 will be revised to reflect the correct spelling.

The map will also be revised to show the correct spelling as "Gerald Solpers."

Comment No. 3

Table A-8, Page 5 of 5 - As of February 23, 1982, all pipeline easements were not yet recorded at the Forest County Register of Deeds Office. Please indicate which easements have not been finalized and/or recorded.

Response:

As of October 20, 1983, all pipeline easements have been recorded with the Forest County Register of Deeds.

Comment No. 4

Section A, Item 9 - Table A-9 should be amended pursuant to the comments made regarding Table 1.1-2 of Exxon's EIR. Also, Table A-9 indicates that an operating license for the MWDF is required prior to construction. In actuality, this license will not be issued until after the facility has been constructed.

(TABLE FOR RESPONSE TO COMMENT NO. 1)

PROPERTIES OWNED, UNDER OPTION, OR LEASED BY EXXON MINERALS COMPANY WITHIN THE CRANDON PROJECT BOUNDARY

Location	Description	Purpose
T35N-R13E:		
Town of Lincoln:		
Section 19:	Portion of NW NW	Access Road ROW
	Portion of SW NW	Access Road ROW
	Westerly 600 feet of SW 1/4	Access Road ROW
Section 20:	Portion of NE NE	Railroad ROW
	Portion of E 1/2 NW NE	Railroad ROW
	Portion of W 1/2 NW NE, NE NW	Railroad ROW
	Portion of W 1/2 SW NW, SE NW	Railroad ROW
	E 1/2 W 1/2 SW - 100 feet Easement	Railroad ROW
Section 28:	SW SW	Tailings/Buffer Zone
Section 29:	Entire Section	Tailings/Buffer Zone

Location	Description	Purpose
T35N-R13E:		
Town of Lincoln:		
Section 30:	NE, NE NW	Mine and Mill Complex/ Buffer Zone
	NW NW, S 1/2 NW, S 1/2	Mine and Mill Complex/ Buffer Zone
Town of Nashville:		
Section 31:	N 1/2 N 1/2	Mine and Mill Complex/ Buffer Zone
	SE NE, E 1/2 SE	Tailings/Buffer Zone
Town of Lincoln:		
Section 32:	Entire Section	Tailings/Buffer Zone
Section 33:	NW NW	Tailings/Buffer Zone
	SW NW, NW SW	Tailings/Buffer Zone
	SW SW	Tailings/Buffer Zone
	SE SW	Tailings/Buffer Zone
T35N-R12E:		
Town of Nashville:		
Section 23:	Portion of NE 1/4	Access Road ROW

Location	Description	Purpose
T35N-R12E:		
Town of Nashville:		
Section 24:	NE NE, W 1/2 NE, NW, NE SW, SE	Access Road ROW
	Portion of SE NE	Access Road ROW
Section 25:	E 1/2 NE, SE	Mine and Mill Complex/ Buffer Zone
Section 36:	NE 1/4, less tract owned by Adeline Vollmar R. 1, Crandon, WI 54520, and lakelot properties, NW 1/4, E 1/2 SW 1/4	Mine and Mill Complex/ Buffer Zone
T34N-R13E:		
Town of Nashville:		
Section 4:	NW 1/4	Tailings/Buffer Zone
Section 5:	Entire Section	Tailings/Buffer Zone
Additionally	All Town Roads in the Town of Nashville in the following sections are covered by a Mining Lease: T35N-R13E: Section 31 T35N-R12E: Sections 25 and 36 T34N-R13E: Sections 4 and 5	

Location	Description	Purpose
Pipeline Easements:		
T35N-R12E:		
Town of Nashville:		
Section 25:	Portion of NE SE, SE SE, SW SE, (also included in Project boundary description)	Water Pipeline Easement, 50 foot
Section 36:	Portion of N 1/2 NE (also included in Project boundary description)	Water Pipeline Easement, 50 foot
Section 36:	Portion of N 1/2 NW (also included in Project boundary description)	Water Pipeline Easement, 50 foot
Section 35:	Portion of NE NE	Water Pipeline Easement, 50 foot
	Portions of SE NE and SE NW	Water Pipeline Easement, 50 foot
	Portion of NE SW	Water Pipeline Easement, 50 foot
	Portion of NW SE	Water Pipeline Easement, 75 foot
Section 34:	Portion of NE NE	Water Pipeline Easement, 75 foot
	Portions of S 1/2 NE, NW NE,	Water Pipeline Easement, 75 foot
	Portions of Government Lot 4,	Water Pipeline Easement, 10-50 foot
	Portion of SW NW	Water Pipeline Easement, 25 foot

Location	Description	Purpose
Pipeline Easements:		
T35N-R12E:		
Town of Nashville:		
Section 33:	Portion of S 1/2 NE	Water Pipeline Easement, 25 foot
	Portion of SE NW	Water Pipeline Easement, 50 foot
	Portion of N 1/2 SW	Water Pipeline Easement, 50 foot
Section 32:	Portion of NE SE	Water Pipeline Easement, 50 foot
	Portions of NW SE, NE SW, SE NW Portions of E 1/2 NW	Water Pipeline Easement, 50 foot

(TABLE FOR RESPONSE TO COMMENT NO. 2)

TABLE A-8

PROPERTIES OWNED, UNDER OPTION, OR LEASED BY EXXON MINERALS COMPANY WITHIN THE CRANDON PROJECT BOUNDARY

Location	Description	Owner
T35N-R13E:		
Town of Lincoln:		
Section 19:	Portion of NW NW - Optioned for 200 feet Roadway ROW	S. N. Moe, et ux 1129 Primrose Court Neenah, WI 54956
	Portion of SW NW - Optioned for 200 feet Roadway ROW	Adah S. Paul Lake Shore Drive Crandon, WI 54520
	Westerly 600 feet of SW 1/4 - Optioned for 200 feet Roadway ROW	John B. Hess RFD 1 Laona, WI 54541
Section 20:	Portion of NE NE - Optioned for Railroad ROW	Leo Zelechowski, et ux R. R. 1, Box 175 Crandon, WI 54520
	Portion of E 1/2 NW NE - Optioned for Railroad ROW	Delmar Pennington, et ux R. R. 3, Box 309 Elkhorn, WI 53121
	Portion of W 1/2 NW NE, NE NW - Optioned for Railroad ROW	Everette Rudloff, et ux R. R. 1 Crandon, WI 54520
	Portion of W 1/2 SW NW, SE NW - Optioned for Railroad ROW	Wallace C. Bradley, et al 204 W. Grant St. Crandon, WI 54520
	E 1/2 W 1/2 SW - 100 feet Easement - Location to be selected	American Can Co P.O. Box 790 Green Bay, WI 54305
Section 28:	SW SW - Option for Purchase	Forest County c/o Forest County Clerk, Court House Crandon, WI 54520
Section 29:	Entire Section	Forest County Crandon, WI 54520

Location	Description	Owner
T35N-R13E:		
Town of Lincoln:		
Section 30:	NE, NE NW - As SW SW of 28	Forest County Crandon, WI 54520
	NW NW, S 1/2 NW, S 1/2	Exxon Corporation 1251 Avenue of the Americas New York, N.Y. 10020
Town of Nashville:		
Section 31:	N 1/2 N 1/2	Exxon Corporation New York, N.Y. 10020
	SE NE, E 1/2 SE - Option to Purchase	Virgil W. Moore 4 Patricia Lane Prospect Heights, Illinois 60070
Town of Lincoln:		
Section 32:	Entire Section	Exxon Corporation New York, N.Y. 10020
Section 33:	NW NW - Option to Purchase	Virgil Richter 450 Lincoln Drive Apt. 120 Twin Lakes, WI 53181
	SW NW, NW SW - Mining Lease	Gerald K. Solpers 1427 Polier Street Green Bay, WI 54301
	SW SW - Option to Purchase	J. Smits 818 Virginia Dr. DePere, WI 54115
	SE SW - Option to Purchase	Eugene Baeten R. 2 Green Bay, WI 54301
T35N-R12E:		
Town of Nashville:		
Section 23:	Portion of NE 1/4 - Optioned for 200 feet Road ROW	Thomas A. Mihalko, et ux R. 1 Crandon, WI 54520

Location	Description	Owner
T35N-R12E:		
Town of Nashville:		
Section 24:	NE NE, W 1/2 NE, NW, NE SW, SE - Optioned for 200 feet Road ROW	Mihalko Land and Logging Co., Inc. R. 1 Crandon, WI 54520
	Portion of SE NE - Optioned for 200 feet Road ROW	S. N. Moe, et ux 1129 Primrose Court Neenah, WI 54956
Section 25:	E 1/2 NE, SE	Exxon Corporation New York, N.Y. 10020
Section 36:	NE 1/4, less tract owned by Adeline Vollmar R. 1, Crandon, WI 54520, and lakelot properties, NW 1/4, E 1/2 SW 1/4	Exxon Corporation New York, N.Y. 10020
T34N-R13E:		
Town of Nashville:		
Section 4:	NW 1/4 - Mining Lease	Connor Forest Industries P.O. Box 847 Wausau, WI 54401
Section 5:	Entire Section - Land Exchange Option	Owens-Illinois, Inc. P.O. Box 1035 Toledo, OH 43666
Additionally	All Town Roads in the Town of Nashville in the following sections are covered by a Mining Lease: T35N-R13E: Section 31 T35N-R12E: Sections 25 and 36 T34N-R13E: Sections 4 and 5	

Location	Description	Owner
Pipeline Easements:		
T35N-R12E:		
Town of Nashville:		
Section 25:	Portion of NE SE, SE SE, SW SE, owned for 50 foot Pipeline ROW (also included in Project boundary description)	Exxon Corporation 1251 Avenue of the Americas New York, N.Y. 10020
Section 36:	Portion of N 1/2 NE owned for 50 foot Pipeline ROW (also included in Project boundary description)	Exxon Corporation New York, N.Y. 10020
Section 36:	Portion of N 1/2 NW, owned for 50 foot Pipeline ROW (also included in Project boundary description)	Exxon Corporation New York, N.Y. 10020
Section 35:	Portion of NE NE, owned for 50 foot Pipelne ROW	Exxon Corporation New York, N.Y. 10020
	Portions of SE NE and SE NW, 50 foot Water Pipeline Easement	Mihalko Land and Logging Co. R.F.D. 1 Crandon, WI 54520
	Portion of NE SW, 50 foot Water Pipeline Easement	Tom and Arlene Tambellini R.F.D. 6 Rhinelander, WI 54501
	Portion of NW SE, 75 foot Water Pipeline Easement	Patrick and Susie Phalen, Jr. 3059 Hwy. CC Slinger, WI 53086
Section 34:	Portion of NE NE, 75 foot Water Pipeline Easement	Patrick and Susie Phalen, Jr. Slinger, WI 53086
	Portions of S 1/2 NE, NW NE, 75 foot Water Pipeline Easement	Patrick and Lillian Phalen R.F.D. 1 Crandon, WI 54520
	Portions of Government Lot 4, 10-50 foot Water Pipeline Easement	Hobert R. and Faye M. LeMaster 1711 54 Street Court Moline, IL 61265
	Portion of SW NW, 25 foot Water Pipeline Easement	Robert and Helen Jacobsen R.F.D. 1 Crandon, WI 54520

Location	Description	Owner
Pipeline Easements:		
T35N-R12E:		
Town of Nashville:		
Section 33:	Portion of S 1/2 NE, 25 foot Water Pipeline Easement Portion of SE NW, 50 foot Water Pipeline Easement	Robert and Helen Jacobsen R.F.D. 1 Crandon, WI 54520
	Portion of N 1/2 SW, 50 foot Water Pipeline Easement	David J. and Edward F. Bula R. 1, Box 698 Crandon, WI 54520
Section 32:	Portion of NE SE, 50 foot Water Pipeline Easement	David J. and Edward F. Bula R. 1, Box 698 Crandon, WI 54520
	Portions of NW SE, NE SW, SE NW, Water Pipeline Easement. Portions of E 1/2 NW	John Schallock Flossie Schallock Neil Schallock Alpha Schallock Crandon, WI 54520
Lake Bed Ownership Within Project Area:		
T35N-R13E:		
Town of Lincoln:		
Section 30:	Portion of E 1/2 SE; that portion underlying Skunk Lake	State of Wisconsin
Section 32:	Portion of W 1/2 SW: that portion underlying Duck Lake	State of Wisconsin
Town of Nashville:		
Section 31:	Portion of E 1/2 SE; that portion underlying Duck Lake	State of Wisconsin

Response:

Table A-9 (attached) has been amended pursuant to the DNR's comments on Table 1.1-2 of the EIR. This table contains a supplemental list of potential federal permits required to begin construction. Also, actions by the Wisconsin Department of Industry, Labor and Human Relations are included.

Many federal programs that would otherwise be applicable are administered by the state. It is assumed that the state will remain or become qualified to administer the following federal programs: National Pollution Discharge Elimination System; Resource Conservation and Recovery Act Solid Waste Disposal programs; Clean Air Act - non-PSD aspects; and Safe Drinking Water Act.

We acknowledge the comment that an operating license for the MWDF is not required prior to construction and that this license would not be issued until after the facility has been constructed. Table A-9 has been revised accordingly.

Comment No. 5

Section A, Item 12 - Unless Exxon can definitively demonstrate an alternate use for the access road, reclamation costs for the road should be included. The reclamation costs presented in Table A-12 must be further itemized and broken down to unit costs. If these are not available, a discussion of how the costs were derived should be included.

Response:

Some of the land agreements associated with the access road right-of-way allow the adjacent landowner the use of the access road. Undoubtedly, over the Project life, some use of the access road will have been established by an adjacent landowner, thereby precluding reclamation of the access road by Exxon Minerals Company.

However, for completeness in presenting total potential reclamation costs the access road has been included. For this estimate the reclamation planned for the access road includes removing the pavement and stone base, performing minor regrading, and establishing vegetation in the disturbed areas. Removal of the Swamp Creek crossing structure is also included.

The following data reflect total estimated Project reclamation costs with the access road included. The attached table and supporting cost data for the reclamation of the various facilities or facility groups include the breakdown used in estimating the total cost.

PERMITS REQUIRED TO BEGIN CONSTRUCTION OF THE CRANDON PROJECT

Statutory Obligation	Administering Agency	Activity	Action
FEDERAL			
33 U.S.C. 1344	U.S. Army Corps of Engineers	Dredge or fill permits for activities in or impacting navigable streams or wetlands	Permit issuance
30 U.S.C. 801 et seq	Dept. of Labor-Mine Safety & Health Administration	File legal identity report	
42 U.S.C. 300 h et seq	EPA	Possible well injection of ground water, placement of backfill sands below ground water aquifer.	Issue Class V permit
33 U.S.C. 1321	EPA	Spill prevention control counter measure plan (40 CFR 112.7)	Have plan on file and before operations begin
49 U.S.C. 1348	FAA	Registration with FAA of a structure that will exceed 200 feet above ground level	Determine that head-frame is not an air navigational obstruction
16 U.S.C. 470F	Advisory Counsel on Historic Preservation	Monitors actions of federal government which may involve sites having buildings, structures, or objects eligible for inclusion in the National Register	Coordinate with U.S. Army Corps of Engineers

PERMITS REQUIRED TO BEGIN CONSTRUCTION OF THE CRANDON PROJECT

Statutory Obligation	Administering Agency	Activity	Action
18 U.S.C. 843	Bureau of Alcohol, Tobacco and Firearms	Explosives user permit	Permit issuance

Many federal programs that would otherwise be applicable are administered by the state. It is assumed that the state will remain or become qualified to administer the following federal programs: National Pollution Discharge Elimination System; Resource Conservation and Recovery Act Solid Waste Disposal programs; Clean Air Act -- non-PSD aspects; and Safe Drinking Water Act.

STATE

Wis. Stat. 23.11	DNR	EIR submittal	Determine adequacy
Wis. Stat. 30.12	DNR	Placement of structures	Permit issuance
Wis. Stat. 30.12	DNR	Placement of riprap	Permit issuance
Wis. Stat. 144.855(2)	DNR	Diversion of surface water	Permit issuance
Wis. Stat. 30.19(1)(c)	DNR	Grading of banks	Permit issuance
Wis. Stat. 30.20 (1)	DNR	Dredging	Permit issuance
Wis. Stat. 31.23	DNR	Bridges	Permit issuance
Wis. Stat. 86.07	Dept. of Transportation	Permit to connect mine access road to State Highway 55 and to run water discharge pipeline underneath Highway 55	Permit issuance

(TABLE FOR RESPONSE TO COMMENT NO. 4)

PERMITS REQUIRED TO BEGIN CONSTRUCTION OF THE CRANDON PROJECT

Statutory Obligation	Administering Agency	Activity	Action
Wis. Stat. 28.11(11)	DNR - Forest County	Withdrawal of land within project site boundary from County forest status	Approval of withdrawal application filed on December 2, 1980 with DNR
Wis. Stat. 101.15	DILHR	Mine shaft sinking, hoisting and ventilation of underground workings	Review mining activities and issue all applicable permits (see letters dated May 3, 1983 and August 30, 1983 between DILHR and Exxon for a more specific listing of required approvals
Wis. Stat. 101.12	DILHR	Surface building plans, blasting procedures	Review and approve applicable construction procedures and building plans and issue applicable permits
Wis. Stat. 145.02	DILHR	Plumbing and fire protection	Review and approve plans and issue applicable permits
Wis. Stat. 145.025(2)(e)	DNR	High capacity wells	Permit issuance
Wis. Stat. 144.04	DNR	Waste water treatment system	Plan approval

PERMITS REQUIRED TO BEGIN CONSTRUCTION OF THE CRANDON PROJECT

Statutory Obligation	Administering Agency	Activity	Action
Wis. Stat. 145.19, 145.20, 147.02	DILHR, Forest County and DNR	Private sewage system	Permit issuance (county) and review and approve final plans (DILHR, DNR)
Wis. Stat. 144.392, 144.391	DNR	Air emission	Permit issuance
Wis. Stat. 144.44, 144.46	DNR	Mine Waste Feasibility Report, Plan of Operation	Approval
Wis. Stat. 144.85	DNR	Mining	Permit issuance
Wis. Stat. 59.971	Forest County, DNR	Placement of mining structures in shoreland/ wetland zoning districts	Adopt Shoreland zoning ordinances in accordance with NR115; approve the placement of such structures in the zoning districts
Wis. Stat. Chap. 147	DNR	Water discharge	Permit issuance
Wis. Stat. Chap. 162	DNR	Potable water supply	Review and approve final plans

LOCAL

The Town of Lincoln has a zoning ordinance. It is expected that the Town of Nashville will have an ordinance relating to mining.

(TABLE FOR RESPONSE TO COMMENT NO. 5)

TOTAL ESTIMATED RECLAMATION COSTS FOR THE CRANDON PROJECT IN 1982 DOLLARS

Facility or Facility Group	Reclamation Year(s)*	Cost (K$)
Access Road	37	$350
Railroad Spur	37	500
Haul Road and Tailings Transport Corridor	35	100
Mine/Mill Site Area	33-37	8,000
Mine Waste Disposal Facility		
Tailings Pond T1	11	4,000
Tailings Pond T2 (Partial)	16	2,000
Tailings Pond T3	25	5,000
Tailings Pond T4 and T2	33-35	10,000
Reclaim Ponds R1 and R2	33-35	1,000
Excess Water Discharge System	35	10
Mine	33	300
TOTAL PROJECT RECLAMATION COST		$31,260

*Start of Project construction in year 1.

(SUPPORTING DATA FOR RESPONSE TO COMMENT NO. 5)

Access Road	Cost (K$)
Remove bituminous concrete pavement 45,000 yd^2 @ \$2/yd^2	\$90
Remove crushed aggregate base course 35,000 yd^3 @ \$2/yd^3	70
Regrading 100,000 yd^2 @ \$0.5/yd^2	50
Vegetation (seed and fertilizer) 100,000 yd^2 @ \$0.5/yd^2	50
Remove Swamp Creek Crossing Structure	50
Contingency	40
TOTAL ESTIMATED RECLAMATION COST	\$350

RECLAMATION COSTS

Railroad Spur

(Salvage value not included)

Remove track and ties 28,000 ft @ \$10/ft	\$280
Remove ballast and subballast 50,000 yd^3 @ \$2/yd^3	100
Regrading 80,000 yd^2 @ \$0.5/yd^2	40
Vegetation (seed and fertilizer) 80,000 yd^2 @ \$0.5/yd^2	40
Remove Swamp Creek Crossing Structure	10
Contingency	30
TOTAL ESTIMATED RECLAMATION COST (with no salvage value included)	\$500

(SUPPORTING DATA FOR RESPONSE TO COMMENT NO. 5 CONTINUED)

RECLAMATION COSTS	Cost(k$)
Rock Haul Road and Tailings Transport Corridor	
Buried Pipe Removal	
Excavation - 5,000 yd^3 @ $2/$yd^3$	10
Pipe Removal - 10,000 ft @ $2/ft	20
Backfill and Cover with 0.5 Foot Soil	
10,000 yd^3 @ $3/$yd^3$	30
Regrading	
30,000 yd^2 @ $0.5/$yd^2$	15
Vegetation (seed and fertilizer)	
30,000 yd^2 @ $0.5/$yd^2$	15
Contingency	10
TOTAL ESTIMATED RECLAMATION COST	$100

RECLAMATION COSTS	Cost (K$)
Mine/Mill Site Area	
Building Demolition	
25,000,000 ft^3 @ $0.10/$ft^3$	$2,500.0
Pavement Removal (asphalt and concrete)	
100,000 yd^2 @ $5.00/$yd^2$	500.0
Foundations/Slabs Removal	
25,000 yd^3 @ $60/$yd^3$	1,500.0
Pipe Removal	
40,000 ft @ $5.00/ft	200.0
Railroad Track and Tie Removal	
10,000 ft @ $10.00/ft	100.0
Site Regrading and Topsoil Replacement	
280,000 yd^3 @ $3.00/$yd^3$	840.0
Turf Establishment	
100 acres @ $2000/acre	200.0
Contingency	2,160.0
TOTAL ESTIMATED RECLAMATION COST	$ 8,000.0

RECLAMATION COSTS

Mine Waste Disposal Facility

Tailings Pond T1 (Construction Phase 3)	Cost (K$)
Grading Cover	
714,000 m^3 @ $1.38/$m^3$	$ 984.3
Bentonite Cap	
50,000 m^3 @ $20.69/$m^3$	1034.4
Overdrain	
66,000 m^3 @ $10.29/$m^3$	679.4
Cover Layer	
304,000 m^3 @ $1.76/$m^3$	534.0
Turf Establishment	
53 ha @ $2900/ha	153.7
Contingency	614.2
Subtotal	$4000.0

Tailings Pond T2 (Partial Reclamation) (Construction Phase 4)	
Grading Cover	
1,132,000 m^3 @ $1.42/$m^3$	$1601.9
Turf Establishment (Partial)	
15 ha @ $2900/ha	43.5
Contingency	354.6
Subtotal	$2000.0

Tailings Pond T3 (Construction Phase 5)	Cost (K$)
Grading Cover	
928,000 m^3 @ $1.53/$m^3$	$1424.1
Bentonite Cap	
59,000 m^3 @ $21.43/$m^3$	1264.4
Overdrain	
79,000 m^3 @ $10.20/$m^3$	805.6
Cover Layer	
360,000 m^3 @ $1.84/$m^3$	662.0
Turf Establishment	
55.5 ha @ $2900/ha	161.9
Contingency	682.0
Subtotal	$5000.0

Tailings Pond T2 and remaining T2 reclamation (Construction Phase 6)	
Grading Cover	
1,071,000 m^3 @ $1.55/$m^3$	$1655.3
Bentonite Cap	
173,000 m^3 @ $20.09/$m^3$	3475.8
Overdrain	
230,000 m^3 @ $10.24/$m^3$	2354.2
Cover Layer	
1,053,000 m^3 @ $1.50/$m^3$	1584.0
Turf Establishment (Partial)	
141.5 ha @ $2900/ha	410.4
Contingency	520.3
Subtotal	$10,000.0

(SUPPORTING DATA FOR RESPONSE TO COMMENT NO. 5 CONTINUED)

Reclaim Ponds R1 and R2	Cost (K$)
Regrading	
402,000 m^3 @ $1.29/$m^3$	518.2
Turf Establishment	
30.0 ha @ $2900/ha	87.0
Contingency	394.8
Sub Total	$ 1,000.0
TOTAL ESTIMATED MWDF AND RECLAIM POND RECLAMATION COST	$22,000.0

Reclamation Costs

Excess Water Discharge System

Concrete plugs at pipe ends, remove discharge structure and riprap, regrade disturbed areas Turf establishment as necessary	
TOTAL ESTIMATED RECLAMATION COST	$ 10.0

Reclamation Costs

Mine

Concrete plugs for the four shafts at overburden/bedrock interface, backfill to surface	
TOTAL ESTIMATED RECLAMATION COST	$ 300.0
GRAND TOTAL ESTIMATED RECLAMATION COST	$31,260.0

Comment No. 6

Section A, Item 13 - Table A-13 states that one of the owners in Section 33, T35N, R13E is John Campshure but Figure A-8 shows John Campshire.

Response:

The correct spelling of the landowner in Section 33, T35N, R13E, is John Campshure. Figure A-8 will be revised to the correct spelling.

Comment No. 7

Section A, Item 14 - Are the Wetlands Assessment Report and Inventory considered part of this permit application? If not, maps should be provided to show the proposed site and the potentially affected wetlands. If the reports are part of the application, they should be attached.

Response:

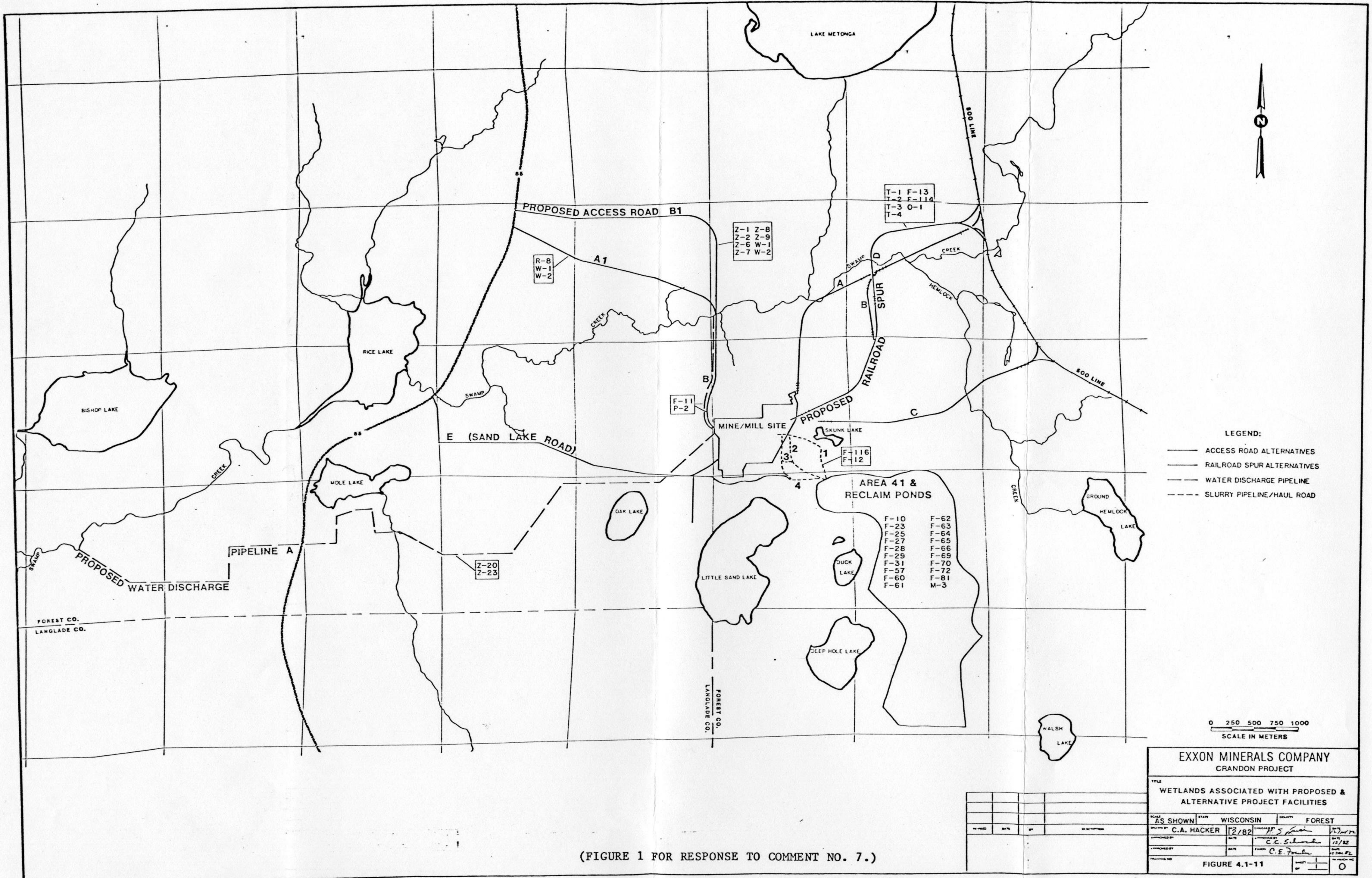
The Wetland Assessment Reports dated August 1982 and August 1983 are not considered part of the Mining Permit Application. Figures 1 through 8 (attached) will be included in the revised Section A, Item 14 of the Mining Permit Application to show wetlands that could potentially be affected by proposed or alternative Project facilities.

Comment No. 8

Contrary to what is stated in the application, since area 41 is hydrologically upgradient of area 40, then area 41 has to have as much, if not more, downgradient domestic use of groundwater.

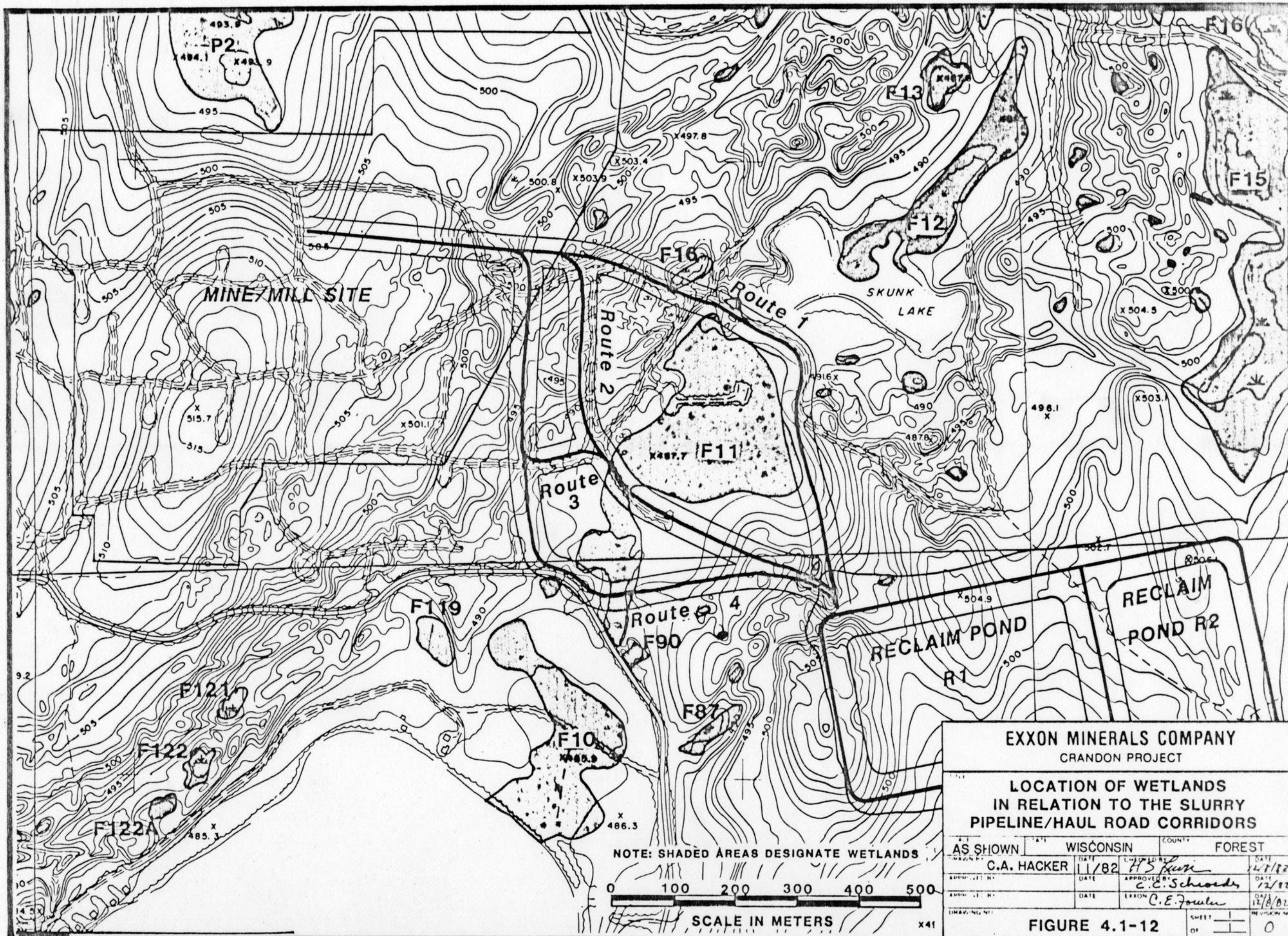
Response:

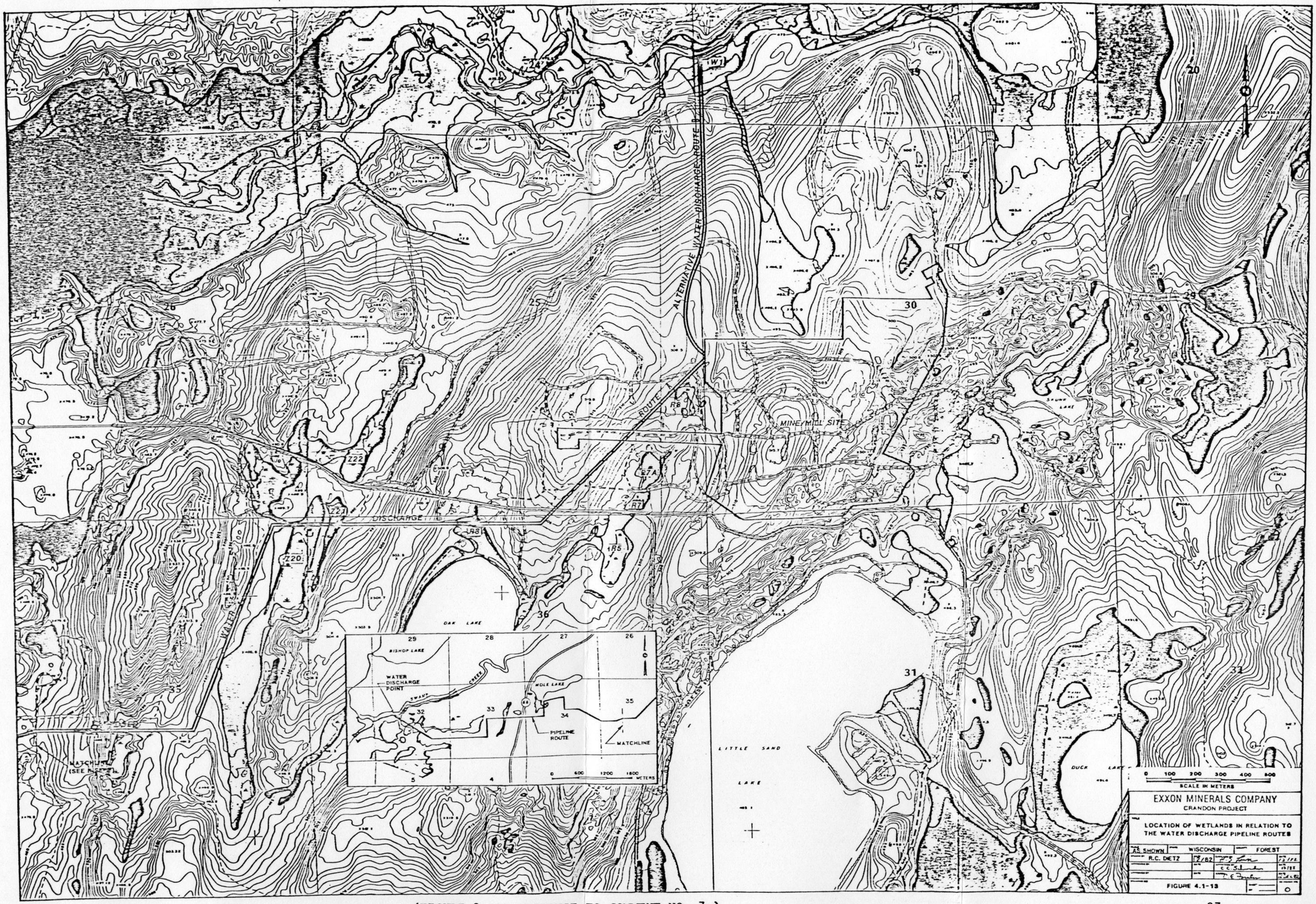
The Mine Permit Application is correct as stated. Area 41 is a recharge area with ground water flow both to the southwest and to the eastern section of the site (i.e., northeast and southeast). Approximately half of this ground water flow is in a direction (i.e., easterly) where there is no major domestic use of ground water. Additionally, a large portion of this area is county or private forest land, and therefore, is not currently available for major domestic use of ground water. Area 40 has its total ground water flow to the south-southwest of the site, so that all of the ground water which goes through this area is available for domestic use. These gradients can be seen in EIR Section 2.3, Figure 2.3-4.



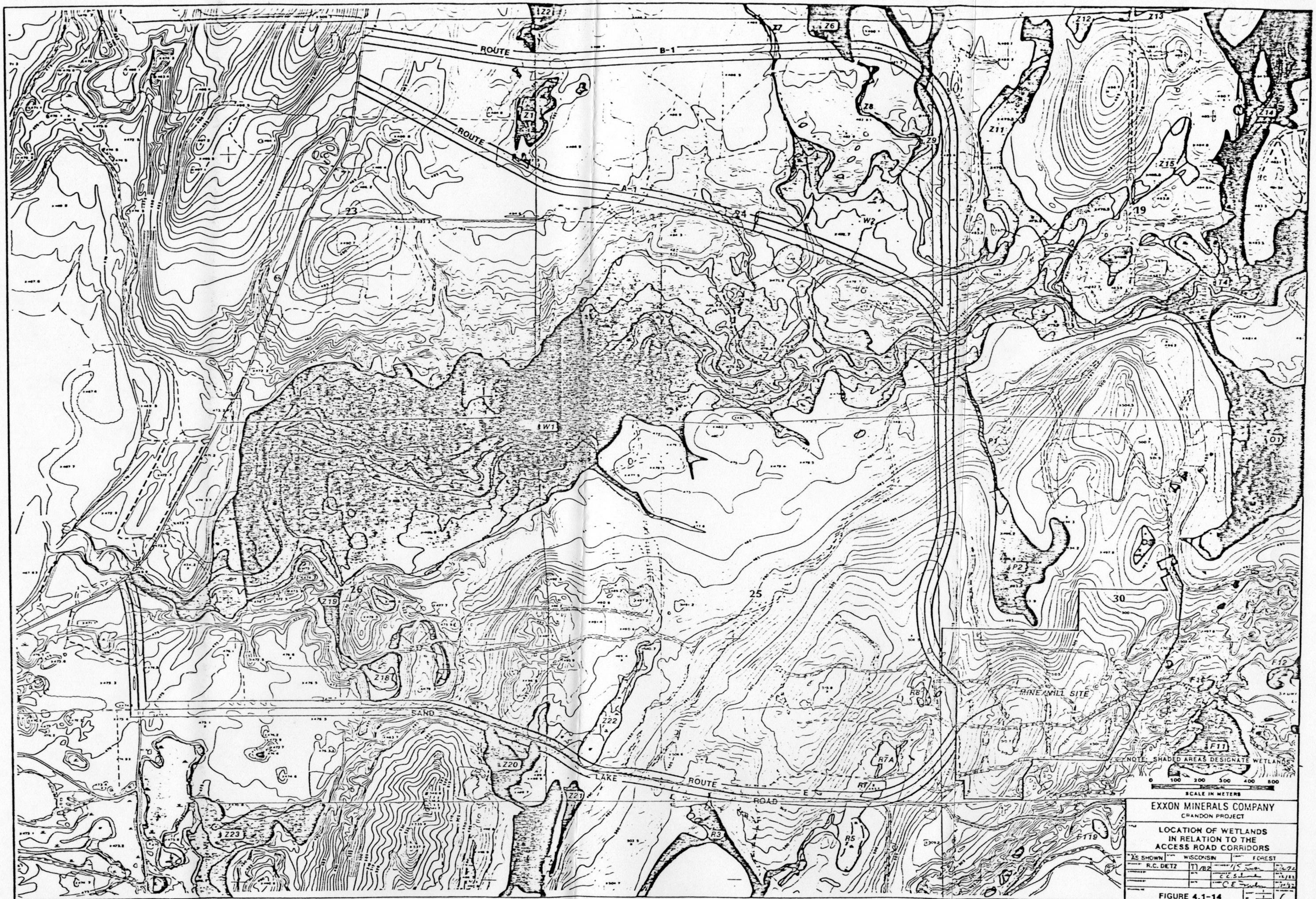
(FIGURE 1 FOR RESPONSE TO COMMENT NO. 7.)

(FIGURE 2 FOR RESPONSE TO COMMENT NO. 7.)





(FIGURE 3 FOR RESPONSE TO COMMENT NO. 7.)



(FIGURE 4 FOR RESPONSE TO COMMENT NO. 7.)

(FIGURE 5 FOR RESPONSE TO COMMENT NO. 7.)

(FIGURE 6 FOR RESPONSE TO COMMENT NO. 7.)

(FIGURE 7 FOR RESPONSE TO COMMENT NO. 7.)

(FIGURE 8 FOR RESPONSE TO COMMENT NO. 7.)

SECTION A, ITEM 15

Comment No. 9

Groundwater - The monitoring requirements related specifically to the MWDF will be finalized through the Feasibility Report review and the Plan of Operation approval. These requirements will have to be included in the mining permit application once they have been established. Following are some preliminary comments pertaining to the proposed groundwater monitoring program.

Response:

Comment acknowledged and the monitoring requirements for the MWDF will be included in the revised Mining Permit Application when they have been finalized through the DNR's Feasibility Report review and Plan of Operation approval.

Comment No. 10

The proposed background and operational groundwater monitoring program as shown in Figure 1 is inadequate. More wells north of the mine/mill site and also around Little Sand Lake should be included. Also, more wells will be needed around the mine waste disposal facility in all directions and at variable depths.

Response

The details of the ground water monitoring program will be resolved through discussions with appropriate DNR staff. This resultant monitoring program will be included in the Monitoring and Quality Assurance Plan as part of the Mining Permit Application when it is finalized.

Comment No. 11

Pursuant to s. NR 182.075(1)(d)5, the parameters to be analyzed in the background ground water monitoring program for the MWDF must include all parameters with a primary or secondary drinking water standard. The list of parameters indicated on Table 1 does not include all of the secondary parameters.

Response:

NR 182.075(1)(d)5 is related to the ground water standards and the need to collect monitoring data "for at least 12 consecutive months prior to disposing of waste at the site to determine baseline water quality." The Monitoring and Quality Assurance Plan was submitted to fulfill the requirements of NR 132.06(3)(d) of the mine permit which requests submittal of a "...proposed monitoring...plan..." consistent with NR 182 and that this proposed plan would be considered at the s.144.836, Stats., hearing. NR 182.08(2)(e) 8 requires submittal of a monitoring program "...developed for...determining whether the proposed facilities meet all environmental standards." Further, the monitoring "Program design...should be based on ... quality and quantity of waste materials...".

Therefore, the proposed Monitoring and Quality Assurance Plan was designed to evaluate the MWDF's performance related to meeting the ground water standards. Several of the primary and secondary drinking water standards have no relation to the MWDF contents. For example, the MWDF will not contain organic chemicals such as endrin, lindane, and 2,4,5-TP Silvex. Similarly, foaming agents, color and odor are more directly applicable to wells and monitoring programs for community or public water supplies. Therefore, these parameters were not proposed for monitoring.

To estimate any organic compounds which might be found in the ground water from whatever source, total organic carbon (TOC) was proposed for the program. If for some unknown reason TOC concentrations measured are indicative of organic chemicals, more specific determinations could be completed from analyses at that time. Corrosivity is calculated from the Langelier Index. All parameters used to calculate this index are included in the monitoring program.

Comment No. 12

A monitoring plan should also include the backfill storage area.

Response:

A reappraisal of the mine plan and the stope development sequence has indicated that there is no longer a need to provide large volume surge storage capacity for backfill sands. As a result, this facility has been eliminated and all backfill material handling will be totally within the confines of the concentrator building.

It is now the intention to utilize the area previously designated for storage of backfill sands as an area for storage of preproduction ore. Prior to mill start-up, a maximum of 1,000,000 t (1,120,000 short tons) of uncrushed ore will be accumulated in the storage area. This material will be fully consumed during the early years of mill operation.

Comment No. 13

Oak Lake should be added to the list of surface waters to be sampled quarterly. The parameters to be analyzed in Oak Lake should correspond to the list in Footnote 3, Table 3.

Response:

The monitoring plan was based on potentially identified effects as warranted by the analyses in Chapter 4, Impacts. As a result, the predictions indicate no effect or impacts to Oak Lake, and the need for monitoring is not believed to be justified.

Comment No. 14

The parameters monitored on Swamp Creek at the proposed discharge location should correspond to the list of pollutants found in Exxon's effluent.

Response:

The parameters monitored in the effluent will be a condition of the WPDES Permit. Parameters monitored as part of the Swamp Creek sampling programs at the proposed discharge location will reflect the list of pollutants identified in the WPDES permit.

Comment No. 15

Suspended solids should be added to the monitoring list in Footnote 3, Table 3.

Response:

Comment acknowledged. Table 3 in the Monitoring and Quality Assurance Plan will be revised accordingly to include suspended solids in the list of parameters to be monitored.

Comment No. 16

Continuous stream flow recording should occur at Hemlock Creek (Station H) and Swamp Creek (Station S -- above Rice Lake). One additional station on Swamp Creek below Rice Lake (either at CTH "M" or in the vicinity of the proposed discharge) should be monitored continuously for stream flow. Quarterly flow monitoring, as proposed by Exxon, at Stations H, S and the proposed discharge location is simply inadequate to address the impacts of mine dewatering on surface water flows.

Response:

Table 3 will be revised to include continuous stream flow monitoring in Hemlock Creek (Station H) and in Swamp Creek at Station S. In addition to these locations, the USGS maintains continuous stream monitoring gages in Swamp Creek at County Trunk Highway M (i.e., downstream of Rice Lake) and at State Highway 55 as part of their statewide stream gaging program. The flow data collected at these locations will be used as part of the monitoring program.

Comment No. 17

Pickerel Creek, Creek 11-4 and Creek 12-9, which are tributaries to Rolling Stone Lake, may be adversely affected by mine dewatering especially during low flow periods. Therefore, these streams should be monitored for flows on a monthly basis from November through May and biweekly from June through October when flows are generally lower.

Response:

Projections developed for the EIR (see Appendix X) indicate that Pickerel Creek, Creek 11-4 and Creek 12-9 are outside the limit of the ground water drawdown zone of influence. Only Creek 12-9 has a small portion at its upper stream section which is within the projected 1 m drawdown contour. This upper stream section has less than 100 m potentially affected. Further, the projected drawdown of 1 m is within the historical ground water level changes for the area. These historical decreases in the ground water levels have not been identified as having an effect on these creeks and the modeling results support this. Therefore, surface water flow rate monitoring of these creeks is not proposed in the Monitoring and Quality Assurance Plan.

Comment No. 18

Table 3 lists the sampling frequency as quarterly for some parameters and annually for others for sampling locations on Swamp and Hemlock Creeks. How was the sampling interval determined for each of the parameters? Quarterly sampling for all the parameters is recommended.

Response:

The rationale for annual measurement of certain parameters was based on the low probability of those parameters being affected by the Project. We would agree to quarterly analyses of those parameters initially during the Project, with the idea that if we can prove over the first several years of operation that they are not affected, then the monitoring will be reduced to annual.

Comment No. 19

Will Exxon analyze the parameters under footnote 2 on a quarterly basis and those under footnote 3 on an annual basis?

Response:

See response to comment No. 18.

Comment No. 20

Table 3 lists Skunk Lake as a sampling location. However, the site for Skunk Lake is not included in Figure 4. Please clarify.

Response:

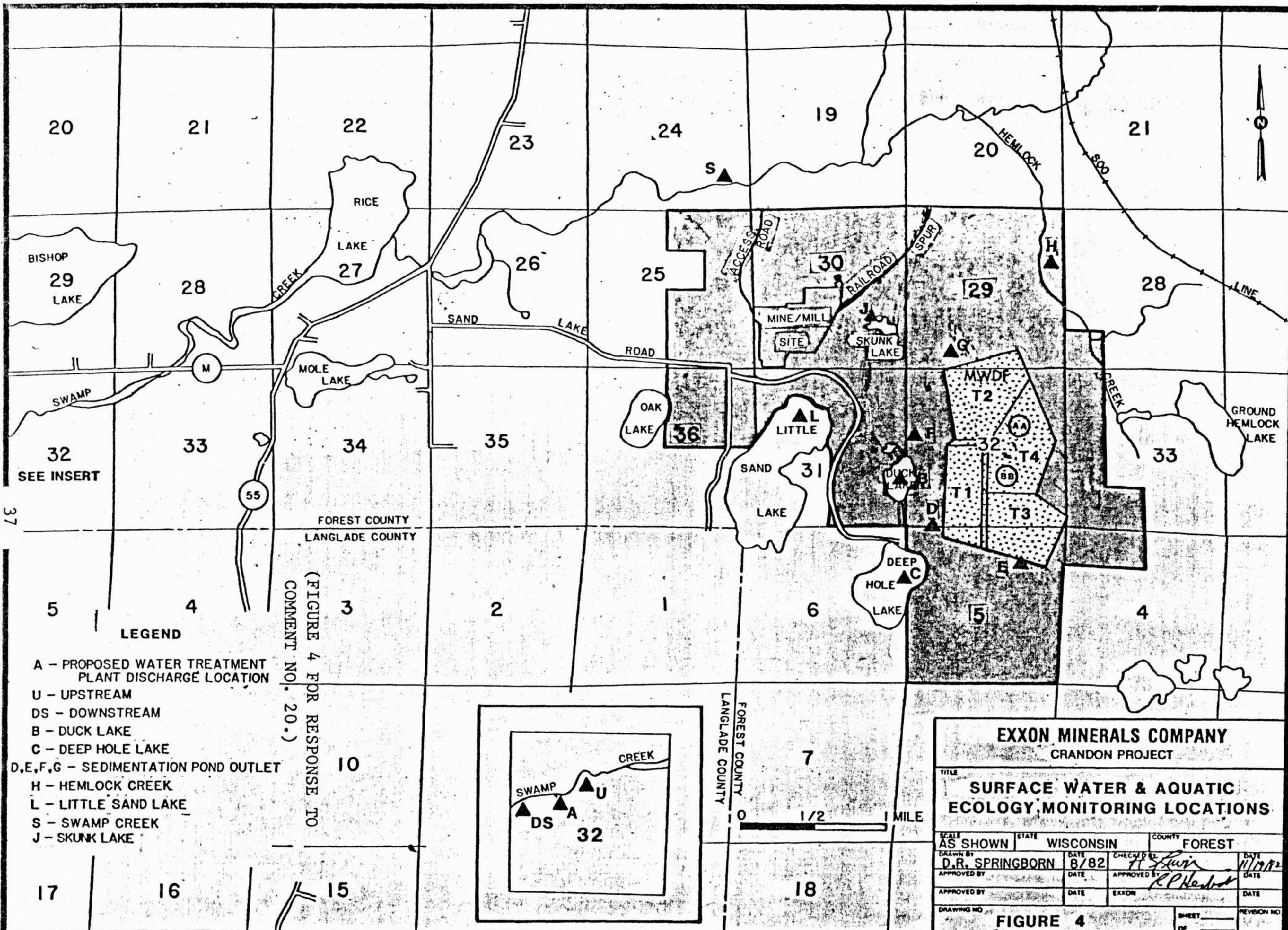
Figure 4 (attached) has been revised to include the location where monitoring will occur in Skunk Lake.

Comment No. 21

Hoffman Springs should be included in the surface water monitoring program.

Response:

Section 3.0, including Figure 4 and Table 3, in the Monitoring and Quality Assurance Plan will be revised to include Hoffman Springs in the surface water monitoring program. Hoffman Springs is located on the perimeter of the 1 m (3.3 feet) drawdown area; however, because it supports a brook trout population downstream in Hoffman Creek, it is considered a more sensitive water body than others in the immediate area. Also, the main source of water for the springs and Hoffman Creek is ground water.



(FIGURE 4 FOR RESPONSE TO COMMENT NO. 20.)

60

Comment No. 22

Parameter lists do not include suspended solids. This should be monitored especially during the construction period.

Response:

Table 3 will be revised to include suspended solids in the list of parameters to be monitored. Also, see response to comment No. 15.

Comment No. 23

In general, a discussion section summarizing potential problem areas and reasons for selecting sites to monitor the problem areas is needed. More specifically, the following questions and comments should be considered for inclusion in a discussion section covering monitoring rationale:

Response:

A brief rationale for the proposed monitoring program was provided as part of the introductory paragraphs for each major section (i.e., air quality, surface water) of the Monitoring and Quality Assurance Plan. Further discussion is presented below to correspond with specific comments of the DNR.

Comment No. 23a

Why were the particular sites on Swamp and Hemlock Creeks selected for study?

Response:

The particular sampling sites on Swamp and Hemlock creeks were selected because of their location related to baseline data collection, the major input sources of their water (see Figure 4 of the Monitoring and Quality Assurance Plan), and the location of any potentially projected effects of the Project. For example, proposed monitoring location H (i.e., Hemlock Creek) is below its major source of water which is Ground Hemlock Lake. It is also below the projected area along Hemlock Creek where Project facilities (i.e., MWDF) might have an effect. Therefore, this monitoring location will aid in determining what, if any, flow rate variations in Hemlock Creek occur at this location. When compared with historical information (i.e., literature and baseline data collections [see EIR Figures 2.4-1 and 2.4-2]), differences measured can be evaluated to determine what effect, if any, they may have.

A similar rationale was used for establishing monitoring location S (i.e., Swamp Creek) below its major tributaries (Outlet and Hemlock creeks) and the Project proposed access road and railroad spur. In addition, monitoring location S is above a USGS flow rate measuring gage at State Highway 55 which provides a long-term data base for comparative purposes.

Comment No. 23b

Why were only four lakes selected for study? Do these four lakes have the greatest potential for ecological impacts from the mine operation? If not, why weren't other lakes included for study?

Response:

In general these four lakes were selected for the monitoring program because of the potential projected effects of Project facilities. Although none of these lakes are projected to have ecological impacts from the mine operation, they are the closest surface water ecosystems to other Project facilities (i.e., railroad spur, MWDF) which may have a potential effect for which to monitor. That is the reason no other lakes were proposed for monitoring.

In addition, the parameters selected for monitoring measurements were chosen with the intent of determining any changes which occur, as soon as possible. Therefore, the designed monitoring program parameters emphasized physical-chemical parameters, many of which can give instantaneous indications of change (i.e., pH, specific conductance, copper). Biological parameters, such as chlorophyll-a, often provide data which are difficult to interpret and require a longer time-frame for analysis and evaluation (i.e., seasonal, yearly). Further, the biological community has inherent response mechanisms which are contradictory. For example, some populations have development patterns (i.e., spring "blooms") which may be totally unrelated to any short-term environmental change. In other cases, biological populations or communities may require decades to exhibit detectable differences related to environmental change. Therefore, biological parameters were considered secondary to physical-chemical parameters for monitoring changes related to Project activities. Biological parameters for monitoring can be selected after a physical-chemical parameter indicates such a need.

Comment No. 23c

Are the lakes to be sampled at different depths?

Response:

Yes, depending upon the parameter and sampling frequency. For example, quarterly sampling for such parameters as pH, temperature and specific conductance would be completed at different depths (i.e., through a "water column" from the surface to the basin). However, sampled parameters such as arsenic, cadmium, copper and selenium would be completed from a composite sample of different depths. Where lakes are sampled with a shallow basin (i.e., Skunk Lake), a single sample would be collected from mid-depth or 1 m (3.3 feet), whichever is deeper from the water surface.

Comment No. 23d

Productivity indicators like chlorophyll-a, total-P and secchi disc should be included in the lake sampling parameter list.

Response:

Productivity indicators such as chlorophyll-a were not included in the monitoring program because physical-chemical parameters are a more immediate and reliable indicator of water quality changes. For example, parameters such as specific conductance, temperature, pH, and copper concentrations would indicate a short- or long-term water quality change which might affect biological populations sooner than aquatic community changes. Further, aquatic community changes such as seasonal blooms are most often related to internal cycling mechanisms in ecosystems. Therefore, measured parameters such as chlorophyll-a concentrations can be unreliable and difficult to evaluate, especially for water quality changes.

Comment No. 23e

Sedimentation pond monitoring should be event-related (sample collection just after significant rainfall and snowmelt events).

Response:

Comment acknowledged and the Monitoring and Quality Assurance Plan will be revised accordingly.

Comment No. 23f

Sedimentation pond should also be sampled for metals, suspended solids and oil and grease.

Response:

Comment acknowledged and the Monitoring and Quality Assurance Plan will be revised accordingly.

Comment No. 23g

Any surface receiving waters of sedimentation pond discharges should be monitored for water quality impacts.

Response:

The Monitoring and Quality Assurance Plan included this consideration in selection of the monitoring locations. There are no unidentified surface waters which will ultimately receive sedimentation pond discharges that are not monitored. The proposed water quality measurements at these locations (i.e., sedimentation ponds and receiving water bodies) will enable an evaluation of any water quality impacts from the sedimentation pond discharges.

Comment No. 23h

Will the annual creek water chemistry samples be limited to metals and nitrate analysis, or will they also include the general quarterly parameter coverage?

Response:

See the response to comment No. 18.

Comment No. 24

Discharge monitoring from the water treatment plant will be required and specified in the WPDES permit. Daily, weekly and monthly monitoring may be required for various pollutants dependent on the toxicity of the pollutant and possibly the volume of discharge.

Response:

Comment acknowledged.

Comment No. 25

Sampling of the runoff from the sedimentation ponds will again be dictated by the WPDES permit. The frequency will depend on the projected contaminants. The parameters which at a minimum will be required include total suspended solids, pH, alkalinity and oil and grease where appropriate. Limitations may be imposed for any or all of these parameters.

Response:

Comment acknowledged.

AQUATIC ECOLOGY

Comment No. 26

This section states that biological parameters will only be examined at the three locations on Swamp Creek in the vicinity of the discharge. It is essential to monitor the aquatic ecology of all of the surface waters where potential impacts could occur from construction activities, dewatering and the discharge.

Response:

The rationale for selection of surface water monitoring locations is presented in the response to comment No. 23. The rationale for the aquatic biology sampling locations is also included in the response to comment No. 23.

Comment No. 27

In general, much more detail is needed for describing the aquatic ecology study plan.

a. Periphyton <u>or</u> aquatic macrophyte populations are scheduled for study. Which components will actually be studied and on what schedule?

b. What collection methods will be used for fish, invertebrates, periphyton and/or macrophytes?

c. There is no mention of data analysis for macrophytes. Which benthos taxa will be saved for tissue analysis? What analyses will be conducted on the tissue? There is no mention of Biotic Index (BI) analysis of benthos samples (BI analysis is being performed on Swamp Creek baseline samples). What is "total numbers" analysis of benthos data - per unit area, per station, or what? Will any qualitative benthos data be collected? From what habitat types will benthos be collected?

Response:

A preliminary sampling schedule for the Aquatic Ecology Monitoring Program is presented in the attached table. The parameters that will be sampled during each phase of Project development (preconstruction, construction and operation) are included in this table.

a. Aquatic macrophyte populations will be sampled as part of the Aquatic Ecology Monitoring Program (see attached table). Swamp Creek will be sampled in alternate years during the summer season at three locations.

Sampling of these populations for species composition and relative abundance and for tissue analysis will be initiated one year prior to construction and will continue through the construction phase and through the third year of operation. The results of the monitoring program will be evaluated at the end of the third year of operation and will serve as the basis for determining the scope of any future monitoring.

b. The methods for sampling macroinvertebrate and fish populations in Swamp Creek will be comparable to those described in the August 1983 report by Ecological Analysts, Inc. entitled "Aquatic Biology of Swamp Creek for the Crandon Project." The following sampling methods will be used:

Macroinvertebrates

Two replicate Ponar grab samples will be collected from each major substrate type (sand, silt and gravel - if present) at each of the three locations during spring, summer and autumn. To ensure complete representation by all taxa present at each location and to provide specimens for tissue analysis, organisms associated with all available habitats (e.g., aquatic vegetation [nearshore and midstream], low and high current velocity areas, underwater structures [branches and logs]) will be sampled by qualitative hand-picking, dip netting and kick-sampling. To maintain comparability between locations, qualitative sampling will consist of 30 man-minutes of collection effort at each location. Also, separate qualitative samples will be collected at each of the three locations in order to calculate Hilsenhoff's biotic index. Sampling to determine biotic index will be performed in accordance with the procedures utilized by the DNR.

(TABLE FOR THE RESPONSE TO COMMENT NO. 27)

AQUATIC ECOLOGY MONITORING PROGRAM FOR THE CRANDON PROJECT

Water Body/ Biological Component	Year	Pre-Construction	Construction				Operation		
		1	1	2	3	4	1	2	3
Swamp Creek									
Aquatic Macrophytes		X	X		X		X		X
Macroinvertebrates		X	X		X		X		X
Fish		X	X		X		X		X
Tissue Chemistry									
Aquatic Macrophytes		X	X		X		X		X
Macroinvertebrates		X	X		X		X		X
Fish		X	X		X		X		X

Fish

Fish populations will be sampled at each of the three locations during spring and autumn. Electrofishing will be conducted at each location over a 305 m (1000 feet) long stretch of stream. Seining also will be conducted at each of the three locations. Upstream and downstream seining will be conducted depending on stream depth and current speed. The number of seine hauls per location may vary according to the number of habitats available and the number of species in the resident fish community. Fish specimens for tissue analysis will be collected by electroshocking and/or seining.

A qualitative survey of aquatic macrophytes will be conducted at each of the three sampling locations to determine species composition and relative abundance. Both stream banks and the channel area will be visually inspected over a minimum 305 m (1000 feet) stretch of the stream to record the species present. The relative abundance of each species will be based on the frequency of occurrence of a given species over the area surveyed at each location.

One or more aquatic macrophyte species that are common to each of the three locations will be selected for tissue analysis. To the extent possible, the aquatic macrophytes will be collected within randomly located quadrats at each of the locations. Samples will be collected from a sufficient number of quadrats (size to be determined by contractor) until an adequate sample size is obtained. Duplicate samples will be analyzed at each location.

c. As indicated under item b above, aquatic macrophytes will be analyzed in the field for species composition and relative abundance. In the laboratory, the samples will be analyzed for metal (i.e., arsenic, cadmium, copper, lead, mercury, zinc) concentrations.

The macroinvertebrate taxa collected for tissue analysis may include crayfish (Orconectes spp.), clams (Fusconaia sp. and Lampsilis spp.) and snails (Campeloma sp.).

All tissues (aquatic macrophytes, macroinvertebrates and fish) will be analyzed for metal concentrations (as indicated above).

As indicated under item b above, qualitative macroinvertebrate samples will be collected for biotic index analysis. These samples will be collected in accordance with procedures utilized by the DNR to ensure compatibility.

Macroinvertebrate density per unit area will be determined from the samples collected with the Ponar dredge. Macroinvertebrates taxa collected by qualitative sampling will be counted (up to a maximum of 25 organisms) and assigned a relative abundance based on the number of each species in the sample.

As indicated under item b above, qualitative macroinvertebrate samples will be collected at each of the three locations. The qualitative samples will be collected by hand-picking, dip netting and kick sampling all available habitats. Also, qualitative samples will be collected for biotic index analysis.

Quantitative samples (Ponar dredge) of macroinvertebrates will be collected in each major habitat (sand, silt and gravel-if present) at each of the three locations. Organisms associated with all other habitats (e.g., aquatic vegetation [nearshore and midstream], low and high current velocity areas, underwater structures [branches and logs]) will also be collected by qualitative sampling.

AIR QUALITY

Comment No. 28

The location of monitor A makes it an upwind rather than a downwind monitor since wind directions recorded at the project site are predominantly from the south through west and northwest while winds from the east and northeast are rare (see Figure 2.1-2 through 2.1-9 in the EIR). A more in-depth analysis of wind data would be necessary to determine the best monitor locations, but it is suggested that monitor A would be better located if it were north of the mine waste disposal facility since winds from the south were recorded quite frequently at the project site. Better justification for the locations of the proposed monitors should be provided.

Response:

The location of air quality monitoring stations will be established as part of the Air Permit.

Comment No. 29

Page 15, Second Paragraph - It is stated that TSP (total suspended particulate) will be monitored at all sampling locations and that the samplers used will be able to distinguish particles larger and smaller than 10 microns in diameter. Does this mean that each TSP sample will actually be collected as two separate samples, one with particles greater than 10 microns in diameter and one with particles less than 10 microns in diameter? A more detailed explanation is in order here.

Response:

The monitoring program for TSP was discussed with the DNR's Bureau of Air Management. The TSP sampler will be a dichotomous sampler currently available on the market.

Comment No. 30

The dust from the MWDF could contain high levels of sulfides. The total particulates should be analyzed for sulfur to determine possible acid generation in adjacent surface waters, i.e., Duck, Deep Hole, and Little Sand Lakes.

Response:

Comment acknowledged.

TERRESTRIAL ECOLOGY

Comment No. 31

How will wildlife activity be monitored in the vicinity of the mining site?

Response:

The results of established wildlife monitoring programs conducted by the Wisconsin DNR, Bureau of Research and Bureau of Wildlife Management will be used to monitor wildlife populations. Any additional monitoring will be determined jointly with the DNR.

SECTION B, ITEM 2

Comment No. 32

Neither self-bonding nor a demonstration of net worth are acceptable methods of satisfying the financial responsibility requirements of the applicable law or code. Section 144.86(1), Stats., specifies a bond furnished by a surety company licensed to do business in Wisconsin, cash deposit, certificate of deposit or government securities as the acceptable methods of meeting the financial responsibility provisions. Does Exxon plan on submitting a bond to cover reclamation of the entire site or will the bond be updated annually according to the amount of surface disturbance? If the latter method is preferred a detailed schedule showing the disturbance which will take place every year over the life of the project is required.

Response:

Under the provisions of NR 182.17 the financial responsibility requirements of NR 132 and NR 182 are to be coordinated in such a manner that "a demonstration of financial responsibility by whatever means shall not be required twice for the same obligation regardless of whether the same is set forth in more than one chapter of the administrative code."

Accordingly, Exxon Minerals Company will use the "net worth test" method (proposed NR 182.17[3][f]) of providing proof of financial responsibility for all facilities covered by NR 182. At this time it is envisioned that the financial responsibility for the remaining mining facilities will be provided by a bond. The bond will be updated as the amount of surface disturbance changes.

SECTION C

Comment No. 33

For the record it should be noted that the fee ($10,000) will be adjusted to reflect the actual cost of evaluation.

Response:

Comment acknowledged.

SECTION D - MINE PLAN

Comment No. 34

General - Exxon refers to a number of state and federal regulations which must be complied with during the course of the project. However, Exxon does not reference the specific Administrative Code or federal rule which must be complied with. Examples of this occur in the following locations in the mining plan:

page 2-11 - sec. 2.1.2.1.2
page 2-12 - par. 1 and 2
page 2-33 - sec. 2.4.5
page 2-34 - sec. 2.4.8
page 2-35 - sec. 2.4.9
page 2-40 - last par.
page 3-8 - first par.

These and any other vague references to compliance with codes or rules should be made more specific.

Response:

The table attached to the response to comment No. 4 should serve as further assistance to more accurately identify the agencies and programs within the agency that will have jurisdiction over the Crandon Project.

Specific references to administrative codes were omitted since these code references frequently change over time. The commitment is to be in compliance with all applicable codes at the time the activity is undertaken.

Comment No. 35

Section 2, (general) - The approximate dimensions and physical appearance of all surface facilities mentioned in this section or shown on the diagrams (Figures 2.1-5, 2.2-5 and 2.4-1) should be presented. No mention is made of the reclamation material storage area, solid waste storage area or the means of limiting access to the site.

Response:

The approximate dimensions of Project surface facilities are shown in the attached table. These data will be included in the revised Mine Plan. Building siding will consist of metal paneling. Roofing will consist of metal ribbed panels. Colors have not yet been selected.

The only reclamation materials to be stored at the Project site will be the topsoil and chipped wood waste to be located on the eastern edge of the mine/mill area.

Necessary fill material required to develop final reclamation grades in the mine/mill area will be obtained from stockpile materials maintained in the MWDF area.

(TABLE FOR RESPONSE TO COMMENT NO. 35)

APPROXIMATE DIMENSIONS OF SURFACE FACILITIES

FACILITY	APPROXIMATE PLAN DIMENSIONS m (feet)	APPROXIMATE MAXIMUM HEIGHT m (feet)
Headframe	15 x 18 (49.2 x 59.0)	78 (256)
Collar House	18.4 x 18.8 (60.4 x 61.7)	9.2 (30)
Coarse Ore Storage	25.8 x 91.8 (84.6 x 301.2)	14.8 (48.6)
Crusher/Concentrator[a]	122 x 182 (400 x 597)	36.7 (120)
Mine/Mill Services Building	73.0 x 70.0 (239.5 x 229.7)	9.8 (32)
Bulk Reagent Storage	17.0 x 54.0 (55.8 x 177.2)	----
Main Substation	40.0 x 45.0 (131.2 x 147.6)	----
Substation Building	24.0 x 34.0 (78.7 x 111.6)	9.0 (30)
Lubricant Storage	13.0 x 17.0 (42.6 x 55.8)	4.0 (13)
Bulk Fuel Storage[b]	10.0 x 15.0 (32.8 x 49.2)	4.4 (14.4)
Core Storage Building	51.7 x 22.2 (169.6 x 72.8)	4.8 (15.7)
Cold Storage Building	19.0 x 27.0 (62.3 x 88.6)	4.0 (13)
Covered Storage Building	19.0 x 30.0 (62.3 x 98.4)	8.0 (26.2)
Water Treatment Building	30 x 76 (100 x 250)	11.3 (37)
Pump House	13.0 x 52.0 (42.6 x 170.6)	6.5 (21.3)
Bentonite Storage	15.0 x 30.3 (49.2 x 98.4)	
Gate House	10.0 x 12.0 (32.8 x 39.4)	5.5 (18)
Parking	121 x 145 (397 x 476)	----
Sedimentation Basin No. 1	64 x 62 (210 x 203)	----
Sedimentation Basin No. 2	100 x 98 (328 x 322)	----
Tailing Thickener[c]	60 m diameter (200 feet diameter)	----

[a]Irregular shaped building; dimensions are widest point in crushing area, longest length through crusher and concentrator including loadout, and maximum height in crushing area.

[b]Includes handrails on top of tanks.

[c]Exclusive of associated pump house.

Solid wastes will be removed for disposal off-site at an approved landfill. However, during the construction period, we do anticipate applying for a one-time disposal permit(s) for burning of some suitable construction wastes. Tree stumps and wood shipping crates would be primary examples of materials considered suitable for one-time on-site disposal by burning.

The entire mine/mill area will be enclosed with security fencing which will be installed as part of the initial site construction work.

Comment No. 36

Section 2.0, Description of Facilities - How much area included in the permitted mining site will actually be disturbed?

Response:

The following estimates of disturbed areas for the facilities comprising the Project site will be included in Section 2.0 of the Mine Plan:

Facility	Disturbed Area ha	Disturbed Area acres
Access Road	15	37
Railroad Spur	18	45
Haul Road/Tailings Transport	4	10
Mine/Mill Site	36	89
MWDF and Reclaim Ponds	249	615
Water Discharge Line	6	15

Comment No. 37

Section 2.1.1, Mine Surface Facilities - The surface facilities associated with the air compressors, mine air heaters and the mine vent exhaust fans should be discussed more thoroughly.

Response:

Compressed air for mine use will be supplied from the surface compressor house located just north of the main shaft headframe (Attachment No. 1, drawing No. 051-1-G-001). The compressor plant, as currently planned, will contain six water-cooled rotary screw or turbine type mine/plant service air units. Each will be powered by a 597 kw (800 hp) motor, and will be rated to deliver 1.65 m^3/s (3500 cubic feet per minute) of air at a line pressure of 7.73 kg/cm^2 (110 pounds per square inch) gauge.

The peak mine demand for compressed air will be approximately 5.66 m^3/s (12,000 cubic feet per minute) or about 60 percent of the compressor plant's design rated capacity of 9.91 m^3/s (21,000 cubic feet per minute). Air will be delivered for underground distribution through a pipeline routed from the compressor house through the coarse ore conveyor gallery to the main shaft headframe, and then down the main shaft pipeway compartment.

During rated capacity mine operations fresh ventilating air requirements will be approximately 590 m^3/s (1,250,000 cubic feet per minute). Air will enter the mine under negative pressure through both the main production and intake air shafts. The proportion of total airflow in either shaft will vary throughout the mine life, contingent upon local underground ventilation requirements at any given time.

Each shaft will be equipped with an air intake structure designed to minimize entry shock losses. Each shaft will also have facilities for heating mine air during the winter months (Attachment No. 1, drawings No. B-MM-0190 and B-MM-0191). Ambient intake air must be warmed to a minimum temperature of 2°C (35°F) to preclude formation of ice in the shafts.

When required, a portion of the intake air at each shaft (up to 113 m^3/s [239,000 cubic feet per minute]) will be drawn into the heating ducts by a pair of double entry centrifugal fans. This split of air will pass through the direct fired natural gas heaters (27-38 million BTU/h, each) in the ducts. The heated air will exit into the primary air intake structure at a rate and temperature controlled such that the combined air streams remain above the minimum 2°C (35°F) intake air temperature.

An exhaust type, or negative pressure, ventilation system is planned for the Crandon Mine. The main mine fans will be located on the surface atop the east and west orebody extremity exhaust raises (Mine Plan Figure 2.1-8, Longitudinal Section). At their exit to surface these raises will be 6.1 m (20 feet) in diameter.

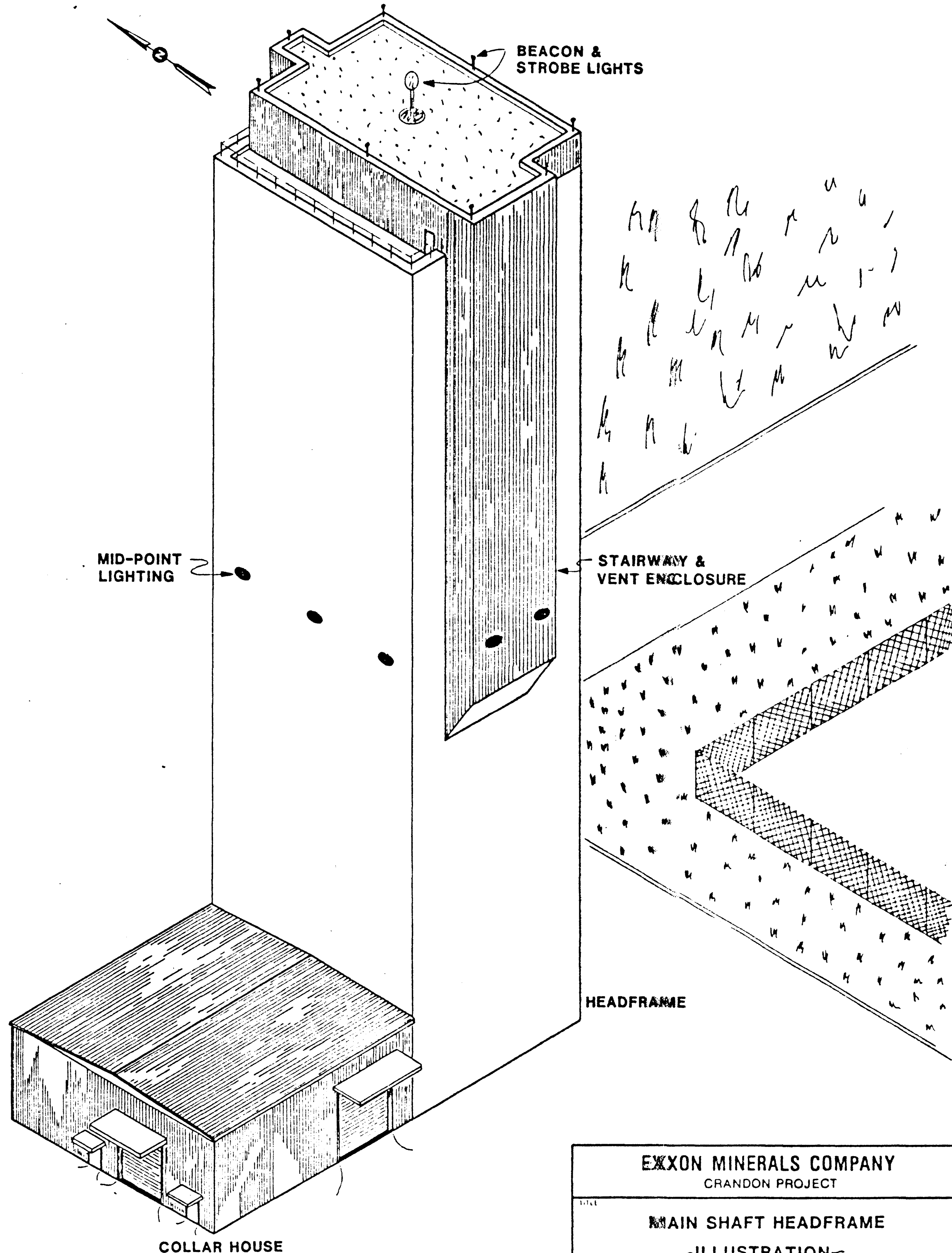
A closed collector hood with two horizontal duct exits will be installed over each exhaust raise collar. Each exit duct will contain a 2.7 m (9 feet) diameter axivane fan driven by a 522 kw (700 hp) motor. Air will exit to the atmosphere through a silenced vertical diffuser. Each of the four main fans, two at each exhaust raise, will be reversible and will feature simultaneously adjustable pitch blades. The pairs of fans will normally operate in parallel at each raise, but will be equipped with shut-off doors to allow single fan operation as required. Fan condition and performance will be remotely monitored and alarmed.

Comment No. 38

Section 2.1.1.1, Headframe - The external appearance of the headframe should be more thoroughly discussed.

Response:

The Crandon mine main production and service shaft headframe will basically be a slip-formed rectangular concrete tower 78 m (258 feet) high. The only appurtenances will be the metal siding enclosures for tower access and ventilation. These include a ventilation penthouse, return air and stairway enclosures on the upper half of the tower's north and south exterior walls and the shaft collar house at ground level. An artist's conception of the headframe is presented in the attached figure.



EXXON MINERALS COMPANY
CRANDON PROJECT

MAIN SHAFT HEADFRAME
-ILLUSTRATION-

SCALE NONE | STATE WISCONSIN | COUNTY FOREST

DRAWN DR SPRINGBORN | DATE 11/83

(FIGURE FOR RESPONSE TO COMMENT NO. 38.)

Subsection 4.2.9.2 of the Crandon Project EIR describes the aesthetics of the headframe's simple line and form. The visual impact of the tower structure's projection above the horizon will be mitigated by use of headframe exterior materials of a color selected to be compatible with the surrounding background. Headframe exterior surfaces will also be rough textured to minimize structure reflectivity.

Due to the proximity of the Crandon airport, the Wisconsin Aeronautics Administration requires installation of 360 degree unlimited distance visibility lighting on the headframe. The planned air traffic safety lighting will include white strobe lights (60 flashes/minute) atop the headframe for daylight hours, and a 300 mm (11.8 inches) flashing red beacon atop the headframe combined with red non-flashing structure mid-point lights at night.

Comment No. 39

Section 2.1.2.1, Main Shaft - Paragraph 2 discusses pumping construction mine water to the surface. The last sentence should not be left open ended. Where on the "surface" will that water go?

Response:

Subsection 2.1.2.1 presents a physical description of the main shaft and does not discuss the handling of "construction" mine water. During normal operations, contaminated water from the mine will be pumped to the water treatment plant feed tank. Uncontaminated mine water will be pumped to the uncontaminated mine water tank prior to discharge. Refer to the response to comments No. 95 and 131 for details of handling mine water during construction.

Comment No. 40

Section 2.1.2.2, Ventilation Shafts - Describe the shaft surface discharge structures, fan size, noise suppression, and air quality controls.

Response:

Fans will be located on the surface of the east and west exhaust shafts. Preliminary design includes a 90° elbow at the shaft collar, with a horizontally mounted fan or fans attached to another 90° elbow, which is directly coupled to a vertical evase for ultimate discharge to the atmosphere. Physical dimensions of the discharge evases can be found in Table C-1 of the "Air Permit Application Appendices." Fan sizes were addressed in subsection 3.5.2.3, Ventilation and Mine Air Heating of the Mine Plan. Present design indicates that each discharge shaft fan installation will convey approximately 290 m^3/s (.63 million cubic feet per minute) of air. Also, see the response to comment No. 37 for additional system detail.

Noise suppression at each of these installations was determined unnecessary by modeling (see EIR Section 4.2). However, to mitigate any undesirable noise emanations and possible resultant impacts, the discharges will be directed vertically to achieve maximum dampening and dispersion.

Description of air quality controls are presented in the Air Permit Application, subsectio 2.2.1, Mine-Construction and Operation.

Comment No. 41

Section 2.1.2.3, Drifts - Describe in detail the mining plan as it relates to the control of surface subsidence.

Response:

The mining methods and stope sequences planned for extraction of the Crandon orebody were selected to control mine area rock mass stability and preclude surface subsidence. A permanent bridge or "crown pillar" of bedrock directly beneath the glacial overburden will be purposely excluded from mining activity. This bedrock barrier will maintain surface stability and prevent piping of overburden materials into active mine workings.

Beneath the orebody crown pillar, stoping methods and sequences will be arranged to maintain local rock mass integrity and avoid disturbance of the crown pillar. All mining methods planned (refer to Mine Plan subsection 3.5.2.1) provide for backfilling of stopes immediately following ore extraction. Depletion of reserves will generally proceed from depth and the orebody extremities toward the surface, with mining directly below the permanent crown pillar planned for the final third of the mine life. These practices, combined with the fact that approximately 8 percent of the mineable ore will be left in place as pillars throughout the mine, will assure perpetual stability of the mine area bedrock surface and glacial overburden.

Comment No. 42

Section 2.1.2.10, Ore Transport Facilities - The dust control system on the primary crusher and related ore handling facilities is not adequately described. Where will the ducts and dust collection hoods duct to?

Response:

The dust collection system consists of ducting from the throat of the gyratory crusher, from the discharge of the vibratory feeder, from the discharge of the picking belt conveyor, and from the discharge of the crusher delivery conveyor to a multiple installation of bag type dust collectors, as shown schematically in a J. S. Redpath drawing No. 050.2.113.M.051 contained in Attachment No. 2. The system is powered by a 50 hp exhaust fan moving 7.27 m^3/s (15,400 cubic feet per minute) at 12 1/2 inches WG. This fan will discharge air into the exhaust air system of the mine. Dust from the collectors will be transported by a screw conveyor to a closed container, which can then be transported to the top of a backfill stope for disposal or, alternatively, emptied into the loading pocket. Drawings No. 050.2.111.S.007, 008 and 009 in Attachment No. 2 show the equipment in detail.

Water mists at each of the feeders above the crusher, above the crusher throat, at the discharge of the feeder below the crusher, at the discharge of the picking belt conveyor, and at the discharge of the crusher delivery conveyor will suppress potentially fugitive dust at these points. This system, together with a conveyor belt fire suppression system, is shown schematically on drawing No. 050.2.113.M.050 in Attachment No. 2.

Comment No. 43

Section 2.1.2.12, Sanitation Facilities - Describe waste preservation chemicals and discuss the compatibility of chemically treated waste with the surface septic system.

Response:

Sanitation units will be serviced as demanded by local use frequency. Containerized waste will be transported to the surface in the mine cage for disposal in the plant septic system. The formaldehyde and perfume used in the chemical toilet control solutions will be in dilute concentrations compatible with the septic treatment system.

Comment No. 44

Section 2.1.2.14, Fuel Handling and Storage - Will the floors of the fuel spill retention areas be made up of bedrock or a prepared material such as concrete or asphalt?

Response:

The floors of the fuel spill retention areas will consist of bedrock.

Comment No. 45

Section 2.1.2.16, Mine Drainage - Describe in detail the physical aspects of the Case I and Case II mine drainage scenarios. How will the interceptor system water be protected from contamination? Could the interceptor system water be directly discharged with little or no treatment?

Response:

The Crandon site geohydrologic regime is relatively simple, predictable, and easily monitored. Saturated glacial overburden with definitive surface water discharge boundaries constitutes the aquifer, exclusively recharged by infiltrating precipitation. In the absence of pumping stress, the bedrock is functionally excluded from the ground water system. Development of the mine will, however, induce flow from the overburden aquifer through weathered bedrock courses not throttled by impermeable materials at the orebody subcrop.

The site geohydrologic conditions will limit the flow of ground water into the Crandon mine to a steady state rate of approximately 0.118 m^3/s (1870 gallons per minute) as documented in the Prickett Associates' report entitled "Ground Water Inflow Model for the Proposed Crandon Mine," December 1982 (previously provided to the DNR). A layer of relatively impermeable glacial till and/or clay-rich weathered bedrock retards ground water entry over much of the mine area. The inflows forecast to occur will be localized and primarily in areas where overburden aquifer sands are in contact with porous weathered rock at the orebody subcrop. The intensity and lateral extent of the bedrock weathering diminishes with depth. Initial mine production has been planned for the 230 to 350 m stope horizon, a position that is below the majority of the weathered zones. Thus, ground water inflows to mine workings during the early years of the mine life are expected to be very localized.

Ground water inflow to the proposed Crandon Mine will be collected in two separate systems. First, an uncontaminated ground water interceptor system will be installed on the uppermost active mine levels. Exploratory diamond drilling techniques will be employed to identify active water courses prior to advance of the mine face. Flows encountered on the uppermost mine level will be captured in interceptor drill holes and contained to avoid contamination by the mining processes at levels below. Mine water control drifts will be developed ahead of production entry in the upper mine areas to maintain the ability to intercept ground water prior to contamination. Ultimately the ground water interceptor system would function as shown on the conceptual Mine Inflow Control cross-section (see attached Figure 1). Cement rock grouting may be used for local inflow control or diversion.

Actual ground water collection will be from exploration or interception drill holes developed from the access and mine water control drifts. These holes will be typically arranged in a conical fan above the drifts, increasing the effective radius of the adit as a line sink drain. As is common mine practice, each water producing hole collar will be sealed and equipped with a pipe manifold.

Ground water collected from exploration drilling, or other drill holes placed specifically for inflow interception, will be piped directly to a clean water sump and pump station near the main shaft on the 230 m mine level (Figure 2 attached). With the exception of ground water inflow diverted for mine utility water use, discharge from this segregated ground water system will be pumped to the surface uncontaminated water holding tank through a separate pipe column in the main shaft. Interceptor system ground water will be monitored prior to surface discharge.

Mine inflow intercepted, contained, and discharged by this system is expected to remain near ambient ground water quality, except for possible transient effects during orebody storage depletion and initial flushing pore volumes. In the steady state, partially saturated flow conditions will exist in the weathered bedrock water courses. Some oxygen may then be introduced to this previously anaerobic environment, but its effects are expected to be minor. The oxidation and leaching potential of the water courses is already limited by the extensive pre-glaciation weathering, and the residence time for further ground water flow will be of a duration which can be measured in hours or days. Ground water intercepted under steady state conditions will likely display aquifer source quality.

Ground water seepage that is not contained by the interceptor system will infiltrate the mine workings and ultimately be recovered in the normal mine local level drainage system sumps and piped or drained to the main mine water sumps. These main mine water sumps and pump stations will be located near the main shaft on the 350 m and 780 m levels, and will also receive backfill seepage and used mine utility water.

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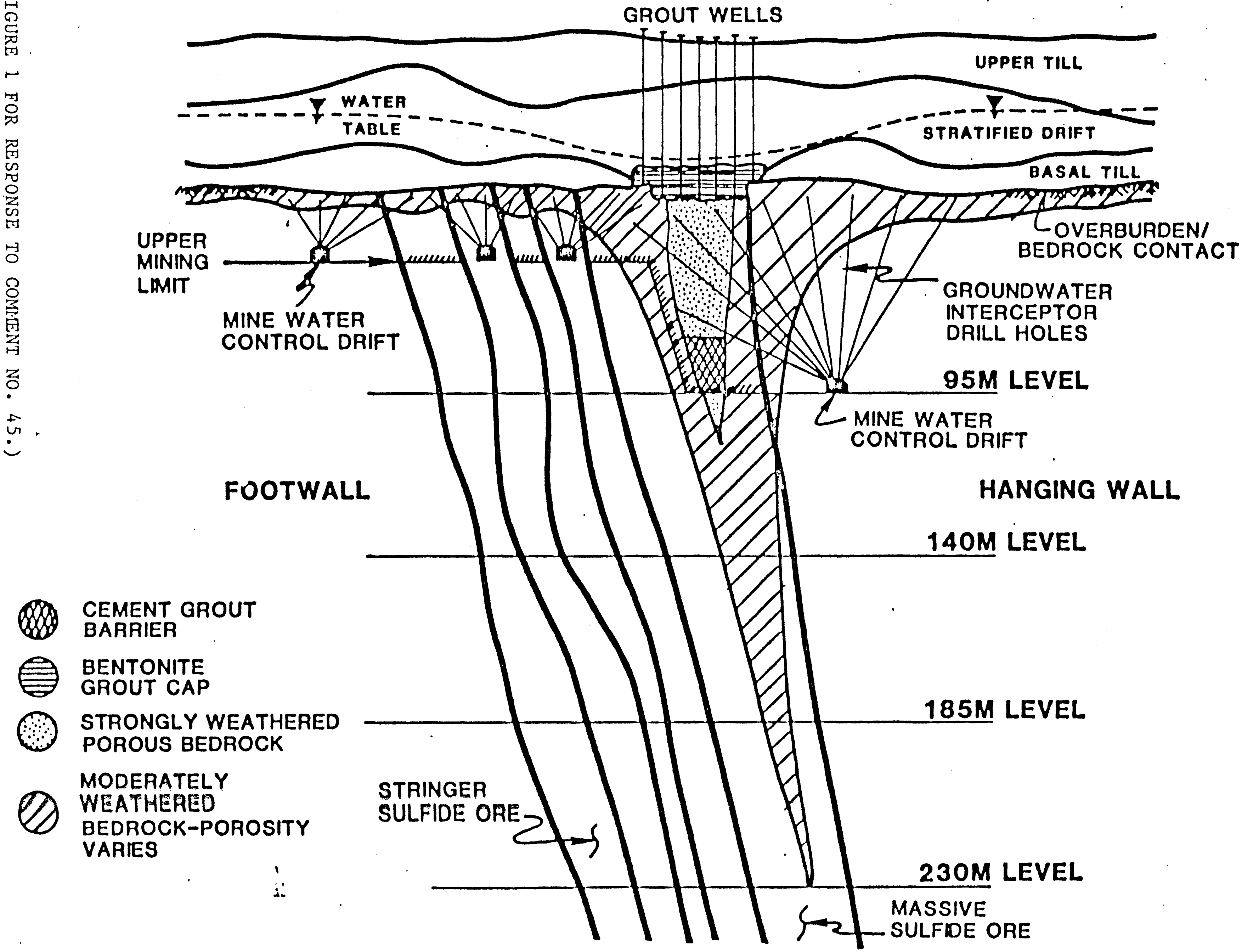
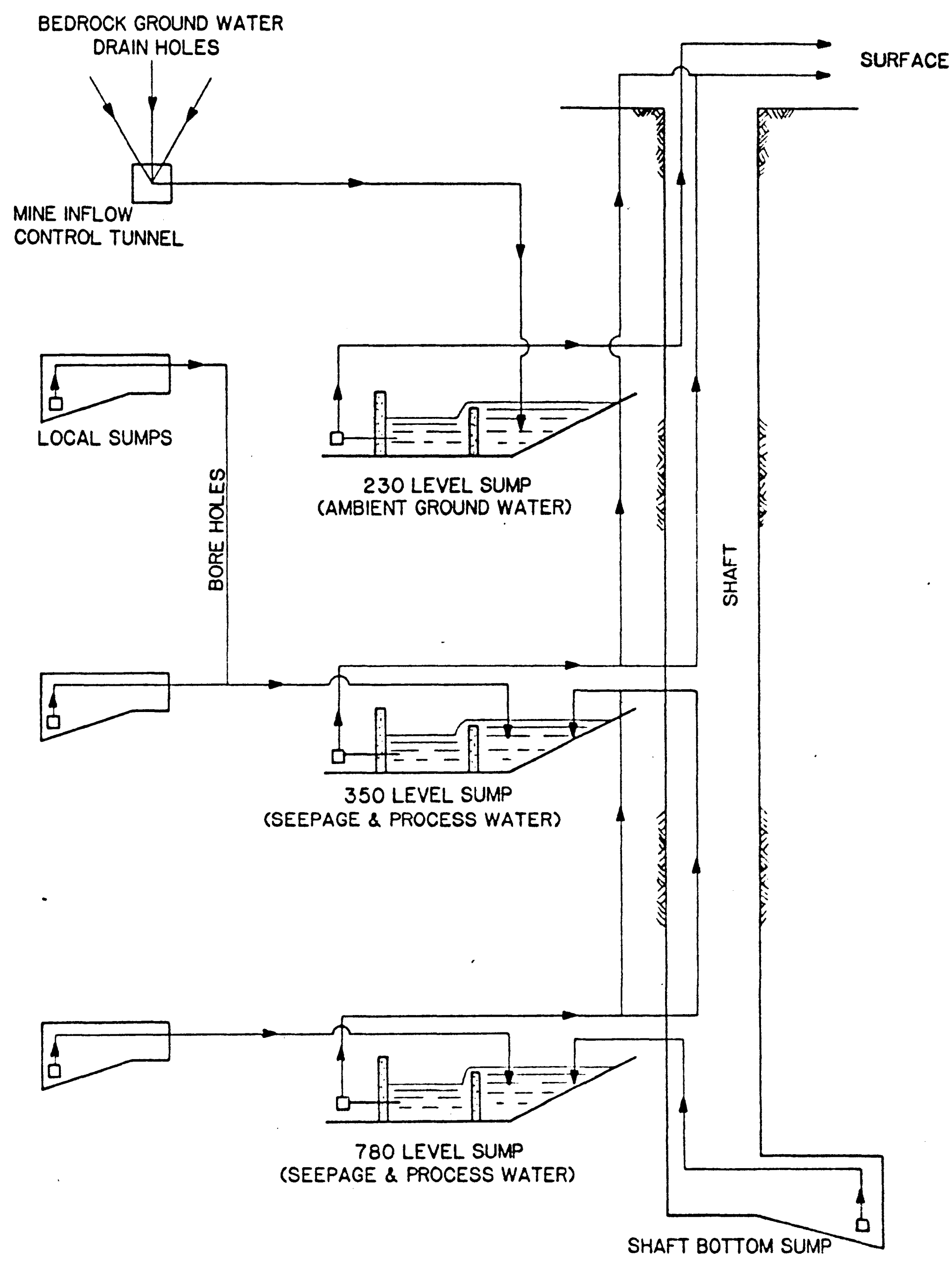
MINE INFLOW CONTROL METHODS

(CONCEPTUAL X-SECTION)



(FIGURE 1 FOR RESPONSE TO COMMENT NO. 45.)



MINE WATER DRAINAGE SYSTEM

EXXON MINERALS COMPANY CRANDON PROJECT		
SUMPING SYSTEM SCHEMATIC		
SCALE NONE	STATE WISCONSIN	COUNTY FOREST
DRAWN DR SPRINGBORN	DATE 10/83	CHECKED BY
EXHIBIT 13, FIG. A		

(FIGURE 2 FOR RESPONSE TO COMMENT NO. 45.)

Normal mine drainage collection will begin on each mine level where flows will be directed to small local sumps excavated in the drift wall. Decant water from the local mine level sumps will be piped or drained through boreholes to the main 350 m or 780 m level sumps. The main sumps will consist of downgrade excavations in the wallrock adjacent to the pump stations. A bulkhead containing the pump station suction pipes will be constructed at the sump outlet.

Since the normal local level mine drainage system pumps will be specified for "dirty" water, the main level sumps will function primarily as pumping reservoirs. However, some settling of solids is expected in the local level and main mine drainage sumps. For this reason, pairs of sumps with front-end loader access will be provided at each mine level transfer point and at the main mine drainage facilities. One sump at each location will then be operated while the other is cleaned. Sump solids will be transported to mined stopes and combined with regular stope backfill.

In the event that additional settling capability is required, a segment of the mine area adjacent to each normal local level mine drainage pump room will be reserved for excavation of a vertical cone settler. Solids discharged from the base of the conical settler would be transported to depleted stopes as backfill.

Discharge from the totally segregated ground water interceptor and mine operations drainage systems will exit the mine in separate main shaft pump columns. The contaminated ground water will be directed to a surface storage tank prior to discharge or, if needed, used as mill process make-up water. Mine drainage effluent will be routed to the water treatment plant feed tank for treatment prior to discharge.

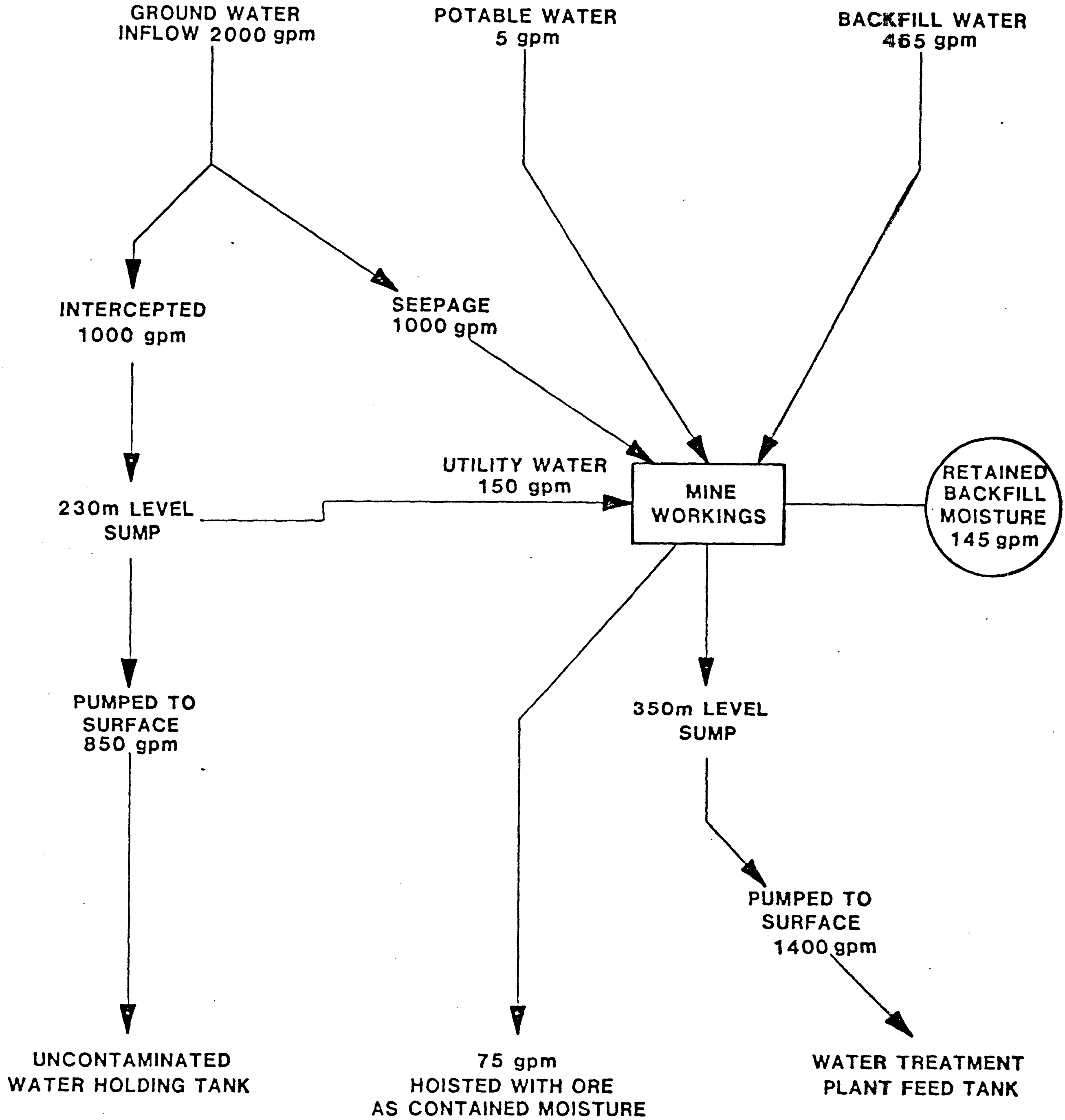
Figure 3 (attached) displays the specific Case II, or nominal 0.126 m^3/s (2000 gallons per minute), ground water inflow/mine drainage ballance. Mine pumping systems will be installed for the indicated capacities. Stand-by pumps and a spare main shaft pump discharge column are planned.

It is possible that the rate of ground water flow into the mine can be controlled. With the simple source - throttle - receptor type of geohydrologic regime in mind, two basic inflow control strategies were evaluated by Klohn Leonoff:

1) Reduction of source ground water over the mine area.

2) Alteration of mine inflow path permeability.

Ground water source-reduction techniques studied included surface well field overburden dewatering, underground drainage gallery overburden dewatering, and aquifer flow restriction methods like slurry trenching and vertical grout curtains. The overburden dewatering methods would require removal of more than twice as much ground water to achieve a marginal reduction of the mine inflow, and were therefore rejected on the basis of increased environmental effects. Aquifer flow restriction methods are impractical at the Crandon site due to the extensive overburden depth. Method details and cost estimates are presented in the Klohn Leonoff report.



MINE WATER DRAINAGE SYSTEM

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
MINE DRAINAGE SCHEMATIC

SCALE NONE	STATE WISCONSIN	COUNTY FOREST
DRAWN BY DR SPRINGBORN	DATE 9/83	CHECKED BY
DRAWING NO EXHIBIT 13, FIG. B		

(FIGURE 3 FOR RESPONSE TO COMMENT NO. 45.)

Mine inflow path permeability reduction methods evaluated included primarily cement and bentonite grouting techniques. Chemical grouting was eliminated as environmentally unsound, and long-term freezing of the saturated overburden was shown uneconomical. Of the grouting methods described by Klohn Leonoff, the plan to place bentonite grout in the high inflow areas of the orebody subcrop was most practical and potentially effective. In essence, this plan artificially creates flow resistant material similar to that which occurs over most of the mine area. Preliminary engineering plans and a cost estimate for this subcrop grouting plan are presented in the Klohn Leonoff report.

During mine final engineering, further site tests can be conducted to confirm active steady state mine inflow courses and verify the proposed bentonite grouting technique. The extent of any inflow control program instituted will be determined by the potential for lessened environmental effects in balance with reduced mine drainage and water treatment and discharge costs.

Mine inflow control grouting and uncontaminated ground water interception methods will be employed to the limit of technical achievability and economic feasibility. The practical limits may approach 50 percent for inflow control, and a 50 percent interception rate in the absence of inflow control. Theoretically, inflow control by grouting could be 100 percent effective with application of unlimited resources, and similarly ground water interception success could be greater than projected.

Given the geotechnical uncertainties which will remain until mine development begins, a non-numerical statement of intent may be best. There is environmental and economic motivation to reduce the inflow of ground water to the mine, and to avoid mine contamination of as much of the uncontrolled mine inflow as possible.

The measurable effectiveness of one system may very well depend upon the success of the other. Reduced mine inflow by grouting might, for example, eliminate flow in a water course amenable to interception. Environmental protection and mine operability will be best served by a practical combination of these proposed techniques.

Case I with its nominal ground water inflow of 0.063 m^3/s (1000 gallons per minute) represents an estimate of the potential success of applied inflow control and interception technology. Physical pumping and drainage systems, designed and installed for the higher Case II inflows, would then simply operate at reduced rates if the rate of ground water seepage can be mitigated.

Comment No. 46

Provide additional details or diagrams to illustrate the groundwater interception system to verify why water intercepted within the bedrock, even though at a shallow depth in the bedrock, can be considered to be clean. Also, some minimum detail should be included on groundwater collection sumps within the mine and disposition of the settled solids removed from the sumps.

Response:

See the response to comment No. 45.

Comment No. 47

Paragraphs 1 and 2 discuss mitigative actions to be taken to reduce ground water flow into the mine. One measure discussed in paragraph 1 is to grout through surface drill holes. Is the 1,000 gpm of reduced flow into the mine referenced in the last sentence of this paragraph attributable to just these grouting measures or will part of this 1000 gpm reduction occur as a result of the interceptor system discussed in paragraph 2? Our understanding of the system was that approximately 1,000 gpm of ground water flow into the mine could be reduced by both grouting and the interceptor system. To cite 1,000 gpm for each mitigative action leaves the reader with the impression that 2,000 gpm of ground water inflow will be prevented from entering the mine. Which is it?

Response:

The mine ground water interceptor system will not reduce the inflow of ground water to the mine. The system's only function is to collect ambient aquifer quality water seeping through the weathered bedrock before it reaches the active mine workings. Any ground water escaping interceptor system collection and segregated pumping will be contaminated as it joins the mine process water streams throughout the workings.

The mine site geohydrologic regime can be most simply described as a source - throttle - receptor system. The water source is the saturated glacial sand overburden. Low permeability glacial tills, clays, and bedrock weathering products, function as the flow throttle at the bedrock subcrop. Zones of oxidation and leaching which penetrate the bedrock to limited depths form the inflow paths to the mine, which together constitute the receptor.

Site geotechnical studies, hydrologic test programs, and inflow computer modeling have confirmed these regime concepts. Evaluation of the results indicates that ground water inflow to the mine will occur where the source and receptor can communicate (i.e., where saturated sands are in contact with porous weathered bedrock and no low permeability throttling materials are present).

There are environmental and economic motivations for attempting to reduce the predicted mine inflow of 0.126 m^3/s (2000 gallons per minute). A variety of ground water source and/or inflow path permeability reduction techniques were, therefore, investigated. Two methods with potential technical and economic feasibility emerged.

First, it may be possible to control areas of source/receptor communication by creating a low permeability throttle material. A layer of aquifer sand in contact with the bedrock could be injected from the surface with bentonite grout to form an artificial till. Success with this type program requires definitive subcrop water course identification, but could be successful over small areas of concentrated inflow.

A second possibly viable method would be source reduction by overburden aquifer pumping. With this method surface wells would be used to reduce the aquifer head over areas of high subcrop inflow potential. The ground water displaced could be reinjected down gradient, discharged to surface water, or used in other ways to mitigate hydrologic impacts.

During mine final engineering, further site tests can be conducted to confirm active steady state mine inflow courses and verify the proposed bentonite grouting technique. The extent of any inflow control program instituted will be determined by the potential for lessened environmental effects in balance with reduced mine drainage and water treatment and discharge costs.

Mine inflow control grouting and uncontaminated ground water interception methods will be employed to the limit of technical achievability and economic feasibility. The practical limits may approach 50 percent for inflow control, and a 50 percent interception rate in the absence of inflow control. Theoretically, inflow control by grouting could be 100 percent effective with application of unlimited resources, and similarly ground water interception success could be greater than projected.

Given the geotechnical uncertainties which will remain until mine development begins, a non-numerical statement of intent may be best. There is environmental and economic motivation to reduce the inflow of ground water to the mine, and to avoid mine contamination of as much of the uncontrolled mine inflow as possible.

The measureable effectiveness of one system may very well depend upon success of the other. Reduced mine inflow by grouting might, for example, eliminate flow in a water course amenable to interception. Environmental protection and mine operability will be best served by a practical combination of these proposed techniques. The nominal ground water inflow of 0.063 m^3/s (1000 gallons per minute) represents only an estimate of the potential success of applied inflow control and interception technology.

Comment No. 48

Exxon should indicate where the water from the interceptor system and the contaminated mine drainage will be routed.

Response:

Paragraph 4 in subsection 2.1.2.16, Mine Drainage, includes a statement that the mine drainage water, meaning the contaminated mine drainage, will be pumped to the water-treatment plant. This will be accomplished by pumping the water to the water treatment plant feed tank located north of the headframe. The uncontaminated water, or intercepted ground water, will be pumped to the uncontaminated mine water tank prior to discharge.

Comment No. 49

Section 2.2.1, Ore Handling - Will there be any need for exterior ore surge piles in the event of system failure? Will there be any surface storage of low grade ores other than at the mine waste disposal facility?

Response:

Study of alternatives for preproduction ore storage has continued since submittal of the Mining Permit Application. While the original Mine Plan proposed preproduction ore storage in the MWDF, the current plan proposes storage at the north edge of the mine/mill site. Additional planning of the management of the mine backfill sands has eliminated the need for a temporary backfill sands storage facility allowing the preproduction ore storage area to be located in its place. This ore storage facility will be lined and drainage will be collected and transported to the plant water treatment system. The liner will be protected with a separate waste rock cover. Recovery of ore will be managed to leave this protective cover in place throughout the life of the facility.

While this storage facility is planned only for temporary storage of the preproduction ore, it could also be maintained (or reactivated) and used as an ore surge storage area if needed.

Comment No. 50

Are the wastewaters generated in the ore handling facility and the contaminated runoff generated on the preproduction ore and regular ore storage areas accounted for in the water balance? What will be the volume of runoff generated in a 10 year, 24 hour storm event? Show calculations.

Response:

These wastewater volumes are included in the water balance. The entire ore handling facility from the mine headframe through coarse ore storage, crushing, fine ore storage, and grinding is completely covered. All conveyor galleries are covered. There will be no contaminated water runoff from the ore handling facility. Any drainage water collected in the coarse ore storage facility will be collected in sumps and pumped to the grinding circuits.

The preproduction ore storage area is now planned for the 3.2-ha (8-acre) area just north of the rail tracks (previous backfill storage area). Surface water runoff from this ore storage area will be collected in a 5600-m^3 (1,479,520-gallon) sump designed to accommmodate the precipitation volume in the area from a 25-year, 24-hour storm event. Water that accumulates in this sump will be pumped to the water treatment plant feed tank.

A 15.6-ha (38.6-acre) area will be allocated in the MWDF area to hold waste rock. A sump will be provided to collect runoff from this area; it will be sized to accommodate a 10-year, 24-hour storm event in addition to a one year average net precipitation gain. If necessary, water from this sump will be pumped to reclaim pond R1. The sump will be designed for a capacity of 40,000 m^3 (10.6 million gallons).

Calculations

a) Preproduction Ore Storage; 8-acre; 25-year, 24-hour storm event; 4.2 inches (0.35 ft) of rain

$$8\text{-acre} \times \frac{43{,}560\ ft^2}{acre} \times 0.35\ ft \times \frac{7.48\ gal}{ft^3} = 912{,}321\ gal$$

Therefore, the sump near the preproduction ore pile will be sized for 5600-m^3 (1,479,520-gallon) capacity which is more than adequate. This water could be pumped to the treatment plant over a 2-week period at a rate of 10.3 m^3/h (45 gallons per minute).

b) Waste Rock Storage; 38.6-acre; 10-year, 24-hour storm event, 3.6 inches (0.30 ft) of rain

$$38.6\text{-acre} \times \frac{43{,}560\ ft^2}{acre} \times 0.30\ ft \times \frac{7.48\ gal}{ft^3} = 3{,}773{,}098\ gal$$

Allowance for 1-year of average net gain in precipitation over evaporation (7.41 inches or 0.62 ft)

$$38.6\text{-acre} \times \frac{43{,}560\ ft^2}{acre} \times 0.62\ ft \times \frac{7.48\ gal}{ft^3} = 7{,}797{,}735\ gal$$

Total requirement of 11.6 million gallons.

The sump near the waste rock storage area will be sized for approximately 40,000 m^3 (10.6 million gallon) capacity which is close to the total calculated requirement of 43,800 m^3 (11.6 million gallons). This water will be pumped, as necessary, to reclaim pond R1 which has a design volume of 898,938 m^3 (237,500,000 gallons), including 308,856 m^3 (81,600,000 gallons) of freeboard volume.

Comment No. 51

Figure 2.2-1 - What is the shaded facility located just east of the water treatment plant? Also, the structures located on either side of this facility and the structure between the tailings thickeners are not identified on this figure or figures 2.1-5 or 2.4-1.

Response:

The shaded facility just east of the water treatment plant was originally intended to be the waste rock crushing facility and the unshaded structures on either side of the crushing area were conveyor transfer towers. These facilities are no longer needed and do not appear on revised plot plans (see Attachment No. 1, drawing No. 051-1-G-001). The structure between the two tailings thickeners is the pump chamber for the tailings thickener underflow and overflow products. Although present plans now call for a single larger thickener, the pump chamber will remain.

Comment No. 52

Section 2.2.5, Reagent Storage and Mixing - Provide detailed plans and specifications for this facility and its equipment with emphasis and spill control, containment, and emission control. Describe the segregation of noncompatible reactive reagents, dusts, vapors, and gases.

Response:

Detailed design of the reagent storage and mixing facilities will be completed during final engineering. Preliminary drawings of these facilities are presented in Attachment No. 3, drawings No. 051-6-G-008 and 051-6-G-009. These facilities are described as follows:

Reagent Facilities Description

The reagents are received by either truck or railcar; there are three modes for receiving reagents:

1) Lime, soda ash, and sulfuric acid will be received on the inside plant track immediately north of the filter area shown on drawing No. 051-6-G-009, which will also be used intermittently to handle lead concentrate cars. These reagents are used in the water treatment plant. The track and storage tanks for lime and soda ash are shown on drawing No. 051-6-G-008.

2) Sulfur dioxide, frothers, and sodium dichromate will be received on a railroad spur entering the center of the mill building (drawing No. 051-6-G-009). Sulfur dioxide is used directly in the process and there is no intermediate storage. The frothers and sodium dichromate storage tanks are contained in a bermed area with blind sumps which will be used to return spillage to the respective tank by pump. The frothers and sodium dichromate are pumped from the storage tanks to intermediate mix tanks in the reagent preparation building (drawing No. 051-6-G-009). From the mix tanks, these reagents and most others are pumped to the day tanks above the control room. The reagent preparation tanks are isolated by berms and blind sumps. Overflows and the floor drains for the day tanks drain to the reagent preparation area blind sumps.

3) Drums, bags, and returnable bins will be delivered by truck at a loading dock at the front of the reagent storage building. These bagged and drummed reagents will be mixed to make solutions in the reagent preparation area using the mix tanks. The solutions will then be pumped to the respective day tank.

The berms that are shown in the reagent storage, mixing, and day tank areas are provided to contain any spills and to isolate noncompatible or dissimilar reagents. Similar reagents such as all xanthates will be contained together since they are chemically and functionally compatible. Noncompatible reagents will be isolated spatially as well as with berms. Sodium cyanide will not be unloaded or stored near acids nor will acids be stored near strong caustics. The berms will be designed to contain a total spill from a single tank of similar reagents. The blind sumps will be used to return spilled reagents to their respective tank.

Dusts will be minimal in the reagent preparation building. Personal breathing protection will be provided as needed for workers in these areas. The reagent dusts encountered will primarily be in the lime and soda ash unloading, slaking and mixing areas. Drawing No. 051-6-G-008 shows this area and indicates the dust collectors used. There is an insertable dust collector provided with the unloading and storage silos in both cases.

Gases will be removed from the enclosed reagent preparation area by a ventilation system. The reagent preparation area and the day tank area will be equipped with alarms for hydrogen sulfide and hydrogen cyanide.

The reagents which are particularly noncompatible include sulfur dioxide, sodium cyanide and sodium sulfide. To avoid the mixing of sulfurous acid (results when SO_2 contacts water) with these or other reagents, SO_2 will be stored outside the concentrator building in two tanks. The liquid SO_2 will then be piped directly into the SO_2 distribution system.

Frother compounds that have fairly high vapor pressure (e.g., MIBC) will be stored in a tank outside and pumped in as needed for mixing.

<u>Special Criteria</u>

The attached table shows storage capacities, shipping mode, and other reagent receiving and storage data. The following criteria will be included in the reagent area design.

1) Adequate ventilation.

2) Sodium cyanide will be received in 1362 kg (3000 pound) Flo-Bins™ which are returnable.

3) Storage and mixing requirements for each reagent have been determined. Where feasible, the preferred system will be a mixing tank and a day tank. The day tanks merely store mixed reagents for distribution to the flotation circuit. Capacity of the day tank is 32 hours of operation.

4) Maximum storage for xanthate solutions is 4 days. All xanthate mixing and storage tanks will have sloping bottoms with drains for cleaning at the low point. Solution removal for process use will be at a height of 15.2 cm (6 inches) above the point where the sloping bottom begins.

5) Xanthate tanks will have a forced air exhaust to remove any carbon disulfide.

(Table for response to comment No. 52.)

REAGENT RECEIVING AND STORAGE DATA

Chemical	Receive By	Monthly Consumption (Pounds)	Shipment Size	Unit Size	Form	Storage Capacity
Sulfur Dioxide SO_2	Tank car	205,000	60,000 or 100,000 lb	30 ton	Liquid	150,000 lb
Copper Sulfate $CuSO_4 \cdot 5H_2O$	Railcar	216,300	100,000 lb minimum	100 lb bag	Granular	300,000 lb
Sodium Cyanide NaCN	Truck	13,200	36,000 lb	3,000 lb	Briquette	36,000 lb
Dowfroth 250	Truck	18,100	40,000 lb	Truck	Liquid	50,000 lb
Sodium Sulfide $Na_2S \cdot 9H_2O$	Railcar	150,200	80,000 lb minimum	400 lb drum	60% Flake	230,000 lb
Xanthates	Truck	42,100	40,000 lb	300 lb drum	Pellet	63,000 lb
Zinc Sulfate $ZnSO_4 \cdot 7H_2O$	Truck	36,000	24,000 lb minimum	50 lb bag	Granular	54,000 lb
CMC-7LT	Truck	16,900	25,200 lb minimum	50 lb bag	Powder	30,000 lb
Sodium Dichromate $Na_2Cr_2O_7 \cdot H_2O$	Truck Tank car	30,100 (8000 gal)	78,000 lb minimum	8000 gal	Liquid	12,000 gal

Note: Ton in this table is short ton (2000 lb).

(Table for response to comment No. 52 [continued].)

Chemical	Receive By	Monthly Consumption (Pounds)	Shipment Size	Unit Size	Form	Storage Capacity
Sodium Silicate Na_2SiO_3	Tank car	90,100	117,000 lb (10,000 gal)	10,000 gal	Liquid	15,000 gal (175,500 lb)
Carbon	Railcar	48,100	24,000 lb minimum	50 lb bag	Powder	75,000 lb
MIBX	Tank car	24,100	40,000 lb minimum 6,000 gal	6000 gal	Liquid	12,000 gal
Lime CaO	Rail	1,100,000	190,000 lb minimum	Railcar	Pebble	2,640,000 lb
Soda Ash Na_2CO_3	Railcar	523,000	200,000 lb minimum	Railcar	Powder	750,000 lb
Sulfuric Acid H_2SO_4	Truck	76,300	45,000 lb	Tanker	Liquid	67,500 lb
HMP	Truck	6.500	No minimum	100 lb bag	Granular	7,000 lb
Flocculant	Truck	31,200	34,000 lb minimum	Tanker	Liquid	40,000 lb

Note: Ton in this table is short ton (2000 lb).

6) All reagents received in solid form will have mixing and storage tanks designed like xanthate tanks.

7) Explosion-proof motors, light fixtures and conduit will be used.

8) Emergency eye wash, shower facilities, and other necessary first aid equipment will be included in the reagent area design.

9) Special consideration will be given to materials selection for each reagent system to guard against corrosion.

10) Sodium dichromate will be received by tank truck in a saturated aqueous solution (69 percent sodium dichromate by weight). Adequate inline heating will be provided to prevent freezing in winter conditions. Sodium dichromate could also be received in solid form if necessary.

Comment No. 53

Table 2.2-2 - This table describes "typical" reagents. A complete listing of all potentially utilized reagents should be provided.

Response:

The reagents shown in Tables 2.2-2 and 2.2-3 of the Mine Plan are essentially the reagents that have been used in the process development testing for the Crandon Project. These reagents are "typical" in the sense that they are commonly used in the treatment of ores of this type. At the present time, there are no plans to use reagents other than those listed in the tables. If pilot plant and actual plant testing shows other reagents to be more beneficial or cost effective, they might be incorporated into the process. Any changes in the list of reagents will be documented in an amended Mining Plan which is reviewed annually by the DNR after the date of mining permit issuance.

Comment No. 54

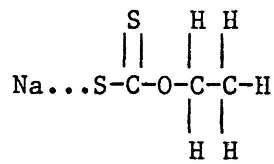
Tables 2.2-2 and 2.2-3 - Some of the reagents listed in these tables are not adequately described chemically so we do not know what they really are. In Table 2.2-2 these are xanthates and flocculants. In Table 2.2-3 they are flocculants, dewatering aid, and "other xanthates."

Response:

The xanthates are a group of flotation collectors which have the following general chemical structure:

```
          S
          ||
Cation...S-C-O-hydrocarbon chain
```

For example, sodium ethyl xanthate is one of the xanthates used for treating Crandon ore:



Xanthates with different hydrocarbon chains that will be used include potassium amyl xanthate and sodium isopropyl xanthate. "Other xanthates" which have commonly been used in treating similar ores might be tested in the pilot plant and ultimately used in the flotation process.

Flocculants are generally organic polymers which are commonly used to flocculate fine suspended ore particles so that they settle faster in thickeners and enhance clarity in the thickener overflow. They are generally used in extremely low dosages, typically 15 to 50 g/t (0.03 to 0.1 pound per short ton of ore). Although a particular type and brand of polymer has not been identified for use at Crandon, the polymer used would be one of the flocculants in general use by mining and other industries. A typical polymer is a polyacrylamide.

Dewatering aids are chemicals used to lower the surface tension of water and/or flocculate mineral particles so that they can be filtered more easily. The mining industry uses these chemicals to aid in filtration of concentrates. They are generally similar chemically to those reagents used by car washes during rinse cycles to prevent hard water spots. A particular dewatering agent has not been identified for Crandon, nor has the absolute need for a dewatering aid been established.

Comment No. 55

<u>Section 2.2.6, Concentrator Control Room</u> - All remote environmental monitoring equipment should be described here or under other appropriate sections.

Response:

The concentrator control room will not have any connections to remote environmental monitoring equipment. Any such equipment will be monitored in the environmental laboratory in the concentrator building. The specifics of any such design will be related to the Monitoring and Quality Assurance Plan and completed with final design engineering.

Comment No. 56

<u>Section 2.2.8, Tailing Thickening</u> - More detail and diagrams should be included to describe the equipment, overflow rates, separation efficiencies of sands and fines, and other items having to do with the thickening of the tailings.

Response:

Thickeners are simple sedimentation or settling devices. A dilute slurry is continuously fed at the center feed well of a large circular vessel. The solids settle towards the bottom while clear water overflows along the periphery of the vessel. The settled solids are continuously withdrawn from the bottom of the vessel as a thick slurry. The feed rate, diameter of the vessel, and flocculants, if used, are factors that affect the performance of the thickener. Thickeners are easy to operate and are not mechanically complex and are comonly used in process industries.

For the Crandon Project, we estimate the feed stream will contain an average of 3667 t/d (4043 short tons per day) of solids with a total pulp volume of 1993 m^3/h (8777 gallons per minute). The solids content in the feed slurry will be 7.3 percent by weight. After settling, we estimate the thickener underflow to contain 55 percent solids by weight at a flow rate of 172 m^3/h (756 gallons per minute). The thickener underflow flows to a sump and will be transported by pipeline to the MWDF.

The thickener overflow at 1822 m^3/h (8022 gallons per minute) contains a small amount of solids, approximately 100-1000 ppm by weight. A portion of this water is recycled to the backfill cyclone process directly (as make-up water) and the remainder is recycled via the reclaim ponds.

Sands will not be fed to the tailing thickener but will be used as backfill in the mine. Only the fine fraction of the tailings as overflow from the backfill cyclones will be fed to the tailing thickener.

Comment No. 57

Section 2.2.9, Concentrate Handling and Loadout - Provide more details regarding the design of the covered rail cars and/or trucks to be used for concentrate shipping. This section specifies two day's production storage capacity while page 3-40 states that 10 days storage will be available. Please clarify this apparent discrepancy.

Response:

The railcars to be used to transport concentrate are open top, rectangular cars commonly called gondola cars. They have a steel bed and sides which will completely contain the concentrate without spillage. After loading, the cars will be covered with a plastic cover made especially for this application. These covers are commonly used for this application. Trucks will not normally be used; however, if they are required, they probably would be 18.1-t (20-short ton) semi-trailer type dump trucks covered with plastic similar to that mentioned above.

The correct storage capacities are 2 days for copper and zinc and 10 days for lead concentrate; the Mine Plan will be revised accordingly. Earlier plans called for a total of 10 days storage with 2 days in bins and 8 days on the floor beneath the bins.

Discussions with officials from the Soo Line Railroad indicate that the history of rail service in the area has been extremely reliable. Therefore, the probability of an extended transportation problem occurring is low. The

2-days storage capacity available for copper and zinc concentrates along with storage capacity in available railcars should be adequate to prevent shutdown of the plant during the day or two that the railroad cannot supply cars due to a weather-related problem. Currently, there is an oversupply of gondola cars and this situation is not expected to change in the near future.

Severe market problems would likely force a temporary shutdown of the Project regardless of the amount of storage capacity available.

If railcar availability was to become a problem and the planned concentrate storage capacity was inadequate, more covered storage area would be planned and a permit application for the Project site would be made.

Comment No. 58

Section 2.2.11, Backfill Preparation Facility - Under what circumstances will crushed waste rock be utilized as backfill? The location of the waste rock crusher is not shown on Figure 2.2-1 as indicated in the text. The facilities for metering and mixing coarse tailings, waste rock and cement should be discussed more thoroughly.

Response:

As described in the response to comment No. 117, shortfalls of classified tailings backfill material could result from unanticipated mine/mill operational events. In such cases it may be necessary to supplement normal backfill production with make-up materials such as glacial sand or crushed waste rock. The backfill preparation plant will be designed with provisions for possible future addition of make-up materials handling equipment. Although these conditions are probably remote, should fine (nominal 25 mm [1 inch]) crushed waste rock be required, it could be produced by a portable crushing plant placed adjacent to the surface waste rock stockpile at the west side of the coarse ore storage building (Attachment No. 1, drawing No. 051-1-G-001). Cleaned glacial sands would likely be delivered from the MWDF storage materials and/or an off-site licensed gravel contractor.

The process flow diagram No. DBM-6-L-009 in Attachment No. 4 illustrates the method of storing and handling cycloned sands for mine backfill. The following is a brief description of the process. The cycloned sands are pumped from the desliming ;yclones directly to a "repulping tank." Any sand or fine crushed rock make-up materials required will also be introduced to the circuit by controlled rate addition to the repulping tank feed. The system described here for repulping from the tanks is similar to that used successfully at other operating mining properties.

The lower part of the repulping tank is shaped to a cone and fitted with a nozzle and jet system to permit repulping to the highest percent solids consistent with pumpability. At other operations this has been approximately 70 percent. To deliver backfill product to the mine, the nozzle/jet system is activated and the repulping tank discharge valve is opened. A density controller in the discharge line maintains the required percent solids.

Cement is added to the system by injection of cement slurry directly into the tailings slurry feed line to the mine. The variable speed drive of the rotary feeder at the discharge of the cement bin is controlled by mass flow control in the sand slurry line, thus assuring the correct cement/sands ratio (normally 6 percent by weight).

Limited surge storage of cycloned tailings sands is provided in horizontal concrete storage bunkers. A total of six such bunkers provides sufficient capacity for the storage of approximately 18,000 t (20,000 short tons) of cycloned tailings sands (approximately 4 days production). These bunkers are located inside the concentrator adjacent to the fine ore crushing area.

Stored coarse tailings sands are reclaimed from the bunker using monitor jets to wash the material into a collecting launder and sump. A sand reclaim pump delivers the sand slurry at 30 to 60 percent solids to a second repulping tank for density adjustment prior to delivery pumping.

High quality backfill mixtures are assured by the precise density and sands/cement ratio control which can be achieved with the system proposed.

Comment No. 59

Section 2.2.12, Backfill, Transport, Storage, and Reclaim - Provide detailed plans and specifications for the backfill pond, including the bottom liner, water decant system, ancillary facilities, and backfill recovery equipment.

Response:

It was originally the intention to store a total of approximately 150,000 t (168,000 short tons) of cycloned tailings sands on a pad located immediately north of the mine/mill site. Cyclone sandfill material would be routed to this storage area when the mine is unable to accept backfill for any reason. Sands would be reclaimed from the storage area as stopes become available for backfilling.

A reappraisal of the mine plan and the stope development sequence has indicated that there is no longer a need to provide large volume surge storage capacity for backfill sands. As a result, this facility has been eliminated and all backfill material handling will be totally within the confines of the concentrator building.

Under the present concept, cycloned tailing sands produced continuously during the milling operation will be mixed with a cement slurry and pumped directly into the mine. Storage capacity for a total of approximately 18,000 t (20,000 short tons) of backfill sands will be provided in concrete storage bunkers. Reclaim from the bunkers will be by monitor jets which will wash the sands into a pump sump. A pump will transfer the sand-slurry to a repulping tank for settling, adjustment of percent solids, and direct transfer to the mine. Decant water from the repulping tanks will be pumped to the monitor jets providing a totally closed no-loss system.

It is now the intention to utilize the area previously designated for storage of backfill sands as an area for storage of preproduction ore. During the 18-month period prior to mill start-up, a maximum of 1,000,000 t (1,120,000 short tons) of uncrushed ore will be accumulated in the storage area. This material will be fully consumed during the early years of mill operation.

The storage area will be cleared and grubbed and then rough graded to provide drainage toward the northwest. The area will be lined with a bentonite-modified soil mixture protected by a layer of crushed waste rock.

A ditch will be provided to collect rainwater runoff from the stockpile and to conduct the water to a concrete sump. The ditch and sump will be sized to provide sufficient storage capacity to retain the full storm runoff, based upon a one in 25-year storm developing 106.7 mm (4.2 inches) of rainfall in 24 hours. A pump will return the runoff water to the plant process water system or to the water treatment plant as appropriate.

Comment No. 60

Will the pipeline between the backfill preparation plant and the backfill storage area be underground? The specifications and route for this pipeline should be presented.

Response:

The backfill storage area has been deleted and, therefore, the reference pipeline will not be installed.

Comment No. 61

<u>Section 2.2.13, Concrete Batch Plant</u> - Describe plans for concrete preparation prior to completion of the permanent concrete batch plant. Further describe the quantity of aggregate needed during various construction and operation phases. Discuss the availability of suitable aggregate on site and off site. Will the batch plant include aggregate crushing, screening, and washing facilities? If so, describe the disposal of aggregate wash water.

Response:

Preliminary studies have indicated that concrete requirements during the construction phase will probably be obtained through a local supplier who would erect a temporary batch plant within the confines of the mine/mill site. Aggregate supply for the concrete would be the responsibility of the concrete supplier. Based on the quantities of aggregate required, the supplier would probably set up a gravel plant as close to the mine/mill site as he could arrange.

During the construction phase a total of approximately 38,000 m^3 (50,000 cubic yards) of concrete will be placed. This volume of concrete will require an almost similar quantity of aggregates. A peak daily rate of approximately 600 m^3/d (783 cubic yards per day) is estimated for a limited period in 1987.

During operations the requirements for concrete decrease to approximately 1700 m^3/y (2,200 cubic yards per year) and a maximum daily requirement of approximately 23 m^3/d (30 cubic yards per day). It is now anticipated that no permanent batch plant will be required and concrete will be trucked from an off-site supplier.

Comment No. 62

The concrete batch plant, liner batch plant, and soil processing plant are not adequately described anywhere in the application. Drawings of these plants and descriptions of the processes involved will be needed.

Response:

The construction methods study and planning by INDECO included a review of material processing requirements. Basic process descriptions and equipment requirements are included in the INDECO report "Construction of Waste Disposal Facilities" (previously provided to the DNR). During the course of INDECO's study, various equipment manufacturers were contacted to provide assurance that proposed processes could be efficiently accomplished. The attached process flowsheets (Attachment No. 5) from Universal Engineering Corporation depict an equipment set capable of providing all required soil materials by processing of the glacial till. Equivalent systems could be provided by other manufacturers.

In Universal Engineering Corporation's system, flowsheets No. 1 and No. 2 are dry processes to prepare liner material and cushion material. The only water used is in flowsheet No. 3 showing the process to prepare the underdrain material. Brief process descriptions are included with the flowsheets.

Water requirements in flowsheet No. 3, for the underdrain material preparation are primarily related to the volume rate of material handled and its fines content. The necessary rate of material handled depends on the scheduled need for facilities. The total water requirement is expected to be in the 0.25-0.38 m^3/s (4000-6000 gallons per minute) range. Actual makeup water is only in the range of 0.03-0.04 m^3/s (400-600 gallons per minute) to account for water loss with the materials removed from the process. There would be a settling pond associated with the process; however, small high capacity clarifiers would be used first to keep the pond size to a minimum. The clarifiers and settling pond would remove the finest material (-200 mesh size), with the clarifier underflow pumped to the pond. After completion of a construction phase the fines would be removed from the pond and used in the liner mix or another appropriate use. The first phase of construction (preparing the waste rock storage area and reclaim pond R1) will determine much of the system sizing requirements because there will be less opportunity to spread out the material processing during that phase.

Based on these needs a settling pond to contain all the fines (-200 mesh) removed during the first phase of construction would be in the range of 0.8 to 1.6 ha (2 to 4 acres) with a depth of 3 to 4.6 m (10 to 15 feet).

In this underdrain material preparation process the -40 mesh fraction of till is removed but does not have to be wasted, as it can be used in place of straight till in other applications. As indicated above, with the reuse of the settled fines, there are no unused materials produced from the classifying or processing operations.

The batching and mixing operations are also accomplished through the use of conventional equipment. The attached manufacturers' data (Attachment No. 5) are typical of the type of equipment that would be used to first batch the bentonite clay with the glacial till and then mix the fractions.

Quality control procedures will be planned in detail for the Plan of Operations; however, general quality control aspects for this type of procedure are included in the Exxon paper "Construction Aspects" (previously provided to the DNR).

Comment No. 63

Section 2.3, Mine Waste Disposal Facilities - What is the total proposed area of the MWDF as measured at the outer toe of the embankments?

Response:

The total surface area of the four tailing ponds within their crests is approximately 161.2 ha (403 acres). The total area of the ponds to the outside toe of the dikes is approximately 202.2 ha (505 acres).

Comment No. 64

Section 2.3.1, Waste Rock Transport and Storage - During the construction phase, will surge piles be needed for waste rock and preproduction ore at the mine site? Will roads at the dump site contain high sulfide materials which could be released by traffic? Will the large diameter waste rock contain enough fines to adequately fill the voids between rocks and prevent piping of cover material into the pile? Will surface crushing of waste rock be required to provide riprap material during the construction phase?

Response:

Surge piles will not be required for either waste rock or preproduction ore in the MWDF. Waste rock will be delivered and placed directly into the storage area at the MWDF. Preproduction ore will be stockpiled at the mine/mill site.

Haul roads at the dump sites (MWDF) will be constructed from crushed rock product obtained from an off-site supplier and will not contain high sulfide concentrations.

Large diameter waste rock up to 0.6 m (2 feet) in diameter will only be produced during the first 3 years of mine development after which time underground crushing will be employed, limiting maximum waste rock size to 152 mm (6 inches) in diameter. The larger diameter waste rock will be placed at the base of the waste rock disposal area and subsequently overlain with the finer crushed waste rock. The predicted waste rock gradation when compared to the average gradation of the local till is such that a piping ratio of less than five can be calculated. The piping ratio is

$$\frac{D_{15}\ (\text{filter})}{D_{85}\ (\text{protected soil})}$$

where D_{15} is the sieve size opening in mm which 15 percent of the mass of the filter (waste rock) passes through and D_{85} is the sieve size opening which 85 percent of the mass (till) passes in a standard gradation test (Cedergren, H.R., 1977, Seepage, Drainage and Flow Nets, John Wiley and Sons, p. 181). Large hydraulic gradients within the till cover are not anticipated; consequently, piping should not be a problem.

Surface crushing of waste rock will not be required to produce rip-rap during construction. Rip-rap will be developed from uncrushed waste rock.

Comment No. 65

Section 2.3.2, Waste Rock Disposal and Preproduction Ore Temporary Storage - Additional detail is needed on how the preproduction ore will be separated from the waste rock. Such removal will have to be performed without damage to the liner. Also, describe how the waste rock will be placed on the liner and sand blanket without damaging the integrity of the liner. Will the preproduction ore be placed directly on the liner system or over a bed of waste rock?

Response:

Placement of waste rock in the MWDF will be on a prepared surface composed of the underdrain system and liner. Rock placement should not affect the liner which will be adequately protected by the overlying drainage and filter zones.

Waste rock to be temporarily stored in the MWDF will be in the upper portions of the pile as shown on Figure 2.3-3 of the Mine Plan and should not impact the liner during waste rock recovery.

Continuing study of mine/mill operations has eliminated the need for mine backfill stockpiling. Preproduction ore will now be stockpiled in the mine/mill area rather than the MWDF.

Comment No. 66

Section 2.3.3, Tailings Transport - Provide detailed plans and specifications for the construction, operation, and maintenance of the transport system. (1)More detail is needed on the HDPE pipes and routing the pipelines, including specifications (ASTM, etc.) which the candidate pipes should meet. (2)Documentation should be included either in the text or in an appendix which addresses such items as resistance to crushing for a design overburden and live load, soil types used for trench and backfill, (3)resistance to collapse in a vacuum situation, and (4)ability to resist damage either from blockage by settled solids or by pipe freezing. (5)Leak detection, containment and repair, necessity for redundant pipes, and storage or disposition of water drained from the pipe during normal pump maintenance or power loss should be addressed. (6)Specify pump capacity for each pump on the three pipelines.

Response:

(1) The pipe will be fabricated from an extra-high molecular weight high density polyethylene. This material has been selected on the basis of its resistance to abrasion and corrosion. It is not attacked by chemicals in the soil and it does not support the growth of, and is not affected by, algae, bacteria and fungi.

Typically, for the HDPE pipe envisaged, the physical properties of the material would be tested according to the following ASTM procedures:

Density: ASTM D 1505
Tensile Strength: ASTM D 638
Impact Strength: ASTM D 256
Hardness: ASTM D 2240
Long-Term Strength: ASTM D 2837
Stress Life Testing: ASTM 1598

The pipe material will be high density polyethylene rated for 1725 kpa (250 psi) internal design pressure. In drawing No. 051-1-PSI-002, (see report "Tailing Slurry and Solution Transport Pipeline Systems" by Pipeline Systems Incorporated 1982; previously provided to the DNR), the hydraulic gradients proposed for the system are identified. It can be seen, especially in the case of the tailing transport line that the rated allowable pressure is well above the expected pipeline pressures. For the tailings line, it is proposed to use a wall thickness of 36.8 mm (1.45 inches) and an internal diameter of 199 mm (7.85 inches).

Inspection of the hydraulic gradient data for the other pipe systems shows that, in each case, the pipe is specified to sustain an operating pressure considerably in excess of the expected pressure.

(2) Tailings pipelines and other pipes handling process water will be buried at a depth of 1.83 m (6 feet) below ground to avoid damage by freezing or external hazards.

The trench will be generally as shown in the pipeline installation sketch shown in the report by PSI, Inc. The trench will be over-excavated by 150 mm (6 inches). The trench volume below the pipes will be backfilled with sand, gravel or other select material to support the pipe. Generally, the pipe bed material will be free of rock greater than 12 mm (0.5 inch) in size and will contain no jagged or soft rock.

After the pipe has been laid, it will be surrounded with compacted sand, gravel, or other select material and then backfilled with glacial till derived from trench excavation. Backfill will be compacted to about 85 percent Proctor density (ASTM 698).

When a pipe is buried, it is subjected to external loads such as soil pressure and the pressure of surface loads. The performance limits due to internal pressure are related simply to hoop tension in the pipe wall. The performance limit due to external pressure could be wall crushing, wall buckling, or ring deformation depending on the applied loads, and the phyical properties of the soil and the pipe. These aspects of pipe design will be considered in final engineering.

Instrument cable will be buried with the pipe. The cable will be used as a metal source for pipeline locating instruments.

(3) Because the tailings ponds embankment berms are at a higher elevation than the pumping station and the discharge of tailings to the lower depths of the ponds could create a vacuum in the tailings line, a vacuum breaker will be installed at the high point of the pipeline on the tailings pond berm.

(4) Because the pipeline is buried it will not be vulnerable to deliberate or accidental damage from humans, vehicles or machines. The depth of burial below the frost-line excludes the possibility of freezing. Rodent attack is unlikely at the 1.83 m (6 feet) depth.

Slurry characteristics determined by laboratory penetrometer testwork show that the solids are "soft-settling." In this test procedure a sample of tailing solids and water is prepared and allowed to settle for 24 hours. A penetrometer is placed on the solid-liquid interface. Weights are added to the penetrometer until the tip penetrates the solids and reaches the bottom of the containing vessel. The weight required to achieve penetration under standard conditions is a measure of the resistance of the settled solids to re-slurrying after a pipeline shutdown.

The results of the tests indicated that if the pipeline is shutdown during an emergency, the solids are soft-settling and can reslurry when the pipeline is restarted. During scheduled shutdowns of the pipeline, the solids will be flushed out with water prior to shutdown.
In the event of a sudden blockage of the pipeline, the slurry pumps will not be able to develop the pressure required to rupture the line. The increase in pipeline pressure and decreasing flowrate would activate alarms and the pipeline would be shutdown.

(5) The pipe will be received in 11.6-m (38-feet) lengths. All pipe will be inspected for damage on site. Sections of pipe with cuts or gouges will be cut out and rejected.

Each piece of pipe will be fusion butt welded to form a continuous pipeline from the pumping station in the mine/mill site to the discharge point.

Butt fusion welding involves heating both ends of the pipes to be joined, making contact between the two molten ends and joining them together under pressure. The operation is performed using commercially available equipment designed for this purpose. The equipment is easily transported and may be used at any point along the pipeline during the installation of new pipe or the repair of old pipe. The joint which is formed is stronger than the pipes it joins.

A similar technique will be used to install the reclaim water, thickener overflow water, and decant water pipelines from the tailings ponds.

Buried pipelines are inherently safer than pipelines laid on the surface. They are silent in operation and not visible. Typically, vegetation covers the trenched area within 2 years.

In the event of a pipeline breakage, flowrate monitoring equipment would warn the operator to shutdown the pipeline system. Such an event could be cause for a complete plant shutdown. For the case of a pipeline break at the lowest elevation in the pipeline route the contents of the pipe would drain to the low point. The contents of about a 1800 m (5905 feet) length of line would leak from the pipeline. This is equal to a volume of 58.4 m^3 (15,420 gallons) of slurry. Because of the low elevation heads, the rate of leakage would be low and little solid material would escape.

Clean-up would require excavation around the leak and the water and tailings would be pumped to the MWDF. Repair would involve the removal of the damaged pipe and welding in new pipe using portable butt welding equipment. The repaired pipeline would be leak tested using water before backfilling and returning the pipeline to normal service.

Spare plastic pipe would be retained in storage for repair purposes.

Pipeline leaks in conventional flanged or mechanically coupled pipelines typically occur at the flanges or in areas of the pipe where sudden changes in direction are necessary. The use of welded plastic pipe eliminates the flange or other connections and reduces the possibility of leakage. Typically, HDPE pipe can be cold bent to a minimum radius of 25 times the pipe diameter. This allows gradual direction changes to be made and reduces the possibility of pipe wall erosion and minimizes the potential for leaks.

(6) The current anticipated capacities of the pumps are as follows:

Tailings slurry pumps	185.2 m^3/h* (815 gallons per minute)
Reclaim water pumps	1153 m^3/h (5,077 gallons per minute)
Thickener overflow pumps	1030 m^3/h (4,535 gallons per minute)

*Includes gland seal water

Comment No. 67

Will there be any areas on the mining site where the pipelines will be on the surface? If so, these should be indicated on a diagram. What is the width of the proposed pipeline/haul road corridors?

Response:

The tailing pipeline, the water reclaim pipeline, and the tailing thickener overflow pipeline will be fully buried within the mine/mill site and along the haul road from the mine/mill site to the MWDF/reclaim ponds area. At the MWDF/reclaim ponds area, the pipelines will be routed along the embankment crests. Within the MWDF area there will be additional water pipes routed along the crests to transfer tailings pond surface decant and underdrain water to the reclaim ponds. Drawing No. 050-1-80598 in Attachment No. 6 shows the routing of all pipelines within the MWDF area.

There will be some piping on the surface between the water treatment plant, concentrator, and water tanks and tailings thickener. These pipes will be supported in a pipe rack shown on drawing No. 051-7-C-001 also included in Attachment No. 6.

The haul road cross-section is shown in drawing No. 050-1-80597 in Attachment No. 6. The width of the limit of construction for this road (and the adjacent pipelines) has been estimated at 40 m (131 feet). For projecting impacts a corridor width of 61 m (200 feet) was used.

Comment No. 68

<u>Section 2.3.4, Tailing Disposal</u> - More detail should be provided on the carbonate sludge and the potential effect it will have when pumped to the tailings ponds. There is no additional detail contained in the feasibility study or contractor documents.

Response:

The carbonate sludge is a very fine flocculant precipitate and will have no adverse effect when pumped with the tailings to the ponds. The most recent estimate of calcium carbonate sludge is 250,000 m^3 (327,000 cubic yards) as presented in Table 3.1 of the Mine Waste Disposal Facility Feasibility Report. It is expected that the sludge will fill some of the existing voids in the tailings and their actual required storage volume would be somewhat less. However, a conservative estimate of 1 million m^3 (800 acre-feet) was used to assure adequate disposal design volume for the MWDF for the carbonate sludge and also for the lesser volume of reclaim pond sludge to be disposed in the tailings pond at completion of operations.

Disposal of this sludge is discussed in the MWDF Feasibility Report in Sections 2.4.5 and 3.4.2.

Comment No. 69

Why does the Golder Report No. 11 (pages 7-19) recommend three feet of freeboard versus the five feet required in NR 182.11(1)(q)?

Response:

NR 182.11 (1)(q) states that "Sufficient freeboard measured from the...crest shall...contain the 100-year, 24-hour rainfall event... or a minimum of 5 feet...". Golder Report No. 11 calculated the 100-year, 24-hour rainfall event and maximum wind generated waves expected for the ponds. These calculations indicated that a 0.9 m (3-foot) freeboard was sufficient to prevent overtopping of waves for the 100-year, 24-hour rainfall event and accompanying high winds. As such, their recommendation meets the requirements of NR 182.11 (1) (q). However, regardless of the interpretation of the regulation, based on the normal maximum tailings pond water levels, freeboard ranges from 2.35 to 3.65 m (7.7 to 12.6 feet).

Comment No. 70

The discussion of the MWDF location is not quite correct with regard to water users in that there are several users downgradient of the site at Rolling Stone Lake. Hemlock and Swamp Creeks are also downgradient of this facility and both drain to Rice Lake. Due to the unique nature of Rice Lake extra measures of protection may be required to maintain its water quality.

Response:

There are approximately 25 private water wells and 21 Exxon Minerals Company owned residential water wells within the area of hydrological influence from the Crandon Project. Since the MWDF is located over a ground water high, all of these wells would be downgradient from the MWDF. However, all of them lie outside of the compliance boundary and should not be impacted by the MWDF. (See EIR Chapter 4.0, Sections 4.2 and 4.3 and Appendix 4.1A.)

Comment No. 71

Section 2.3.5, Water Treatment Waste Disposal - Greater detail should be provided on the effect of disposal of Na_2SO_4 sludge on the types of landfills available in Forest County. It is not likely that a typical town dump will be allowed to accept this material. If a large, engineered county landfill such as the Marathon County Landfill is suitable, that should be made explicit.

Response:

Exxon Minerals Company will comply with any applicable regulation for the disposal of sodium sulfate by-product from the water treatment plant. There are no plans to dispose of this material in any currently existing landfill site in Forest County. Ideally, the material could be marketed to Kraft paper mills. Until the material is accepted as being marketable, or if the material cannot be marketed, the following options could be considered:

1) Disposal in an isolated area within the proposed MWDF;
2) Placement in the MWDF;
3) Placement in an approved off-site landfill; or
4) Placement in the mine, either in a specially excavated area in unfractured footwall rock or in backfilled stopes.

We are willing to work with the DNR to determine an acceptable method of disposing of the sodium sulfate until and if its marketability can be established.

The following information regarding the potential marketability of sodium sulfate is provided:

Sodium sulfate, or salt cake as it is commercially known, is consumed by Kraft pulp and paper mills. Wisconsin has three Kraft pulp mills which consume a total of 29 t/d (32 short tons per day) of salt cake, based on a telephone survey.

Wisconsin Kraft Pulp Mills

Company	Location	Salt Cake Consumption (t/d)
Mosinee	Mosinee	3
Nekoosa	Nekoosa	4
Thilmany	Kaukauna	22*

* 27 t/d (30 short tons per day) of Copeland sulfate (80% Na_2SO_4, 20% Na_2CO_3) equivalent to 22 t/d (24 short tons per day) of pure Na_2SO_4.

An additional 20 t/d (22 short tons per day) of salt cake is projected to be consumed by the states of Minnesota and Michigan, and the Canadian provinces of Manitoba and Ontario.

The production of crystallized sodium sulfate from the water treatment plant will range from 0 to 14 t/d (0 to 15.4 short tons per day) depending on the amount of water being treated by the reverse osmosis/vapor compression evaporation (RO/VCE) units.

Prior to sodium sulfate crystallization (removal of soluble impurities), the nearly saturated sulfate solution exiting the VCE unit will be lime neutralized and then clarified to remove insoluble impurities (heavy metals). This post treatment of the VCE brine will help to ensure a marketable salt cake or a non-hazardous secure landfill disposal option.

Comment No. 72

Section 2.3.6, Reclaim Pond Sludge - Describe the method and frequency of sludge removal. Characterize sludge based on the analysis of sludge from similar operations.

Response:

A conservative projection of 100,000 m^3 (131,000 cubic yards) of reclaim pond sludge has been made for the life of the Project. This estimate is based on the water flow rate passing through the two pond system, the suspended solids in the water, the total Project time, and a sludge density. This volume of sludge can be held in the system for the life of the Project with no effect on the operation of the reclaim ponds. Overall, it is approximately 8.5 percent of the total operating volume. If divided evenly between the two ponds, it would amount to approximately 0.6 m (2 feet) of sediment on the pond bottom.

There will be some difference in the sludges between the two ponds. Reclaim pond R2, the first pond to receive the tailings pond decant and underdrain water, will have sludge consisting largely of tailings and calcium carbonate precipitates, while reclaim pond R1 will have a predominance of gypsum precipitates from the pH adjustment step between the two ponds. There may also be some metal hydroxide precipitates in pond R1.

Aside from the conservative sludge estimates, the operation of the tailings pond decant system offers a degree of control on the clarity of the water returned to the reclaim ponds. Some additional ponding with increased retention time in the tailing ponds could reduce suspended solids in the decant water.

If it would ever be necessary, there are suitable sludge removal methods that would not damage the pond liner while still allowing continued pond operation. A small floating suction dredge with depth control on the suction head could be used. In practice, a small depth of sludge (0.3 m [1.0 foot]) would not be removed to maintain an additional layer over the liner. Specific disposal details for the sludge have not been determined, but are not expected to present any problems. If the estimated 100,000 m^3 (131,000 cubic yards) of sludge were distributed evenly over the final tailings surface of pond T4, the depth of sludge would be approximately 0.25 m (0.8 foot). Since there are no crucial timing constraints on reclamation of pond T4, there will be ample time for proper management of the sludge through drying or blending with tailings or cover soil. The sludge could also be incorporated into the thick till grading layer planned as the first step in reclamation of the tailings pond.

Comment No. 73

Section 2.4.1, Rail Spur - Discuss right-of-way maintenance as it relates to aesthetics, erosion control, and the prevention of railroad initiated wildfires.

Response:

Standard railroad maintenance practices will be followed for the railroad spur. Because the spur line will be new and will receive relatively little use, maintenance will primarily relate to control of vegetation in the right-of-way. The ballast section will be kept free of vegetation altogether, either through use of EPA-approved chemical herbicides or other means. Undesirable weeds or woody vegetation within other areas of the right-of-way will be controlled by mowing or through use of EPA-approved chemical herbicides or other means.

The railroad right-of-way will be periodically inspected to ensure all vegetated areas are stabilized and are effectively controlling erosion. If any areas within the right-of-way show signs of erosion, measures will be taken to regrade the affected area and establish vegetative cover.

Other than the measures identified above to control vegetation within the corridor, no additional preventative measures are planned to control fires originating within the corridor.

Comment No. 74

Section 2.4.2, Access Road - Describe the surface material to be used on this road.

Response:

Bituminous concrete will be used for the access road pavement.

Comment No. 75

Section 2.4.6, Sanitary Waste Facilities - Discuss the anticipated volumes and frequency of sludge disposal. Greater detail should be provided as to how much area is needed annually for the disposal of septage. Given the climate in Forest County, there is potential that this material may have to be stored for a significant part of the cold winter months. Please estimate the land area needed and available for landspreading or the available treatment plants for treating this waste.

Response:

The initial preliminary sewage treatment system was designed by CH2M Hill in accordance with Wisconsin Administrative Code Section ILHR 83 as well as U.S. Department of Health, Education, and Welfare "Manual of Septic Tank Practice." The total liquid capacity of the septic tank is 223.3 m^3 (59,000 gallons). This will provide one-day liquid retention time and allow for 49.2 m^3 (13,000 gallons) of sludge storage. This system will require sludge removal once or twice a year. If the entire septic tank of approximately 223.3 m^3 (59,000 gallons), which includes 49.2 m^3 (13,000 gallons) of sludge, is emptied, the sludge field required is less than 2 ha (5 acres). This assumes an application rate of 0.11 m^3/9.3 m^2 (30 gallons per 100 square feet). Although land area is available for on-site disposal, Exxon does not currently plan to develop such an area. These volumes will be handled by a licensed private contractor.

Initially, pumping might be more frequent to avoid winter sludge disposal problems (if winter disposal is prohibitive for the private contractor); however, with some operating experience, a sludge pumping schedule could be established to avoid winter disposal.

Additional design work on the soil absorption field portion of the sanitary waste disposal facilities has reduced the estimated sewage flows. This information has been provided to DILHR and the DNR. In the final design work for the septic tank and appurtenances, these reduced flows will be used in refining the design. The reduced sewage volumes will further lessen sludge disposal quantities and disposal effects from those described above. Also see response to comments No. 106 and 133.

Comment No. 76

Section 2.4.8, Fuel Storage and Distribution - Provide a map showing the location of fuel distribution pipelines. Provide specifications for pipeline construction, particularly in areas of potential earth settling or mine subsidence. Provide specifications and the anticipated life expectancy for buried fuel tanks. Provide plans for the containment dikes around surface fuel storage tanks and detail the storm water drainage from these containment structures.

Response:

The fuel distribution system is confined to a single line, approximately 200 m (656 feet) long, from the bulk fuel storage tanks to the fuel tanks located at the fuel delivery borehole to the mine (see drawing No. 051-7-C-001 in Attachment No. 6). No settlement is expected along this pipeline route. The pipeline specification would be C.S. Sch. 40 with welded joints.

Details of the buried fuel tanks are presented in drawings No. 051-0-G-003 and 051-1-G-004 in Attachment No. 7. The anticipated life expectancy for the buried fuel tanks is longer than the Project life.

The area within the containment dikes surrounding the bulk fuel storage facility will be lined with an elastomer membrane to prevent spills and contaminated runoff from reaching ground water. Any minor spills and washdown or runoff from this area will be transferred to the industrial wastewater treatment system. (This system also collects washdown and runoff from around the shops and other areas of potential oil/grit contamination.)

Precipitation collected within the containment berms would not normally be contaminated in any way since the fuel storage and handling systems are totally enclosed and sealed. In such case the precipitation would simply be permitted to flow off into the surrounding area.

The design of the industrial wastewater treatment system will be finalized during detailed engineering. The system will be provided with an oil/water separator to remove oily contaminants. This contaminant material will be transferred to a holding tank for eventual removal from the site. The clear water will be pumped to the reclaim pond.

Comment No. 77

Will collection and treatment of runoff from the fuel oil storage area and the tank unloading area be provided? Please elaborate on the answer and indicate the type of treatment proposed, quantity of runoff, etc.

Response:

See the response to comment No. 76.

Comment No. 78

Section 2.4.10, Potable Water Facilities - The discussion of the potable water supply system should be expanded to contain more detail on such things as well construction, the distribution system and any storage facilities. These questions and others will have to be addressed in detail in the high capacity well approval submittal.

Response:

A comprehensive discussion of the proposed potable water facilities is presented in the application for high capacity well permits (submitted to the DNR in October 1983).

Comment No. 79

Section 2.4.11, Water Treatment Facilities - Details are needed of the water release pipeline similar to those for the tailings and reclaimed water pipelines addressed above.

Response:

At the current stage of project engineering the water discharge pipeline is expected to be constructed of 0.36-m (14-inch) diameter high density polyethylene (HDPE) pipe and buried a minimum of 1.5 m (5 feet) below ground to beneath the frost line. The exact size and wall thickness of the pipeline will be determined later.

Because the trench will be excavated in glacial till, blasting will not be required and all excavation can be by a backhoe or trenching machine. The trench volume in the pipeline zone will be backfilled with sand or gravel or other select material and the remaining trench volume will be backfilled with till. During construction, exposed areas with potential for runoff of sediments will be controlled with straw bale sediment traps. Seeding and reestablishment of vegetation will follow shortly after trench backfilling.

General HDPE pipe characteristics are discussed in the response to comment No. 66. Current engineering calculations show that HDPE pipe rated at 250 psi internal design pressure would be well above expected pipeline pressures.

The water discharge pipeline should not experience vacuum conditions because vacuum breakers will be installed prior to operation.

Blockage of the pipeline due to settled solids will not be a problem because solids in the discharge water will be less than 20 mg/l. Any settling due to periodic pipeline shutdown will be flushed out during start-up.

The depth that the pipeline will be buried will preclude pipeline freezing.

The pipe will be received in 11.6-m (38-feet) lengths. All pipe will be inspected for damage on-site. Sections of pipe with cuts or gouges will be removed and rejected.

Each piece of pipe will be fusion butt welded to form a continuous pipeline from the pumping station on the mine/mill site to the discharge point.

Butt fusion welding involves heating both ends of the pipes to be joined, making contact between the two molten ends and joining them together under pressure. The operation is performed using commercially available equipment designed for this purpose. The equipment is easily transported and may be used at any point along the pipeline during the installation of new pipe or the repair of old pipe. The joint which is formed is stronger than the pipe it joins.

Buried pipelines are inherently safer than pipelines laid on the surface. They are silent in operation and not visible. Typically, vegetation covers the trenched area within 2 years.

In the event of a pipeline breakage, flowrate monitoring equipment would warn the operator to shutdown the pipeline system.

Clean-up and removal of spilled water will not be necessary due to the good quality of the treated discharge. Repair of the pipeline will involve the removal of the damaged pipe and welding in new pipe using portable butt-welding equipment. The repaired pipeline would be leak tested using water before backfilling and returning the pipeline to normal service.

Spare plastic pipe will be stocked for repair purposes.

Pipeline leaks in conventional flanged or mechanically coupled pipelines typically occur at the flanges or in areas of the pipe where sudden changes in direction are necessary. The use of welded plastic pipe eliminates the flange or other connections and reduces the possibility of leakage. Typically, HDPE pipe can be cold bent to a minimum radius of 25 times the pipe diameter. This allows gradual direction changes to be made and minimizes the possibility of leaks.

Current plans call for use of three pumps in the system. Two 110-hp pumps and one 170-hp pump. During normal operation (discharge less than 2,000 gallons per minute) one of the 110-hp pumps will be used with the other for standby operation. During maximum discharge (3,000 gallons per minute), all three pumps would be used.

Comment No. 80

Section 2.4.12, Reclaim Water Ponds - The statement that "the reclaim ponds and the tailings ponds will provide surge capacity for the water management system" needs further clarification. The reclaim ponds apparently will be filled to capacity during normal operations and according to Knight and Piesold, it is desirable to reduce or eliminate any pond on the tailing surface in order to achieve drying and consolidation of the tailings. Under these conditions, how long could the mine or concentrator continue operation in the event of an extended water treatment plant shutdown?

Response:

When the water level in the reclaim ponds is at the maximum normal operating level, there is water surge (storage) capacity in the ponds in the pond freeboard depth. Reclaim ponds R1 and R2 have a design freeboard of 2.59 m (8.5 feet) and 0.91 m (3.0 feet), respectively, above maximum operating water level. Approximately 1.55 m (5.1 feet) of the freeboard in reclaim pond R1 will hold 14 days of water flow at a rate of 0.158 m^3/s (2500 gallons per minute). The reclaim ponds freeboard is designed to contain the volume of the probable maximum precipitation (PMP) event including the water from the largest tailing pond (T4). The preferred operating practice will be to keep the water level in the pond below the maximum level so that surge capacity is available without infringing on the freeboard allowance. In Section 3.0 of the "Miscellaneous Details and Analyses" report by Golder Associates, additional pond freeboard information is presented.

The surge capacity in each of the tailing ponds, above highest normal water levels, is in all cases greater than required from a storm and wave run-up standpoint. In an emergency, if the surge capacity in the reclaim ponds was not sufficient, the tailing ponds could be used to store water.

To use the tailing ponds storage capacity and maintain low seepage rates, pumping of the underdrains would continue with underdrain water circulated back to the tailing ponds. Then, depending upon the rate of decant water pumping, water level in a tailings pond could be increased to accommodate surge storage requirements. As the ponded water depth is increased there is an increase in the underdrain flow rate, but it can be accommodated as a result of the design of the underdrain pumping system. If the underdrains were not pumped, they would flood; while this would temporarily increase seepage, it would not affect the integrity of the facility, nor change the stability of the embankments.

Tailings deposited underwater would have a slightly lower density (approximately 10 percent less) than the previously deposited tailings. However, the overall tailings volume change within the pond would be negligible.

Tailing pond T1 has the smallest surge capacity of the four ponds. Its lowest surge capacity (at completion of tailings deposition) is approximately 660,000 m^3 (535 acre-feet) from the tailings surface to a level surface 0.91 m (3 feet) below the pond crest. Surge capacity within the 0.91 m (3 feet) freeboard height is approximately 300,000 m^3 (244 acre-feet). At a water flow rate of 0.158 m^3/s (2500 gallons per minute), these volumes represent 48 and 22 days of surge capacity, respectively. The total minimum surge capacity (i.e., tailings pond T1 and reclaim pond R1 water storage) would be approximately 84 days at a 0.158 m^3/s (2500 gallons per minute) flow rate. These conclusions are based on the fact that the concentrator is still operating and that water continues to flow into and out of the reclaim pond for process purposes. The estimate of 0.158 m^3/s (2500 gallons per minute) is a conservatively high value for total water pumped from the mine.

Comment No. 81

Section 2.4.14, Shop, Garage and Warehouses - Where will drainage of the southside unloading dock be routed?

Response:

The revised design incorporates the shops, garage, warehouse, offices and change rooms into a single building known as the Services Building (see drawing No. 051-1-G-001 in Attachment No. 1). This building is located in the same general area as were the shops and warehouse in previous layouts shown in the Mine Plan. The off-loading and outside areas adjacent to the shops are located to the north and northwest of this building. Spills, grit or other contamination which might occur in these areas will be routed and handled through the industrial wastewater treatment system.

Comment No. 82

Section 2.4.15, Other Water Facilities - In addition to the fueling station drainage, what other waste streams will be routed to the oily water sewer system? What is the volume of water which will flow through the oily water sewer system? Overflow from the oily water sewer system should not be directed to the reclaim ponds unless it can be shown that the pond and mill treatment system can handle the wastes.

Response:

The 1-ha (2.48-acre) area in front of the shops and warehouse and the 0.25-ha (0.62-acre) equipment and material laydown area southeast of the headframe will also drain into the oily water sewer system. The volume of water which will flow through the industrial wastewater sewer system is only that from precipitation runoff. For a 1.25-ha (3.1-acre) area this is approximately an annual average of 1.1 m^3/h (5 gallons per minute). The industrial wastewater sewer system is designed to separate the immiscible oil from water. Once separated, the oil-free water stream flows to the reclaim pond. There is no incompatibility of this 1.1-m^3/h (5-gallons per minute) oil-free water stream with the 1135+ m^3/h (5000+ gallons per minute) water feeding the reclaim ponds or the mill process recycle water treatment system.

Comment No. 83

Section 3.2, Facilities Construction (General) -The clearing of trees and shrubs during periods of snow cover is preferable because the wildfire hazard is miminized, salvage wood increases in volume and value because the logs are protected from dirt, and the lack of leaves reduces the slash volumes.

Response:

Comment acknowledged.

Comment No. 84

Commercial whole tree chipping contractors and the sale of chips for fuel or pulp should be investigated as an alternative to burning. The burial of stumps under a one-time disposal permit may also be an alternative. DNR burning permits will be required for any burning during the fire season.

Response:

Comment acknowledged. To minimize the amount of burning that will be required during clearing of the Project site, consideration will be given to using contractors having whole tree chipping capability for the removal of wood.

Comment No. 85

Provide a grading plan <u>for all disturbed areas</u> showing interim and final grades, along with earth material balances. If negative balances are derived, specify the source of imported fill and/or topsoil If positive balances are found, specify the use or disposal of surplus material. Include in the plans the specifics of the runoff and erosion control program and further describe the scheduling relationship between grading and runoff control. Calculate anticipated maximum runoff volumes from each storm water collection area and maximum flow rates in major collection ditches. Provide plans for all temporary and permanent storm water impoundments, specifying design capacity, retention times, control structures, overflow pipes, weirs, energy dissipaters, and surface stabilization material or methods. Define and differentiate between short-term and long-term erosion control measures (for example, the use of straw bales for periods of more than one year may aggravate siltation release problems because of the need for frequent maintenance with resulting disturbance to other stabilization materials).

Response:

The three attached civil drawings (Attachment No. 8) indicate the grading plans for final grades superimposed on existing topography in the site area.

As described in the Mine Plan, the site will be cleared, grubbed, and rough graded as necessary which will be one of the initial activities in the construction schedule. Since there is no phasing to this work, there will be no interim conditions for any length of time.

The storage area for the salvaged topsoil, estimated at 53,500 m^3 (70,000 cubic yards), is shown on the east side of the mine/mill area. Earthwork calculations for the mine/mill area indicate a net excess of 70,700 m^3 (92,400 cubic yards) of material in addition to the topsoil stockpile. This excess material will be utilized in the construction of the MWDF.

Erosion control will be developed as necessary with the rough grading. To the extent possible, the two permanent surface drainage basins will be used for runoff control (see drawings No. 051-1-C-001 and 051-1-G-002 in Attachment No. 8). The basin areas will be excavated first with grading work generally progressing outward from the basins. Where portions of the storm drainage system are not installed concurrently with the rough grading, separate provision for runoff and erosion control will be made. These provisions will consist of temporary siltation basins or hay or straw bale ditch retention checks.

Graded areas not scheduled for immediate development would be revegetated with a temporary ground cover following the grading work to reduce siltation from runoff erosion. As an area is subsequently developed, any portions of the final storm drainage system not installed with the initial site work would first be installed for the area before beginning other construction.

At that point, runoff would be controlled by the final system, although some hay or straw bale ditch checks might still be used to prevent downstream siltation of the system. Development of the site in this manner will reduce the need for short-term temporary erosion control measures. The long-term control will be through the final surface water drainage system.

The three civil drawings include a culvert schedule which presents the water flow rates in the ditches and culverts, for a 10-year, 24-hour storm. Runoff coefficients and tributary areas are included with the other drawing data.

Except for two small extremities of the mine/mill area (the road to the underground fuel delivery borehole at the southwest and the explosive storage area at the northeast), all surface water will be directed to surface drainage basins No. 1 and No. 2. The drainage basins are sized for a 25-year, 24-hour storm, with pond depth allowance for sediment accumulation and maintenance of freeboard. Runoff in the preproduction ore storage area, which is now located where the backfill sands were originally designated to be stored, is collected and pumped as needed to the water treatment plant feed tank. As shown on the drawing, drainage is also collected separately from three other small areas in the central portion of the mine/mill site. This water is directed through and oil/water separator and then to the reclaim pond.

Typical drainage inlets for paved areas and for ditches, and details of the surface drainage basins are included with the drawings.

Comment No. 86

<u>Section 3.2.1, Mine/Mill Site Preparation</u> - What is the projected volume of wood waste which will have to be handled? Where will the mulched material be stockpiled?

Response:

A Forest Inventory and Timber Appraisal Report prepared for the Crandon Project by Edward F. Steigerwaldt and Sons included an estimate of timber resources recoverable during mine/mill site development (report previously provided to DNR). By adjusting their estimates to actual cleared area for the mine/mill site, and applying percentage waste factors, the amount of wood waste from timber harvesting was estimated. Using a factor of 65 percent waste (culls, branches, and tops) on an air dry weight basis, a wood waste quantity of approximately 1360 t (1500 short tons) was estimated.

The calculations leading to these totals are presented in the attached table. Stumps removed during grubbing would increase these totals.

The disposal options of burning or mulching and reusing, as suggested in the Mine Plan, are still considered appropriate.

(TABLE FOR RESPONSE TO COMMENT NO. 86)

WASTE WOOD FROM MINE/MILL SITE CLEARING
STEIGERWALDT DATA

Acres	Cords	Board Feet
201	2761	186,795
(Revise cleared area to 89 acres)		
89/201	1215	82,190
Air dry tons	2126	154
Waste at 65%*	1382	100
Total: 1482 Tons		

Notes: Cord - 128 ft^3
Wood Volume - 80 ft^3
Air dry weight (hardwoods) - 3500 lbs/cord (1.75 tons per cord)
Air dry weight (hardwoods) - 45 lbs/ft^3 (0.0225 tons/ft^3)

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* Contained in a Dames and Moore Study for WPSC on wood availability in this area of Wisconsin. (65% represents culls, branches, and tops normally left in the field after harvest - stumps would increase the percentage.)

If the approximate 1361 t (1500 short tons) of waste wood were chipped for mulch and stockpiled, it could be stored adjacent to the topsoil storage area. Assuming a density of 0.32 t/m^3 (20 pounds per cubic foot) for the waste wood, approximately 4320 m^3 (3.5 acre-feet) of storage volume would be required.

Comment No. 87 and Comment No. 88

Section 3.2.2, Temporary Facilities - None of the existing on-site water wells were constructed or approved for potable water supply purposes. Modifications of previously granted high capacity well approvals will, therefore, be required prior to the use of existing wells for drinking water purposes. The use of several strategically located wells should be considered in order to minimize the need for tank trucks and potable water dispensers.

Where will the construction water well be located? Construction details, distribution system and storage facilities should be discussed.

Response:

A high capacity well permit application has been recently submitted to the DNR to cover two wells that will supply potable and construction water for the Crandon Project. One of the wells is a completely new well located southwest of the mine/mill area (N 35,330, E 693,730) which will be the primary potable water supply well during the mine operating period. The other well is located in the MWDF area (N 34,787.24, E 697,267.63) and will be a modification of an existing, previously approved potable water well. During the mine operating period, this well will provide some potable water for use in the area of the MWDF but will primarily be used for water supply for material processing to produce the underdrain and liner materials for construction of the MWDF.

Both of these wells will be built as soon as possible with start of initial site development. They will then be available to meet all potable and construction water requirements throughout the construction period. For the very short time (a matter of weeks) before the well in the MWDF area could be ready for use, other arrangements would be made for supply of potable and construction water. During this time the two existing site wells (WW#1 and WW#2), although not approved for potable water, would be used for construction water and Exxon Minerals Company would arrange to haul in and distribute (through water dispensers) required potable water.

Comment No. 89

Section 3.2.3, Access Road Construction - Please discuss the road surfacing process.

Response:

The access road preliminary design pavement section includes a 76 mm (3 inch) bituminous concrete pavement with an underlaying 0.3 m (1 foot) crushed aggregate base course.

Construction processes for the pavement would follow normal practice used in the area. A central plant would batch and mix the pavement materials followed by truck transfer to the site where paving machines would be used for pavement placement.

Comment No. 90

What off-site landfill will be used for disposal of wood waste created by the construction of the access road corridor?

Response:

The estimated wood waste from the access road construction is approximately 272 t (300 tons). If this wood waste were chipped for use as mulch, the approximate volume would be 841 m^3 (1100 cubic yards). If this volume could not be used in landscaping of the access road, it would be transferred to the mine/mill site for storage with other chipped wood waste.

Unchippable wood waste (stumps) would be burned (a permit would be requested) at a suitable location along the access road. Transfer to an off-site landfill for disposal is still considered as an alternative but not a preferred one.

Comment No. 91

What will ultimately be done with the sediment that is collected in the temporary retention areas near the wetlands and behind the sheet piling at the stream crossings? How much peat is expected to be encountered in the wetland crossings?

Response:

After the various temporary sediment traps along the access road are no longer required, the sediments will be removed and transferred to either the topsoil stockpile area at the mine/mill area or to the soil stockpile areas at the MWDF.

The total estimated wetland/marsh materials removed along the access road is approximately 4800 m^3 (6275 cubic yards). No separate estimate of peat materials within this volume has been made.

Comment No. 92 and Comment No. 93

Section 3.2.4.2, Shafts and Collar - The discussion of shaft construction needs expansion. What type of brine will be used? How large will the holes be and how will they be constructed and spaced? How much area will be affected by the soil moisture freezing? How long will the "ice ring" be intact? What diameter will the total excavation for the main shaft be?

Discuss brine containment and waste brine disposal.

Response:

The plan for development of the Crandon Mine includes construction of four vertical shafts:

1) Main production and service shaft - 7.3 m (24 feet) finished diameter;

2) Intake air shaft - 5.5 m (18 feet) finished diameter;

3) East exhaust air raise - 6.1 m (20 feet) finished diameter; and

4) West exhaust air raise - 6.1 m (20 feet) finished diameter.

Each shaft will have a concrete lined collar through the glacial overburden and weathered subcrop rock. Collar construction will include stabilization and hydraulic control by ground freezing, followed by excavation and concrete lining within the protective frozen soil cylinder.

The stabilized ice wall is formed by closed circuit circulation of a cooling fluid (calcium chloride brine) through a circular pattern of vertical pressure-tested steel-cased boreholes (114-152 mm [4 1/2 - 6 inches] diameter) containing inner 38-mm (1 1/2-inch) down-flow tubes. Monitor boreholes are also provided to measure ground water levels, ground temperatures, and for detection of brine leakage. With this temporary ground stabilization method no foreign materials are introduced to the ground water regime or surrounding soils.

Freezing system design, e.g., number of freeze holes, hole spacing, and required ice wall thickness, is contingent upon the geohydrologic conditions of each site. Preliminary designs for the Crandon shaft collars have been prepared by Ground/Water Technology, Inc. of Denville, New Jersey. Site design details are shown on the four figures included in Attachment No. 9.

Once excavation and lining of the shaft collars are complete, the protective ice walls and the surrounding soils will be allowed to thaw. The ice walls will be intact for various periods depending upon the shaft being constructed. They will range from 14 weeks (east exhaust raise) to 24 weeks (intake air shaft). Abandonment of the freeze pipes will include:

1) Removal of brine for off-site disposal by the freezing contractor;

2) Clean water flushing of freeze pipes;

3) Mechanical perforation of freeze pipe casings at the soil-rock interface and at the hole bottom; and

4) Displacement of freeze pipe flushing water with cement grout delivered from the surface.

Ground freezing is an established shaft collar construction technique for sites with saturated or unstable soils. For additional technique and application details the reader is referred to:

1. Sanger, F. J. 1968, Ground Freezing in Construction. - Journal of the Soil Mechanics and Foundations Division, A. S. C. E. Vol. 94, No. SMI. Proc. Paper 5743. January, 1968.

2. Sanger, F. J. and Sayles, F. H. 1978, Thermal and Rheological Computations for Artificially Frozen Ground Construction. - International Symposium on Ground Freezing. March, 1978. Bochum.

3. Maishman, D. 1982, Ground and Water Control by Freezing - The Application in Shaft Construction. - University of Wisconsin, Extension Course on Shaft Design and Construction. January, 1982.

Comment No. 94

The discussion of blasting should identify the magnitude of the blasts, types of explosives and demonstrate compliance with DILHR requirements.

Response:

The main production and intake air shafts will be developed concurrently. The main production shaft will be developed at a rate of 2 m (6.9 feet) in depth per day (7.3 m [24 feet] finished diameter). This will require an average of 2 blasts per 24-hour day. Each of these blasts will require approximately 97 Kg (214 pounds) of 40 or 60 percent strength straight-gelatin dynamite and 66 no. 6-strength electric blasting caps.

The intake air shaft (5.5 m [18 feet] finished diameter) will be developed at a rate of 2.6 m (8.5 feet) in depth per day and require an average of 2.5 blasts per day. Each blast will require approximately 84 Kg (186 pounds) of 40 or 60 percent strength straight-gelatin dynamite and 45 no. 6-strength electric blasting caps.

All blasting will be conducted to comply with the appropriate DILHR Code (i.e., Chapter Ind 5, Explosives and Blasting Agents), in particular sections 5.64, 5.65 and 5.66. All required permits and procedures will be complied with prior to undertaking these tasks.

Comment No. 95

What is the projected volume of water that will be generated during the shaft construction (i.e., is 2,000 gpm the maximum to be reached 2-3 years after starting construction)?

Response:

During development of the main production and intake air shafts, water will enter the excavations from three sources: (1) precipitation; (2) ground water seepage; and (3) utility water supply.

All shaft drainage will be pumped to surface storage ponds prior to treatment and discharge as required.

Precipitation gains over the total area of the shafts will be less than 0.07 m^3/h (0.3 gallons per minute). Construction plans provide for control of surface runoff around the shaft excavations. Therefore, the effects of precipitation drainage on shaft development are negligible.

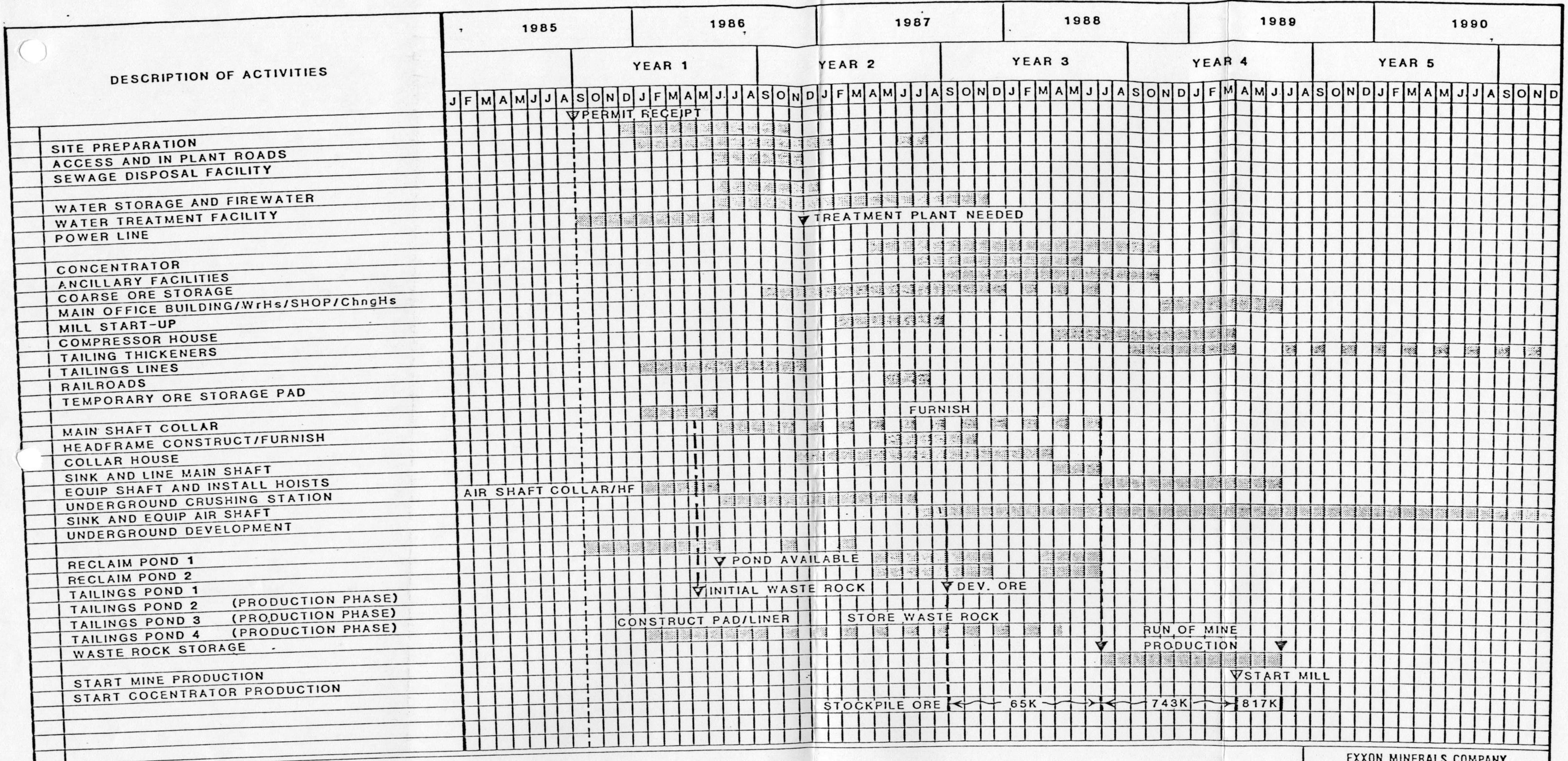
Ground water seepage into the shaft excavations will vary from 0 to 3.4 m^3/h (0 to 15 gallons per minute) in each shaft, and is estimated to average 0.9 m^3/h (4 gallons per minute) (Dames and Moore, April 19, 1978, pumping tests of shaft pilot hole No. 155). During collar excavation and lining, the freezewall methods to be employed will negate ground water influx. When sinking begins in bedrock, ground water quantity will vary with depth, fracture intensity, and reservoir source (overburden aquifer or connate bedrock water). Shaft construction specifications will require rock grouting any time ground water inflow to the excavation exceeds 3.4 m^3/h (15 gallons per minute) in sections not yet permanently lined with concrete.

Utility or process water consumption during shaft development will vary from zero to 1.4 m^3/h (0 to 6 gallons per minute) during different shaft sinking operations. The nominal average use is estimated to be 0.45 m^3/h (2 gallons per minute).

Once intake air shaft sinking is complete and mine level development begins, shaft drainage water will constitute only a small part of the estimated total mine inflow. Until that time, approximately 18 months after the start of shaft sinking, all mine water will be pumped to a surface sedimentation pond prior to discharge. During this 18-month period an estimated 18,925 m^3 (5,000,000 gallons) of water will be pumped from the shaft excavations. Reclaim pond R1 and a small transfer pond at the construction site will be available to receive the shaft construction water when sinking in bedrock begins (see the attached revised construction schedule). (Only 3.2 percent of reclaim pond R1's 590,460 m^3 (156,000,000 gallons) normal operating capacity will be required to store the estimated 18,925 m^3 (5,000,000 gallons) of shaft excavation drainage, discounting any treatment and discharge which will be available as an option 10 months after shaft construction begins.

Comment No. 96

<u>Section 3.2.4.3, Underground Development</u> - (1)The discussion of grouting the bedrock-overburden interface is inadequate. Details on the location of grouted sections, thickness of grout layers and total amount of grout to be injected must be presented along with a detailed plan of construction. (2)A similar discussion of the specifications and construction of the groundwater interceptor system is also necessary. Diagrams and cross sections of these two systems would be extremely beneficial. What will the temporary water containment facilities consist of?



YEARS ON GOING ACTIVITIES

1994-1997 CONSTRUCT TAILINGS POND T2-RECLAIM TAILINGS POND T1

2001-2004 CONSTRUCT TAILINGS POND T3-RECLAIM PART OF TAILINGS POND T2

2007-2010 CONSTRUCT TAILINGS POND T4-RECLAIM TAILINGS POND T3

2016-2022 FINAL RECLAMATION OF TAILINGS POND T2-RECLAIM TAILINGS POND T4-FINAL SITE RECLAMATION

EXXON MINERALS COMPANY
CRANDON PROJECT

CRANDON PROJECT
CONSTRUCTION SCHEDULE
COST OUTLOOK 1983

SCALE NONE | STATE WISCONSIN | COUNTY FOREST
DRAWN BY BWM | DATE 08/83 | CHECKED BY C.D.Z. | DATE 08/83
FIGURE 1.3-8

(FIGURE FOR RESPONSE TO COMMENT NO. 95.)

Response:

(1) Site geohydrologic conditions will limit the flow of ground water into the Crandon mine to a steady state rate of approximately 0.118 m^3/s (1870 gallons per minute) as documented in the Prickett Associates' report entitled "Ground Water Inflow Model for the Proposed Crandon Mine," December 1982 (previously provided to the DNR). A layer of relatively impermeable glacial till and/or clay-rich weathered bedrock retards ground water entry over much of the mine area. The inflows forecast to occur will be primarily in areas where overburden aquifer sands are in contact with porous weathered rock at the orebody subcrop. The ground water impact modeling presented in EIR Appendix 4.1A reflects these flow mechanics of the site geohydrology, in that only partial desaturation of the aquifer above the mine is forecast.

Any artificial controls applied to reduce the inflow would reduce mine drainage and water treatment and discharge costs. Potential mine inflow control techniques were investigated by Klohn Leonoff Consulting Engineers as described in their June 1982 report entitled "Crandon Project Mine Water Control Plan - Alternative Evaluation and Preliminary Engineering."

Mine inflow path permeability reduction methods evaluated included primarily cement and bentonite grouting techniques. Chemical grouting was eliminated as environmentally unsound, and long-term freezing of the saturated overburden was shown uneconomical. Of the grouting methods described by Klohn Leonoff, the plan to place bentonite grout in the high inflow areas of the orebody subcrop was most practical and potentially effective. In essence, this technique would artificially create flow resistant material similar to that which currently occurs over most of the mine area.

At areas of the orebody subcrop where saturated glacial sands are in contact with porous weathered bedrock, bentonite grout would be injected through surface wells (Figure 1 attached). Klohn Leonoff has recommended a descending two stage technique. The first stage would place 4.5 m (15 feet) of grout in the glacial overburden immediately above the bedrock. A second grouting phase would then be conducted in the upper 4.5 m (15 feet) of the weathered bedrock. The resulting layer of reduced permeability material, or grout blanket, would then be 9.0 m (30 feet) thick (Figure 2 attached).

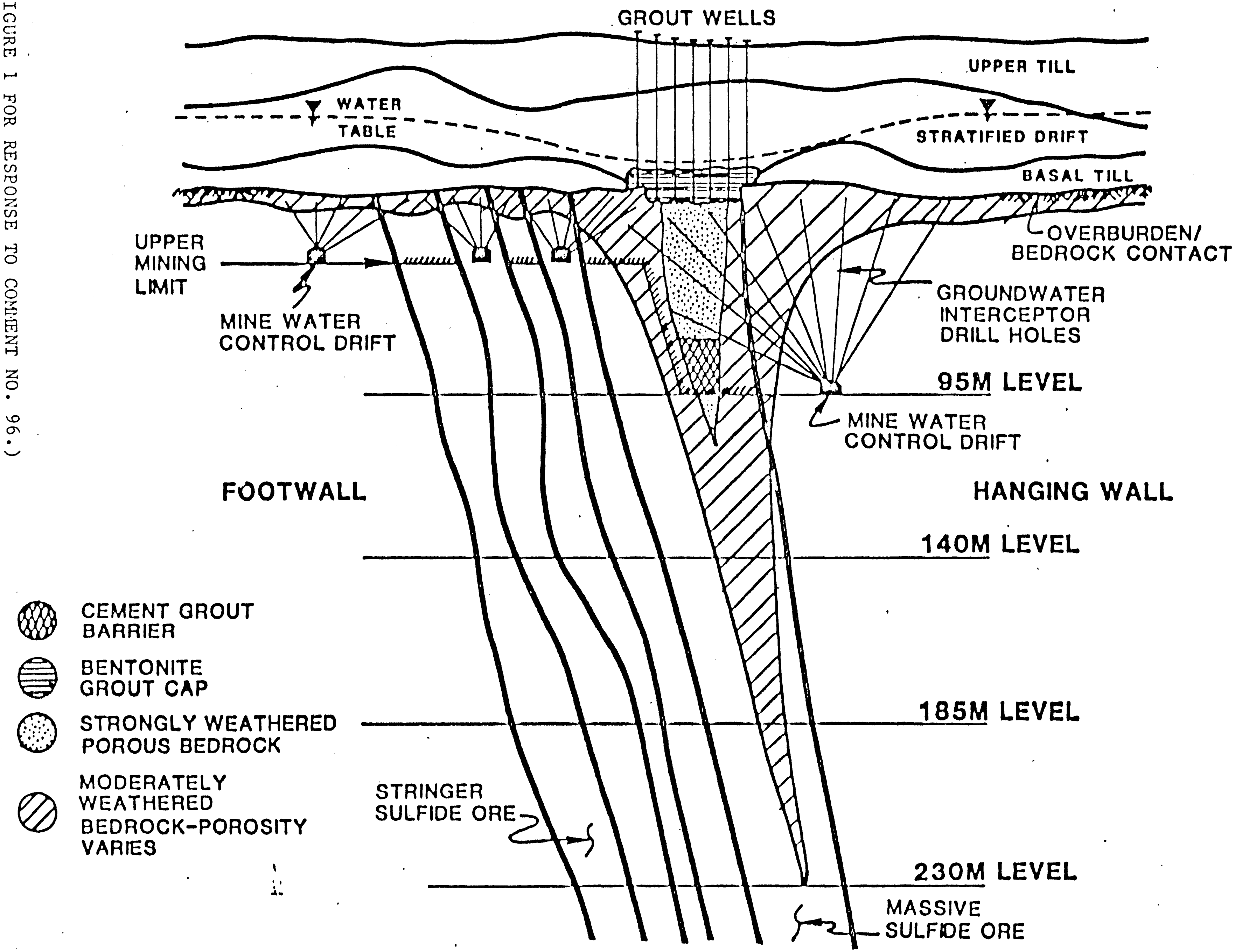
Grout well spacing will be determined by future field testing, but the preliminary engineering work has suggested primary boreholes on a 6 m x 6 m (20 feet x 20 feet) pattern. Such a spacing would require the bentonite grout to travel only 3 m (10 feet) in order to interface with that from adjacent wells. This is within the likely horizontal penetration distance for bentonite slurry injected at a pressure of 690 kPa (100 pounds per square inch) into materials with permeabilities of 10^{-1} to 10^{-3} cm/s.

Following primary hole grouting and testing for effectiveness, a pattern of secondary split spaced holes (Figure 3 attached) would be injected as needed with grout to the point of refusal at 690 kPa (100 pounds per square inch) of collar pressure. These holes should accept only about one-third the grout volume of the primary wells. The combined primary/secondary grout

EXXON MINERALS CO.
CRANDON PROJECT

MINE INFLOW CONTROL METHODS

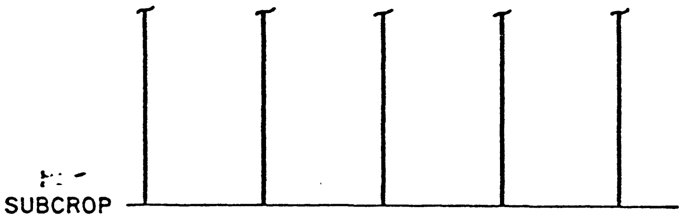
(CONCEPTUAL X-SECTION)



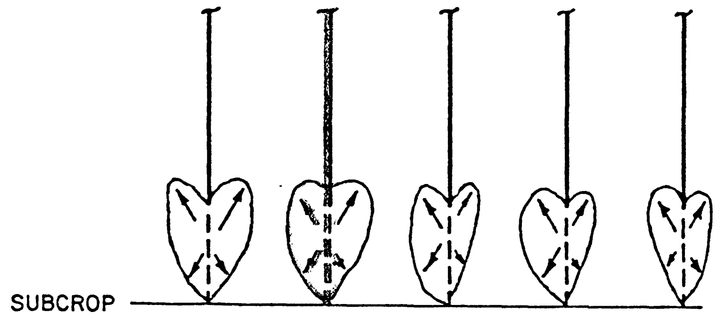
(FIGURE 1 FOR RESPONSE TO COMMENT NO. 96.)

STAGE 1

Primary Holes *



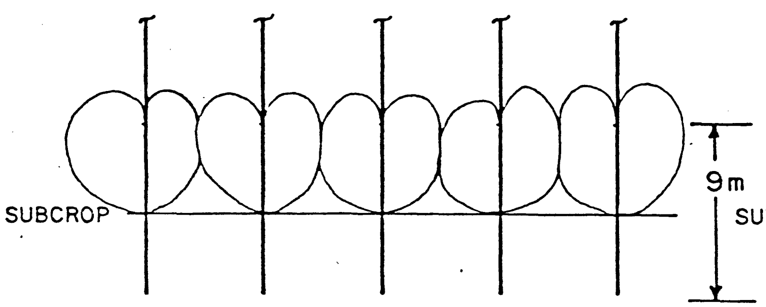
Drill and case to subcrop



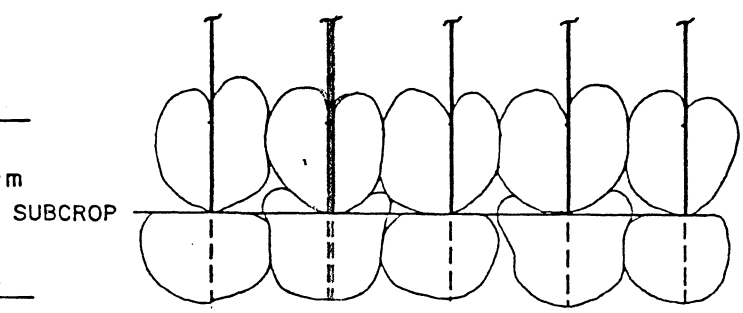
Lift casing 4.5 meters and grout

STAGE 2

Primary Holes *



Drop casing and drill 4.5 meters below subcrop



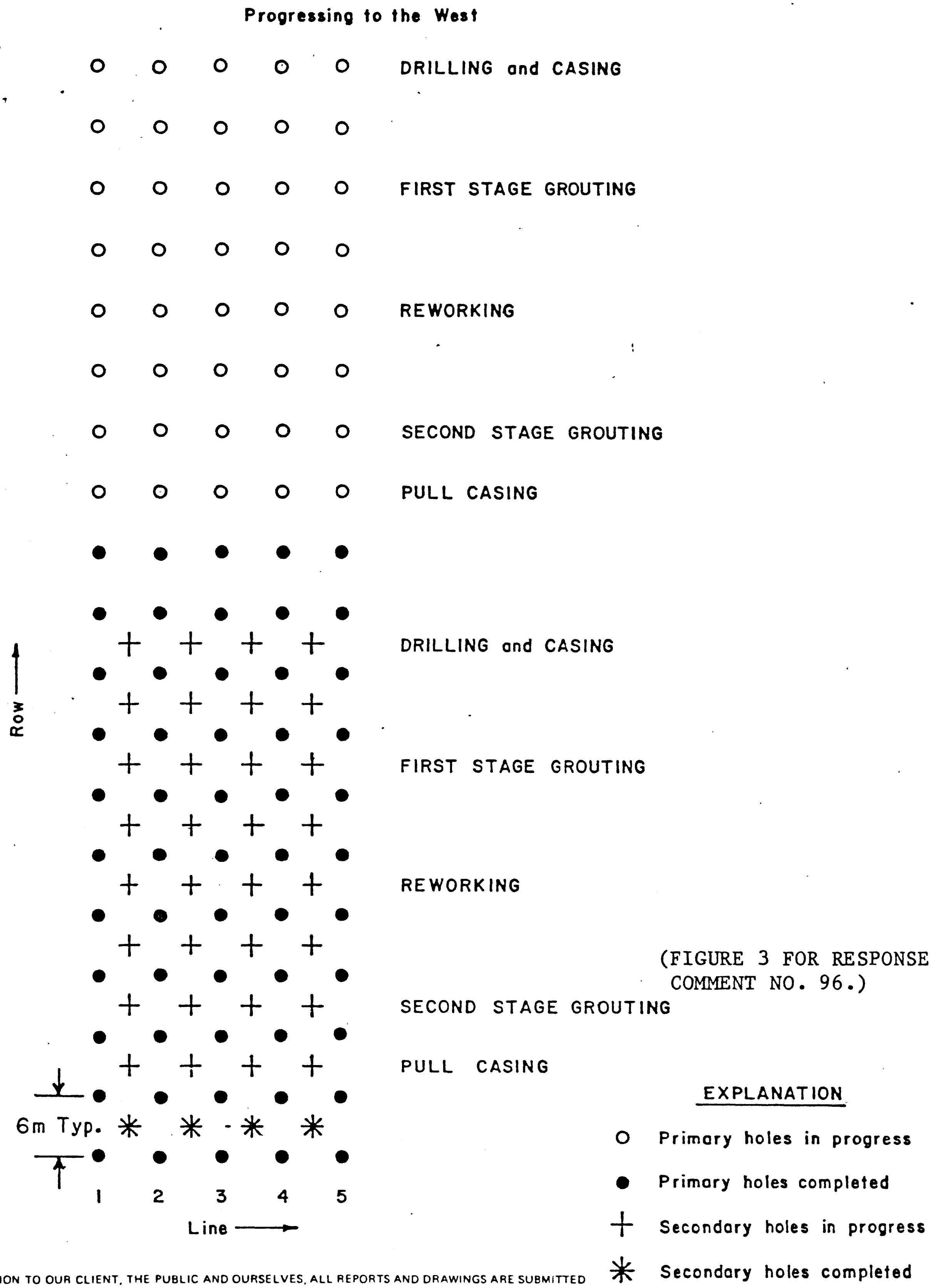
Lift casing 4.5 meters and grout

* Offset secondary hole grouting will fill spaces and make cap tight.

(FIGURE 2 FOR RESPONSE TO COMMENT NO. 96.)

KLOHN LEONOFF INC. CONSULTING ENGINEERS	PROJECT: Crandon Mine Water Control			SCALE
	TITLE: Two Stage Grouting Techniques			
CLIENT: Exxon Minerals Company A-MM-0202	DATE OF ISSUE / APPROVED	PROJECT No. CC0030	DWG. No. Fig. 10	REV.

NCI-457



(FIGURE 3 FOR RESPONSE TO COMMENT NO. 96.)

SCALE

KLOHN LEONOFF INC.
CONSULTING ENGINEERS

PROJECT: Crandon Mine Water Control

TITLE: Preferred Plan Schedule Layout

CLIENT: Exxon Minerals Company

A-MM-0208

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
4-16-82	CC0030	Figure 12	
APPROVED			

NCI-453-K L

injection program should provide a continuous layer of material with reduced (10^{-5} to 10^{-6} cm/s) permeability. Any pumping test wells used initially to locate the grouting targets could subsequently be employed to verify the success of the grout injection program.

Sodium bentonite, the recommended grouting agent, is an inert, thixotropic, colloidal clay. It can be expected to retain a certain degree of elasticity following injection, such that minor soil movements would not affect its permeability reducing performance. Once mining has ceased, the 9 m (30 feet) layer of inert bentonite grouted glacial overburden and weathered bedrock will remain in position and will function in a similar manner to the tills and clays in the site area.

During mine final engineering, further site tests can be conducted to locate potential steady state mine inflow courses and verify the proposed bentonite grouting technique. The extent of any inflow control program instituted will be determined by the potential for lessened environmental effects in balance with its installation costs, offset by appropriately reduced mine drainage, water treatment and discharge costs.

(2) Subsequent to any mine inflow controls which may be applied, a residual ground water seepage interception program will be instituted. Its purpose will be to intercept and contain ground water inflow before any contamination by exposure to mine operations is possible. To accomplish this, interception must occur above the active mine workings.

Initial mine production has been planned for the 230 to 350 m stope horizon, a position at the base of the weathered bedrock ground water inflow courses. Thus, seepage into the mine workings during the early years of the mine is expected to be very localized. Exploratory diamond drilling techniques will be employed to identify active water courses prior to advance of the mine face.

The specific design of the ground water interceptor system will begin during preoperational underground exploration. Conceptually, water encountered on the uppermost mine level will, where possible, be captured in interceptor drill holes and contained to avoid contamination. In most cases, as the mine progresses upward from the initial 230 m level, access for interceptor drilling will be provided by premature development of production drifts temporarily dedicated for mine inflow control. Otherwise, specific mine water control drifts will be developed as required by identification of any area of concentrated seepage. Ultimately, the ground water interceptor system would function, as shown on the conceptual Mine Inflow Control cross-section (Figure 1 attached). Cement rock grouting may be used for local inflow control or diversion.

Actual ground water collection will be from exploration or interception drill holes developed from the access and mine water control drifts. These holes will be typically arranged in a conical fan above the drifts, increasing the effective radius of the adit as a line sink drain. As is common mine practice, each water producing hole collar will be sealed and equipped with a pipe manifold.

Collected ground water from the interceptor drill holes will be piped through the drifts to the separate clean water sump and pump station. This facility will be located on the 230 m mine level near the main shaft, and will be developed at the start of mining prior to interception of potential ore deposit weathered zone water courses.

The clean water surge sumps on the 230 m level will consist of downgrade excavations in the wallrock adjacent to the pump station. A bulkhead containing the pump station suction pipes will be constructed at the outlet of the sumps. Twin sumps will be provided for ease of maintenance and reserve capacity.

Clean water sump discharge will be pumped up the main shaft in a dedicated pipeline. A bank of stand-by pumps and a second main shaft discharge pipeline will be provided to avoid system interruption. At the surface, the intercepted ground water pipeline will be routed directly to the uncontaminated water tank.

Comment No. 97

Section 3.2.6.1, MWDF and Reclaim Pond Site Preparation - The removal of wetland soils from below the MWDF may be necessary to stabilize the liner in dikes.

Response:

All wetland deposits (peats, mucks, and other organics) will be removed from the MWDF area. Most of the deposits are in the pond bottom areas and are 5 to 10 m (16 to 33 feet) higher in elevation than the bottom grade of the pond and would be removed in pond excavation. Those wetlands in the embankment areas would also be removed completely, down to firm subsoils prior to any embankment construction.

Based on estimated wetland material depths and areas, an approximate volume of 253,000 m^3 (331,000 cubic yards) of material would be removed. Of the total estimated excavation for the MWDF (13,600,000 m^3 [17,800,000 cubic yards]), this wetland material represents about 2 percent. The excavated organic materials will be used as top dressing on embankments and other areas where vegetation is to be established.

Comment No. 98

Section 3.2.7, MWDF and Reclaim Pond Construction - The discussion of the batching and mixing plant and the screening plant could have been supplemented by reference to the INDECO Report. Unfortunately, this Report is very general with regard to the discussion of these plants and does not detail in any way possible water releases and quality control of the product. Details of both of these plants should be provided.

Response:

See response to comment No. 62.

Comment No. 99

This section discusses the retention basin for runoff from the waste rock storage area but does not include a description of details of construction of the ABC liner. These details are not included in the feasibility study and will have to be provided for Departmental review.

Response:

Runoff from the waste rock storage area at the MWDF will be contained in a temporary, membrane lined pond located on the west side of the waste rock area. This temporary pond is sized to hold the volume of a one year net precipitation gain plus one 10-year, 24-hour storm. If the temporary pond approaches its capacity, the water will be pumped to reclaim pond R1.

Final design details for this temporary pond are not available at this stage of Project development; however, pond layout and preliminary design data are included in the INDECO report "Construction of Waste Disposal Facilities" (previously provided to the DNR). In that work INDECO selected a PVC membrane as a liner. Design criteria are also provided in subsection 9.2.2 of EIR Appendix 1.2A. Final details of the liner construction will be completed during Plan of Operations engineering.

Comment No. 100

Figs. 3.2-3 through 3.2-8 - These figures appear to be reductions of full size plan sheets. The full size plan sheets should be submitted to the Department to facilitate review and analysis of erosion control measures. The figures indicate that two tailings ponds will be under construction simultaneously while the project schedules show that only one pond will be constructed at a time. This apparent contradiction should be clarified.

Response:

Mine Plan Figures 3.2-3 through 3.2-8 are simplified figures of the MWDF configuration at each of the six main construction stages. The ponds are constructed sequentially and each stage is from 2 to 4 years in duration. The next pond in sequence is constructed early in its stage and the previous pond is reclaimed in the latter part of the stage. The detail of this scheduling is presented in the INDECO report entitled "Construction of Waste Disposal Facilities" (previously provided to the DNR). Full size drawings from that report, which were used to prepare the EIR figures, are included in Attachment No. 10.

Comment No. 101

The route from the Woodlawn Siding should be indicated and the potential effects of heavy truck traffic on local roads should be addressed.

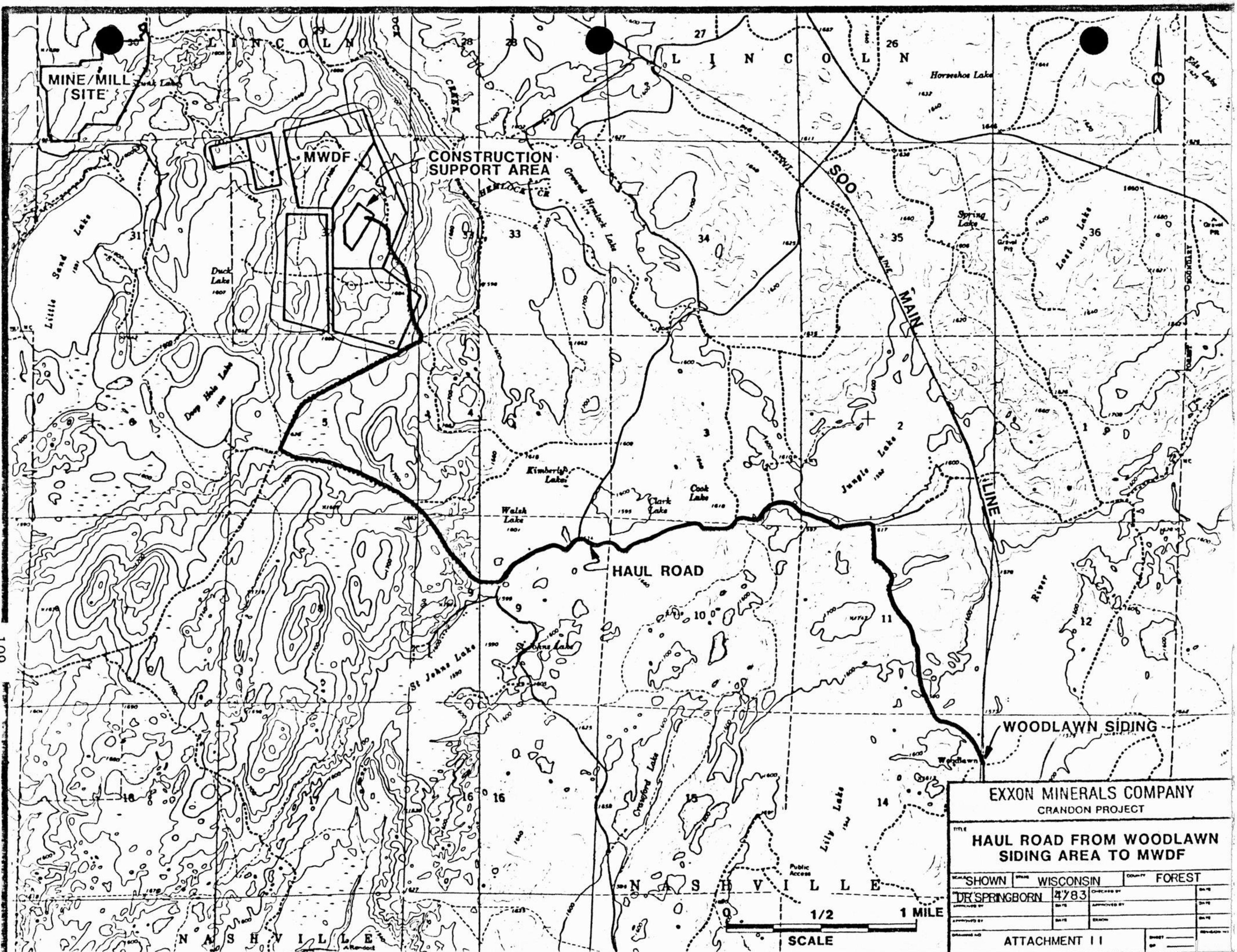
Response:

The attached figure depicts the route from the Woodlawn Siding area to the MWDF. This route will be used for approximately 2 months by trucks hauling bentonite to the MWDF for the first phase of MWDF construction. After construction of the first phase of the MWDF, bentonite will be brought to the mine/mill site on the new railroad spur and use of the Woodlawn Siding will not be required. Approximately 4.8 km (3 miles) of the route to the Woodlawn Siding (of a 9.6 km [6 mile] total) will require grading and compaction prior to use by Exxon Minerals Company for the above purpose. If any damage to the route is incurred as a result of hauling bentonite to the MWDF, appropriate repairs will be made to return the road to its former condition prior to use by Exxon Minerals Company.

Comment No. 102

Section 3.2.8, Pipeline Construction - Details of pipeline construction are needed with particular emphasis on jointing and changes in heading of the

(FIGURE FOR RESPONSE TO COMMENT NO. 101.)



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lines. Specifications and documentation demonstrating the life expectancy and durability of the pipeline material should be presented.

Response:

The response to comment No. 66 provides discussion of pipeline jointing procedures. That response also provides information on typical allowable installation radii that can be used for pipeline heading or alignment changes. Direction changes will be made gradually, taking advantage of the HDPE pipeline flexibility and thereby eliminating most fittings and thrust blocks.

The pipeline material choice and preliminary wall thickness selection were made through a study by PSI, Inc. (report previously provided to the DNR) considering tailings design flows and slurry characteristics. The pipeline chosen is expected to remain in service for the life of the Project. Final pipeline wall thickness and material specifications will be determined during detailed engineering. The actual installation will include some test sections of pipe at convenient locations that would be periodically inspected for performance evaluation.

Comment No. 103

<u>Section 3.2.9, Railroad Construction</u> - More detailed plans and discussion of the railroad spur construction, especially near the wetlands and Swamp Creek are needed. A diagram of the stream crossing and a cross section of the entire spur from the main line to the mine/mill site should be provided. If borrow or waste areas will be necessary, where will they be located?

Response:

Preliminary engineering design of the entire length of the railroad spur and siding area were completed by Foth and Van Dyke and Associates, Inc. Portions of the drawing set from that work, showing alignment plan and profile, the typical cross-sections, and the Swamp Creek crossing structure are attached (Attachment No. 11).

The plan drawing noted above shows the locations of the permanent erosion control facilities, such as the ditchs, culverts, and ditch settling basins. The cross-section drawings show the extent of permanent revegetation established with initial construction. In addition to the permanent facilities, temporary facilities will also be employed to the extent necessary to control erosion and minimize siltation. Temporary sheet piling, diversion dikes, ditches and settling basins will be constructed during clearing and grubbing operations to collect disturbed area runoff. Temporary revegetation will be used to provide interim stability to slopes when weather conditions or construction delays preclude immediate establishment of permanent vegetation. The specific activities and detailed plans for these temporary erosion control measures will be completed in the final engineering phase of the work.

The earthwork balance determined during preliminary engineering design of the railroad indicated approximately 22,000 m^3 (28,800 cubic yards) of select borrow material would be required to construct the railroad. This material would be provided by excess material available from development of the mine/mill area or alternatively it could be obtained from the MWDF area during its initial development.

Comment No. 104

Section 3.2.11, Water Supply - The estimated peak demand for water of $45.3m^3$ day appears conservative. Provide data used for this estimate.

Response:

The earlier estimate of a peak demand for water of 45.3 m^3/d (12,000 gallons per day) was too conservative. Water use will peak during the first year of construction and will be used for supplying human needs, sprinkling of site roads as required, compaction for fill and for use in concrete production. The heaviest water use will occur from June to November, with an estimated peak demand of 326 m^3 (86,129 gallons) per day. This peak consumption is estimated as follows:

	m^3/day	(gallons per day)
Compaction	225	59,445
Batch plant	60	15,852
Road sprinkling	40	10,568
Human consumption	1	264
Total	326	86,129

Average water demand for the first year will be less, depending on the amount of rainfall, moisture content of the soil being compacted, and the rate of concrete production. Water use during the remainder of the construction phase will be considerably less than the peak demand that occurs during the first year.

Comment No. 105

Provide a plan for potable water supply testing and reaction to unsafe samples.

Response:

Potable water will come from a fresh water well and should not require pretreatment. The testing program has not been developed, but will comply as appropriate with Chapter NR 108 and 109. The testing scheme will be provided to the DNR prior to construction. This testing will include evaluation of the bacteriological quality of the wells.

Comment No. 106

Section 3.2.13, Sanitary Facilities - Please provide documentation justifying the estimated daily sanitary waste flow of 1,500 gpd.

Response:

Since submittal of the Mining Permit Application, there has been additional refinement of estimated sewage flows and plans for handling of sanitary sewage during the construction period. Prior to installation of the permanent septic tank and soil absorption field, the maximum daily sanitary waste flow is estimated to be 10.6 m^3 (2800 gallons).

The permanent septic tank and soil absorption field will be installed as soon as possible and should be available within 6 months after start of Project construction. Portable toilets will be used throughout the site from initial construction until sewer lines and permanent restrooms are constructed. If Exxon or a contractor utilizes a restroom/shower trailer, a temporary sewage holding tank will be used for that facility.

A licensed septic tank pumping contractor will be used to service the portable toilets (and the holding tank if there is one) as necessary. Prior to installation of the permanent septic tank and soil absorption field the licensed contractor will haul the sewage off-site for disposal. After installation, he will transfer sewage to the permanent facilities.

With portable toilets there is approximately 0.015 m^3 (4 gallons) of sewage generated per person per week. With a restroom/shower trailer approximately 0.19 m^3 (50 gallons) of sewage is generated per person per day. During the first 6 months of construction, assuming a peak work force of 400 people with 50 having access to a restroom shower trailer, approximately 53 m^3 (14,000 gallons) of sewage would be generated weekly, or approximately 10.6 m^3 (2800 gallons) of sewage on a daily basis.

Assurances have been received from licensed septic tank pumping contractors that this type of arrangement and their service would be satisfactory. We have not attempted to determine where they have sewage disposal capabilities.

Comment No. 107

Section 3.2.15, Testing and Training Facility - Where will this facility be located and when will it be operated with respect to the overall mine/mill schedule? What will become of the facility once full scale operation begins?

Response:

A pilot plant has been proposed as a means of training mill personnel and determining optimum operating and control parameters for the full scale plant. This pilot plant has not yet been designed; however, it would essentially be a very small version of the full scale plant and would process one to two tons of ore per hour when operating.

The current plans are to house the pilot plant in a portion of the core storage building. The current estimated building area requirement is 372 m^2 (4000 square feet). Tailings from the pilot plant would be retained temporarily in a small lined basin. Sometime after the establishment of a permanent tailings pond, pilot plant tailings would be transported to the MWDF, probably via truck. A small water reclaim pond will also be provided and would be removed once the operation of the pilot plant ceases.

This pilot plant would be run intermittently for 1.5 to 2 years prior to and during the start-up of the full scale plant and as needed thereafter. When there is no longer a need for the pilot plant, the equipment will be cleaned, removed from the building, and prepared for storage or transported to another facility.

Comment No. 108

Where will reagents be stored during this time and what spill prevention/control measures will be followed? What will be the volumes and characteristics of the wastewater? Where and how will wastewater be treated?

Response:

The pilot plant will not operate with the same schedule as the full scale concentrator, but rather in test campaigns lasting up to 1 or 2 weeks. Each pilot plant run will have specific training and testing objectives. Since the pilot plant will only run with a capacity of about 2 t/h when operating, the total reagent requirements will be considerably less than for the actual concentrator. Reagents will be received in much smaller quantity lots consisting largely of 5-gallon pails and some bags. Sulfur dioxide will be received in standard gas cylinders. All reagents will be stored in the pilot plant and mixed in appropriate size batches on a daily basis. The reagent mixing area will be designed for spill containment. Procedures for safely handling and mixing regents will be taught to various plant operators as part of the function of the pilot plant.

Water is expected to be recovered from the tailings at a rate of approximately 6.8 to 9.0 m^3/h (30 to 40 gallons per minute). This water could be recovered either by decantation from a temporary tailing basin or by direct filtering. This water will be stored in a lined, temporary reclaim pond to be located just south of the pilot plant site (core storage building). Most of this water will be used as recycle process water. Any excess water that accummulates will be transported to the available larger Project reclaim pond. No water from the pilot plant will be directly discharged to the environment.

The attached table shows a set of chemical analyses of water from the tailings produced during pilot testing of the Crandon ores at Lakefield Research of Canada. These data will serve to characterize the water. However, these analyses were obtained from testing where water was not recycled in the process. The analyses for tailings water from massive ore were provided to Mr. Archie Wilson of the DNR in a letter dated April 13, 1981; DNR also obtained samples of the same water during their visit to the pilot plant in 1981.

Comment No. 109

If a temporary storage facility is constructed, details of its construction and operation must be provided for Department review. The location of the temporary storage facility should be specified.

Response:

The pilot plant will be located in the core storage building. Temporary facilities for storing tailings and water for reuse will be located just south of this building. Designs for these facilities are being developed and will be reviewed with the DNR when they are available. Concentrates produced in the pilot plant will probably be stored in drums until shipped with concentrates from the full scale plant. Some pilot plant concentrates will undoubtedly be shipped to smelters for evaluation.

Comment No. 110

Will any air pollution control equipment be utilized in conjunction with the testing and training facility?

Response:

Dust collection equipment will be provided with the crushing and screening equipment for the pilot plant and with the sample preparation area. The building itself will be ventilated. Details will be made available when other design work is completed.

Comment No. 111

<u>Section 3.3, Construction Schedule</u> - According to Figure 3.3-1, the water treatment facility will not be completed until September 1987, approximately one year following commencement of main shaft and equipment air shaft construction. Reclaim Pond #1 should be completed within 3 months after start of the main shaft construction and 8 months after start of the air shaft construction and therefore could be used to store water from shaft construction. What will be done during the 3 and 8 month period when this pond is not in service? Waste rock and preproduction ore storage runoff will also go to reclaim pond #1. Will the storage volume be sufficient to handle construction wastewater before the surface water treatment systems are completed? What is Exxon's contingency plan if the voume is <u>not</u> sufficient?

(TABLE FOR RESPONSE TO COMMENT NO. 108)

TABLE 1

CHEMICAL ANALYSES OF WATER FROM TAILINGS PRODUCED IN PILOT PLANT TESTING

All Values As mg/l Unless Otherwise Specified

Constitutent	Stringer Ore Zinc Scavenger Tailing	Massive Ore Zinc Scavenger Tailing
Aluminum	0.04	0.51
Calcium	102	142
Copper	0.008	0.131
Iron (+2)	5.44	<0.01
Iron (+3)	2.46	<0.01
Potassium	5.57	5.23
Magnesium	0.37	0.207
Manganese	0.065	<0.001
Sodium	65.2	54.2
Zinc	0.171	0.091
Silver	<0.001	0.004
Barium	<0.01	<0.01
Cadmium	<0.001	<0.001
Mercury	<0.0001	<0.0001
Lead	0.04	<0.01
Selenium	0.21	0.28
Chromium (total)[a]	<0.001	0.055
Chromium (hex)[a]	<0.01	<0.01
Arsenic(1)	0.004	0.012
Carbonate (as $CaCO_3$)	<1	60
Bicarbonate (as $CaCO_3$)	8	<1
Chloride	6	8
Fluoride	0.79	0.64
Sulfate	104	367
Thiosulfate	<2	449
Cyanide	0.001	0.023
Carbon Dioxide[a]	300	<0.1
Silica[a]	5.92	1.59
Hardness (EDTA)[a,b]	264	356
pH[a]	6.6	11.3
TDS[a]	691	656
Conductivity[a]	900	1000
BOD_5	63	2
COD[a]	154	284
TOC[a]	14.2	13.1

[a]Data from water sample that was not filtered through 0.47 um filter; all other analyses obtained on sample filtered through 0.47 um filter.

[b]As $CaCO_3$.

Response:

A revised construction schedule is attached to the response to comment No. 95. This schedule shows that the water treatment plant is completed at the end of the 15th month and reclaim pond R1 is completed at the end of the 9th month. Construction of the main mine shaft collar starts during the 5th month. Mine shaft sinking starts during the 14th month of construction. Any water from main shaft collar construction and intake air shaft construction will be routed through an oil/water separator and then to surface drainage basin No. 1 (south side of Project site). Water from main shaft sinking and underground mine development will be sent to reclaim pond R1. Water will be pumped from the reclaim pond to the water treatment plant as necessary. Storage in the reclaim pond will provide water needed for mill start-up. The storage volume in the reclaim pond combined with the ability to treat water at a rate in excess of 250 m^3/h (1200 gallons per minute) will assure the ability to accommodate water from shaft sinking, underground mine development, waste rock storage area, and the equipment laydown area. Note that water from the preproduction ore storage area will be pumped directly to the water treatment plant feed tank at the plant site.

Comment No. 112

What area will be enclosed by the perimeter fence mentioned on Page 3-22?

Response:

The perimeter fence noted on page 3-22 of the Mining Permit Application surrounds the mine/mill site and enclosed an area of approximately 31.6 ha (78.0 acres).

Comment No. 113

A section similar to Section 1.3.3, Construction Operations, of the EIR should be included in the Mining Permit Application after the discussion of the Construction Schedule.

Response:

Comment acknowledged. This subsection is being prepared and will be provided in early 1984.

Comment No. 114

Figure 3.4-1 - What is the area of "open water" shown in the northeast corner of this figure?

Response:

The open water area in the northeast corner of the mine/mill site as shown in Figure 3.4-1, is a deciduous swamp having some open water. This wetland is less than 0.1 ha (0.25 acres) in size and is located approximately 152 m (500 feet) northwest of wetland F116. This wetland is designated but not numbered on Figure 4.3-1E of the August 1982 Wetland Assessment Report prepared by Normandeau Associates, Inc. and Interdisciplinary Environmental Planning, Inc. (previously provided to the DNR).

Comment No. 115

Section 3.5.2.4, Mine and Backfill Dewatering - Provide details regarding the operation of the groundwater interception system and the plans for grouting the bedrock/drift interface.

Response:

The mine water interceptor system and the plans for grouting the bedrock/drift interface are described in the response to comments No. 45 and 96.

Comment No. 116

Section 3.5.2.5, Waste Rock - Provide additional detail regarding waste rock handling, use and disposal. Specifically, address the use of waste rock as riprap and as road surfacing material and provide estimates of the volume of waste rock which will be used for the various purposes and disposed of in the MWDF.

Response:

All waste rock produced in development and operation of the mine will either be used as mine backfill or be used in construction/disposal at the MWDF. All waste rock used in construction of the MWDF, or disposed there, is underlain by the continuous seepage control system used throughout the MWDF. Use of the waste rock as road surfacing material is not planned. Transport of the waste rock will be by 35-40-ton dump trucks from the mine/mill site to the MWDF. At the MWDF, grading and compaction of the waste rock will be primarily managed by a dozer. Approximately 1,900,000 m^3 (2,500,000 cubic yards) of waste rock are expected to be used/disposed at the MWDF. Of the total approximately 900,000 m^3 (1,200,000 cubic yards) will be used as slope protection in the ponds and the remaining 1,000,000 m^3 (1,300,000 cubic yards) will be used to form most of the main interior embankment of the MWDF.

Comment No. 117

Section 3.5.2.6, Backfill Handling Underground - Under what conditions will it be necessary to supplement the coarse tailings with waste rock and glacial sand? Where will the backfill delivery boreholes be located?

Response:

The Crandon mine stopes are to be backfilled with classified (deslimed) mill tailings. Approximately 50 percent of the mill feed tonnage can be prepared as backfill with suitable drainage characteristics. Average backfill production combined with underground retention and use of mine development waste rock will satisfy the normal mine backfill demands. However, shortfalls of backfill tailings material could result from unanticipated operational events. These might include:

1) Periods of lower recovery of backfill sized materials compared to fine tailings due to changes in ore composition; and

2) Interruption of mine backfill operations, followed by a make-up period demand in excess of the backfill plant capacity.

In these cases or others, it will be necessary to supplement normal classified tailings backfill production with make-up glacial sand or crushed waste rock. The mine backfill preparation facilities will be designed with provisions for the future addition of equipment to supply make-up materials, if required during some period of the mine life.

Mine backfill slurry will be pumped from the concentrator in buried surface lines (HDPE) to a pair of delivery boreholes on the south side of the plant area (Mine Plan Figure 3.3-6, Construction Plan - Year 5). These boreholes located in the orebody hanging wall will serve for gravity distribution of backfill to the mine levels. The delivery boreholes will be intercepted by the hanging wall laterals on the mine levels and outfitted for horizontal pipeline transfer of backfill to depleted stope locations.

Comment No. 118

Which of the two options (adding cement to the backfill or leaving an ore wall) is actually being proposed? Whichever it is, a more detailed discussion is needed.

Response:

Long-term rock mass stability in and around mine workings can be achieved by leaving load bearing pillars between open stopes or by backfilling the depleted stopes. Backfill mining methods like that proposed for the Crandon mine allow for more complete ore recovery. During primary mining, ore in every other stope block is removed, with the adjacent undisturbed blocks serving as interim pillars. Once the depleted primary stope blocks are backfilled, they become the functional "pillars" and mining of the alternating secondary stope blocks can proceed (see Mine Plan Figure 2.1-9, Typical Stope Blocks). Ultimately, the entire stoping area is supported and stabilized by backfill.

Both uncemented and cemented backfill are planned for use in the Crandon mine. When uncemented tailing sands are placed in a primary stoping block, it will be necessary to leave a retaining rib pillar on each end of the stope (see attached figure). These rib pillars will have a nominal minimum thickness of 3 m (10 feet), and will serve to contain the uncemented primary stope backfill sands while mining of the adjacent secondary stope blocks proceeds.

If the rib pillar locations contain ore of sufficient value, it can be recovered by use of cemented backfill in the primary stope block. At a typical tailings sand to cement ratio of 15:1, cement stabilized primary stope backfills can be expected to stand unretained while the mining of adjacent secondary stope blocks proceeds.

It is currently estimated that approximately one-third of the total Crandon mine backfill will be strengthened by cement addition for placement in primary stopes. All depleted secondary stope blocks will be backfilled with uncemented tailing sands. Long-term mining area rock mass stability will be assured by the process of stope backfilling, regardless of type.

Comment No. 119

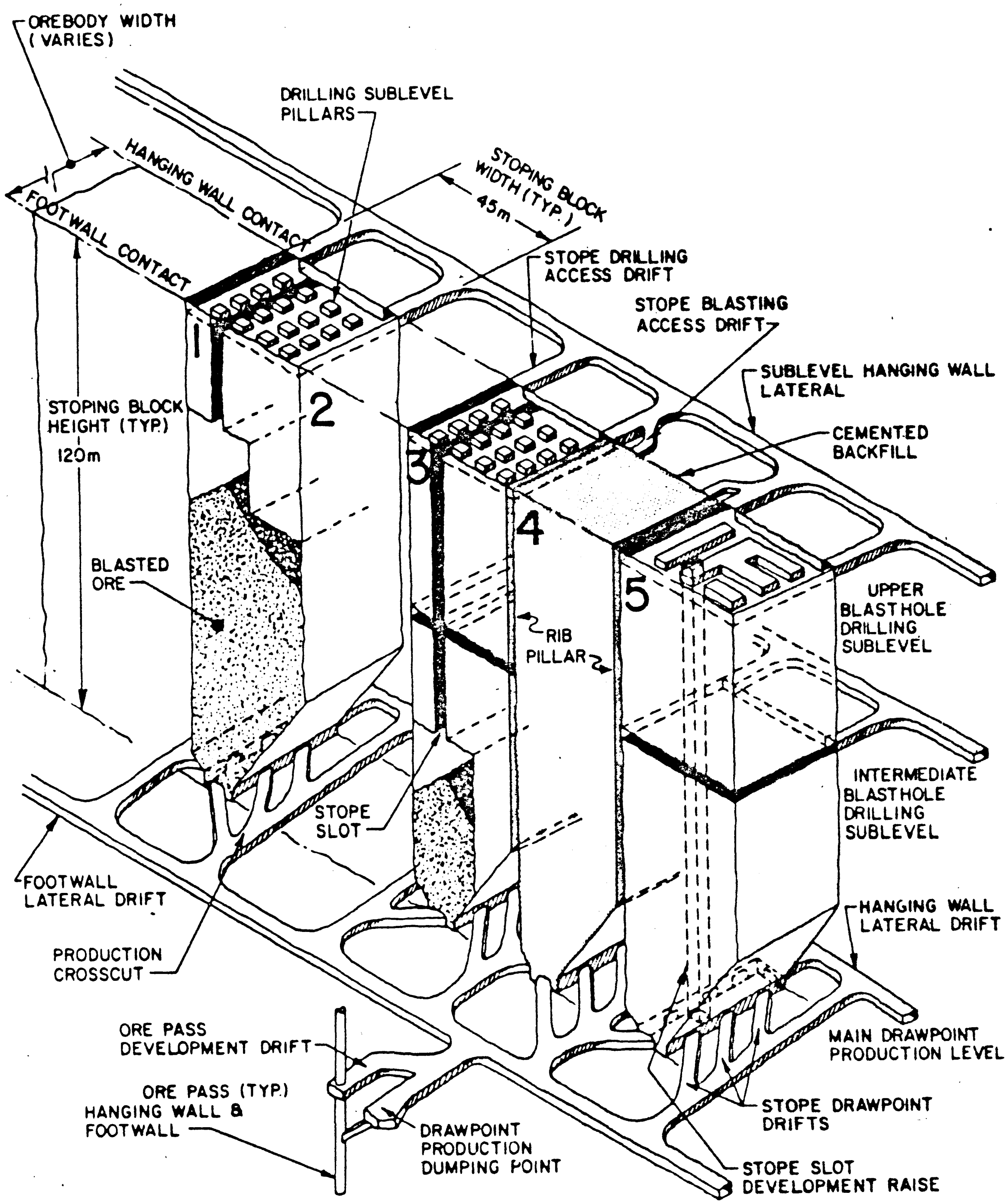
Explain the kind and amount of cement which will be required to stabilize the backfilled stopes and what thicknesses of rock must be left on the sides and bottoms of each stope to assure safety and stability within the mine. Demonstrate that the cement of choice will work with an aggregate that may be predominately sulfides.

Response:

As described in the response to comment No. 118, rib pillars left to retain uncemented primary stope backfill will be a minimum of 3 m (10 feet) thick. Analysis of rock mechanics data further indicates that this nominal minimum dimension should be increased to 10 percent of the stope hanging wall (HW) to footwall (FW) depth for stopes in excess of 30 m (100 feet) deep. Thus, for a stope spanning 50 m (164 feet) from HW to FW, rib pillars 5 m (16.4 feet) thick would be required.

The size of horizontal crown or sill pillars (at the stope blocks top and bottom, respectively) required will depend upon the local stope block geometry, rock mass strengths, in situ stresses, and mining sequence. Such pillars can be left for a variety of reasons including local ground support, backfill retention, and protection of life-of-mine accessways. At similar operations horizontal pillars of this type are typically 10-15 m (33-50 feet) thick. These pillars are often temporary and are subsequently recovered as a mining area nears depletion.

Cemented backfill used in the Crandon Mine will be produced by the addition of Type I Portland cement to the classified mill tailings. Realizing that mill tailings will contain substantial amounts of sulfide mineral, backfill testing programs included evaluation of the use of Type V sulfate-resistant



STOPING BLOCK # 1 — ACTIVE PRODUCTION — STOPE BLASTING NEARING COMPLETION

STOPING BLOCK # 2 — ALTERNATE STOPING BLOCK PILLAR — TO BE MINED AFTER BACKFILLING ADJACENT STOPES

STOPING BLOCK # 3 — ACTIVE PRODUCTION — INITIAL STAGES OF STOPE BLASTING

STOPING BLOCK # 4 — DEPLETED STOPE BLOCK — UNCEMENTED BACKFILL IN PLACE

STOPING BLOCK # 5 — STOPE BLOCK PARTIALLY DEVELOPED

(FIGURE FOR RESPONSE TO COMMENT NO. 118.)

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
UNDERGROUND MINE
TYPICAL STOPE BLOCK
BACKFILL RIB PILLARS

SCALE	NONE	STATE	WISCONSIN	COUNTY	FOREST
DRAWN BY	S.J. HARVEY	DATE 7/82	CHECKED BY J.E. GRIMES		DATE
APPROVED BY		DATE	APPROVED BY		DATE
APPROVED BY		DATE			DATE
DRAWING NO.	FIGURE 3.5-		SHEET		REVISION NO. 0

cement. No ultimate strength differences were observed between cemented backfill samples containing Type I or Type V cement, nor were there any indications of long-term strength deterioration for Type I samples.

Strength tests have been conducted on cemented backfill samples prepared with varying tailings sands/cement ratios. It has been determined that a sands to cement ratio of 15:1 will result in cemented backfill strength sufficient for self-support within the planned stope mining dimensions. Lower sands/cement ratio backfills may be prepared for specific situations where additional strength is required (e.g., a 5:1 mixture placed as a floor upon which mobile mining equipment will subsequently operate).

Comment No. 120

Section 3.5.2.7, Water Balance - What constitutes mine "process" water to be collected and discharged to the surface water treatment system? This is somewhat confusing in light of the discussion to recycle 200 gpm for mining processes. How much mine process water will be generated which will be transported to the surface? How is it accounted for in the 335 gpm value; of which 325 gpm is backfill water and 10 gpm is potable water?

Response:

As stated in subsection 3.5.2.7 of the Mine Plan, mine "process" water is simply water used for drilling and dust suppression. The source of this water is the uncontaminated mine seepage sumps. After use, this "process" water drains to the contaminated water collection sumps. This water is, of course, accounted for in the water pumped from the mine.

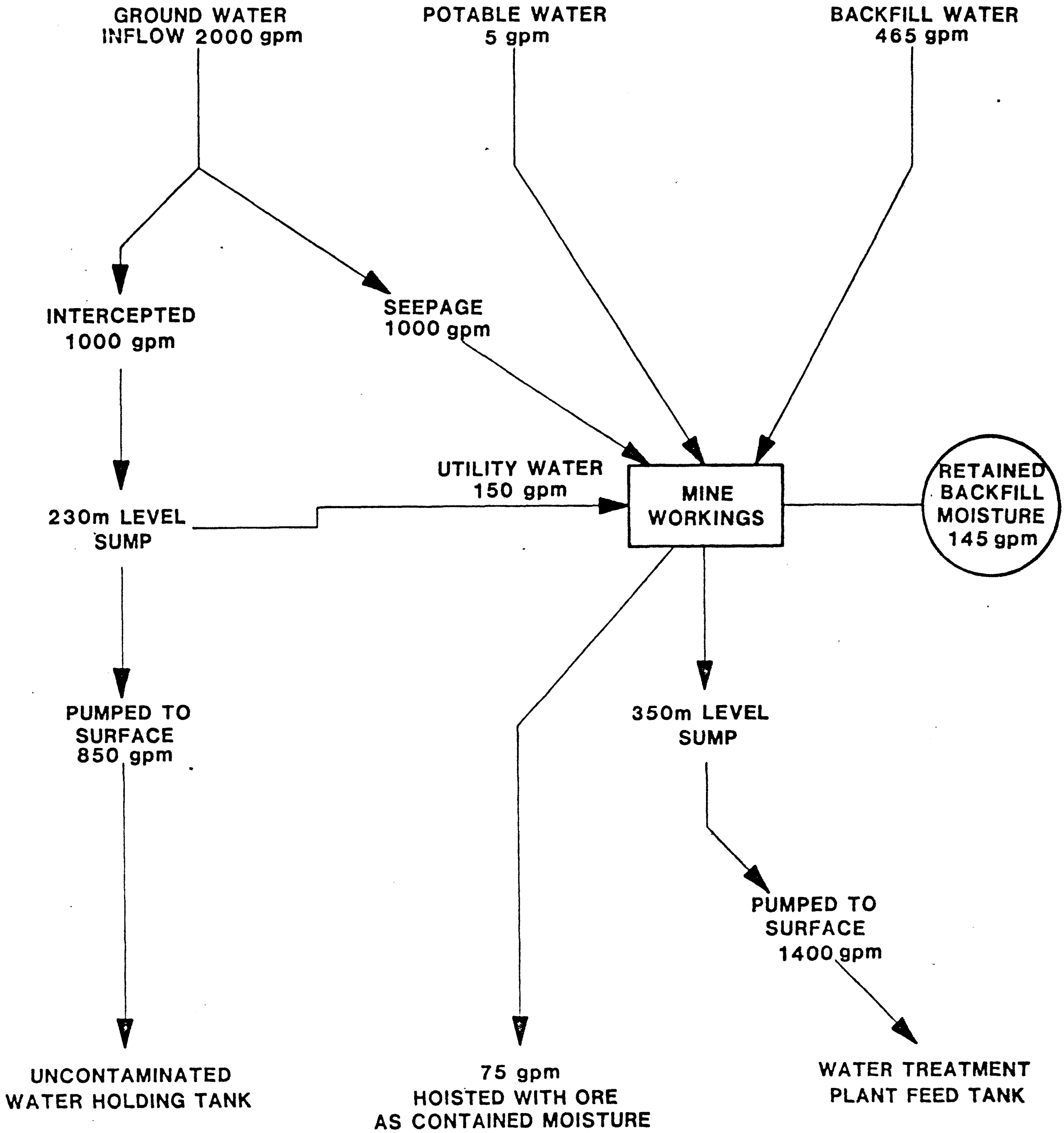
The attached figure is a schematic diagram showing how mine drainage is handled with revised volume projections. The mine "process" water is represented as utility water in this diagram.

Comment No. 121

Section 3.5.3.3, Concentrate Handling and Shipping - The planned 10-day storage capacity for concentrate does not appear to allow much flexibility in the event of extended shipping or market problems. What alternatives are available other than mill shutdown?

Response:

Concentrates will be shipped from the Project via rail. Discussions with officials from the Soo Line Railroad indicate that the history of rail service in the area has been extremely reliable. Therefore, the probability of an extended transportation problem occurring is low. The 2-days storage capacity available for copper and zinc concentrates along with storage capacity in available railcars should be adequate to prevent shutdown of the plant during the day or two that the railroad cannot supply cars due to a



MINE WATER DRAINAGE SYSTEM

EXXON MINERALS COMPANY

CRANDON PROJECT

TITLE

MINE DRAINAGE SCHEMATIC

SCALE NONE	STATE WISCONSIN	COUNTY FOREST
DRAWN BY DR SPRINGBORN	DATE 9/83	CHECKED BY
DRAWING NO. EXHIBIT 13, FIG. B		SHEET

(FIGURE FOR RESPONSE TO COMMENT NO. 120.)

weather-related problem. Currently, there is an oversupply of gondola cars and this situation is not expected to change in the near future. Also, see the response to comment No. 57.

Severe market problems would likely force a temporary shutdown of the Project regardless of the amount of storage capacity available.

If railcar availability were to become a problem and the planned concentrate storage capacity was inadequate, more covered storage area would be planned and a permit application for the Project site would be made.

Comment No. 122

What type of cover will be used on the rail cars transporting the concentrate?

Response:

The railcars to be used to transport concentrate are open top, rectangular cars called gondola cars. They have a steel bed and sides which will completely contain the concentrate without spillage. After loading, the cars will be covered with a plastic cover made especially for this application. These covers are commonly used for this application. Typical cover material is a woven polyolefin fabric.

Comment No. 123

Section 3.5.3.4, Surface Backfill System - How will backfill in the temporary storage area be reslurried? All associated pipelines and the proposed routes must be presented on a diagram. What will the backfill storage area be lined with? Where will runoff be directed?

Response:

The temporary storage of backfill in the area north of the mine/mill site is no longer part of the Project plan. Temporary storage of backfill will be provided in storage bunkers inside the mill building.

Comment No. 124

Section 3.5.3.6, Water Balance - Figure 3.5-8 shows the water balance during full mill operation. Does this mean that this is the maximum amount of water and wastewater which will pass through each line shown? If not, please show the maximum amount expected.

Reponse:

Figure 3.5-8 is a water balance for the mill and related process facilities and was not meant to depict the whole Crandon complex. A detailed overall water balance for the mine, mill, tailings and reclaim ponds is presented on Figure 3.5-17 in subsection 3.5.6. The flow rates listed on Figure 3.5-8 or 3.5-17 were used for preliminary design. Maximum flow rates for water treatment and discharge are addressed in the WPDES Permit Application. Maximum and minimum flow rates for all streams will be assessed in final engineering.

Comment No. 125

Section 3.5.3.10, Spills and Odors - Where will the spilled materials be disposed of if the material is not recycled?

Response:

There should be no disposal of reagents. Recovered reagents will be collected in such a manner to assure that they can still be used as intended. Reagent storage and preparation facilities will be designed with the criteria that any spills are to be contained for recovery and use.

Comment No. 126

Section 3.5.4.2, Tailing Slurry and Water Transport Systems - As mentioned previously, the routes of all pipelines (buried and unburied) associated with the project should be shown on a figure or series of figures.

Response:

The response to comment No. 67 provided a drawing showing the routing of tailings and water lines in the area of the MWDF. The routing of these same pipes within the mine/mill is presented in drawing No. 051-7-C-001 in Attachment No. 6. The route of the tailing pipeline and water reclaim pipeline will follow the haul road between the mine/mill site and the MWDF and is shown on the attached figure. The overall routing is shown in Figure 2.3-6 of the Mining Permit Application.

Comment No. 127

Expand on the procedures and equipment which will be utilized to detect and repair leaks in the pipelines.

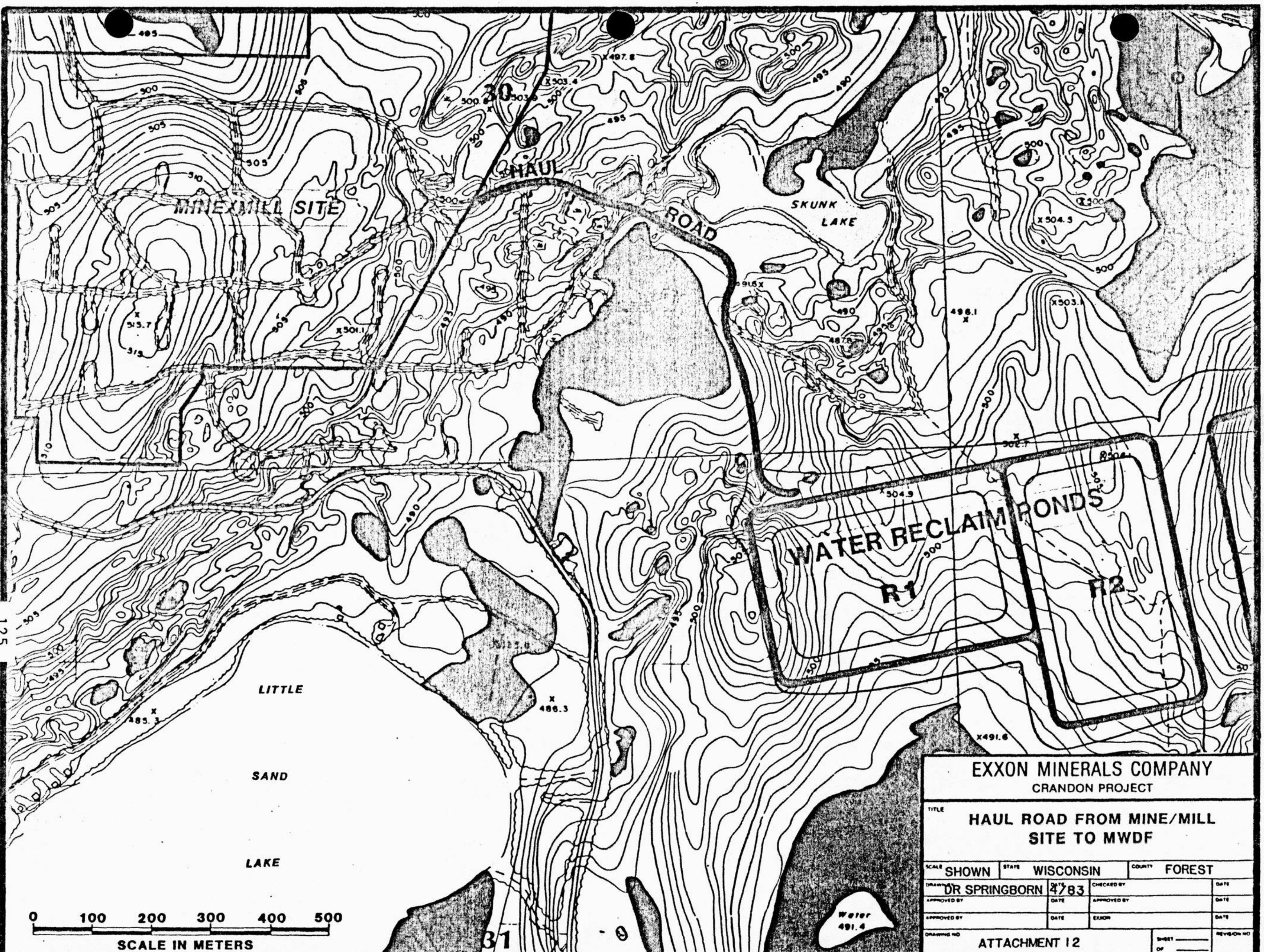
Response:

Leak detection systems and actions designed to prevent ground water contamination in the event of a pipeline failure are described in the response to comment No. 66.

The pipeline corridor will be visually inspected by periodically walking along the route. Physical inspection of pipe materials is best conducted at the pump station during scheduled maintenance. Physical measurements of pipe wall thickness will be completed routinely. If necessary, flanged pipe test spools can be inserted into the pipelines at selected intervals and in easily accessible locations.

Spare plastic pipe will be stored on-site so that it is available for repairs when required. Repairs to HDPE pipelines are expected to be needed

(FIGURE FOR RESPONSE TO COMMENT NO. 126.)



A-PE-0970

infrequently and the pipeline life in slurry service is expected to be longer than would be anticipated for pipelines constructed of alternative materials. For water service, the life of HDPE pipe is expected to be longer than would be expected for carbon steel pipe.

Comment No. 128

Section 3.5.5.2, Water Treatment System - How long can the mine and mill continue in operation under the conditions described on the bottom of page 3-55?

Response:

Assuming that the total water pumped out of the mine is 530 m^3/h (2335 gallons per minute) and that none of it can be discharged, and that 194.6 m^3/h (857 gallons per minute) are still required as make up in the mill, the remaining 335.6 m^3/h (1478 gallons per minute) would be pumped to the reclaim ponds if the treatment plant was completely shutdown. Assuming 310,950 m^3 (82,153,000 gallons) of available freeboard volume (75 percent of total freeboard) in two reclaim ponds, the mine and mill could continue to operate for 39 days before this freeboard volume is used up. This still leaves freeboard for the 100-year, 24-hour storm and allowance for wave run-up. In addition, there is freeboard volume available in the operating tailing pond that could be used to store additional water. However, it is highly unlikely that the treatment plant would be totally shutdown for extended periods of time.

Contaminated water from mine	1335 gpm
Uncontaminated	1000 gpm
	2335
Less water needed in mill	857
	1478 gpm

Freeboard available 82,153,000 gal (75 percent of total)

$$\frac{82{,}153{,}000 \text{ gal}}{1478 \text{ gal/min}} = 55{,}584 \text{ min or about 39 days}$$

Comment No. 129

What standards will be used to determine whether or not the "uncontaminated" water from the mine requires treatment?

Response:

As uncontaminated mine water is pumped from the surge tank to the excess water discharge tank, it will be continuously monitored for pH, turbidity, and conductivity. Although details of the monitoring program are not yet developed, periodic samples of this water will be obtained for chemical analyses.

If this water is intercepted at ground water quality (see EIR Table 2.3-8), it should not require treatment. However, if it is determined that the quality of the intercepted ground water is such that the total effluent will not meet WPDES permit effluent limits on a long-term basis, appropriate treatment technology will be used.

Comment No. 130

Section 3.5.5.4, Water Treatment Wastes - Identify the prospective landfill site and delineate the 2-3 acre cell within the tailing pond area which could be used for disposal of the reverse osmosis sludge if the sludge is not marketed. Which of these options is actually being proposed?

Reponse:

See response to comment No. 71.

Comment No. 131

Section 3.5.6, Overall Water Balance - The overall water balance for "mature" operation has been presented. How will the water balance vary from start-up through shutdown?

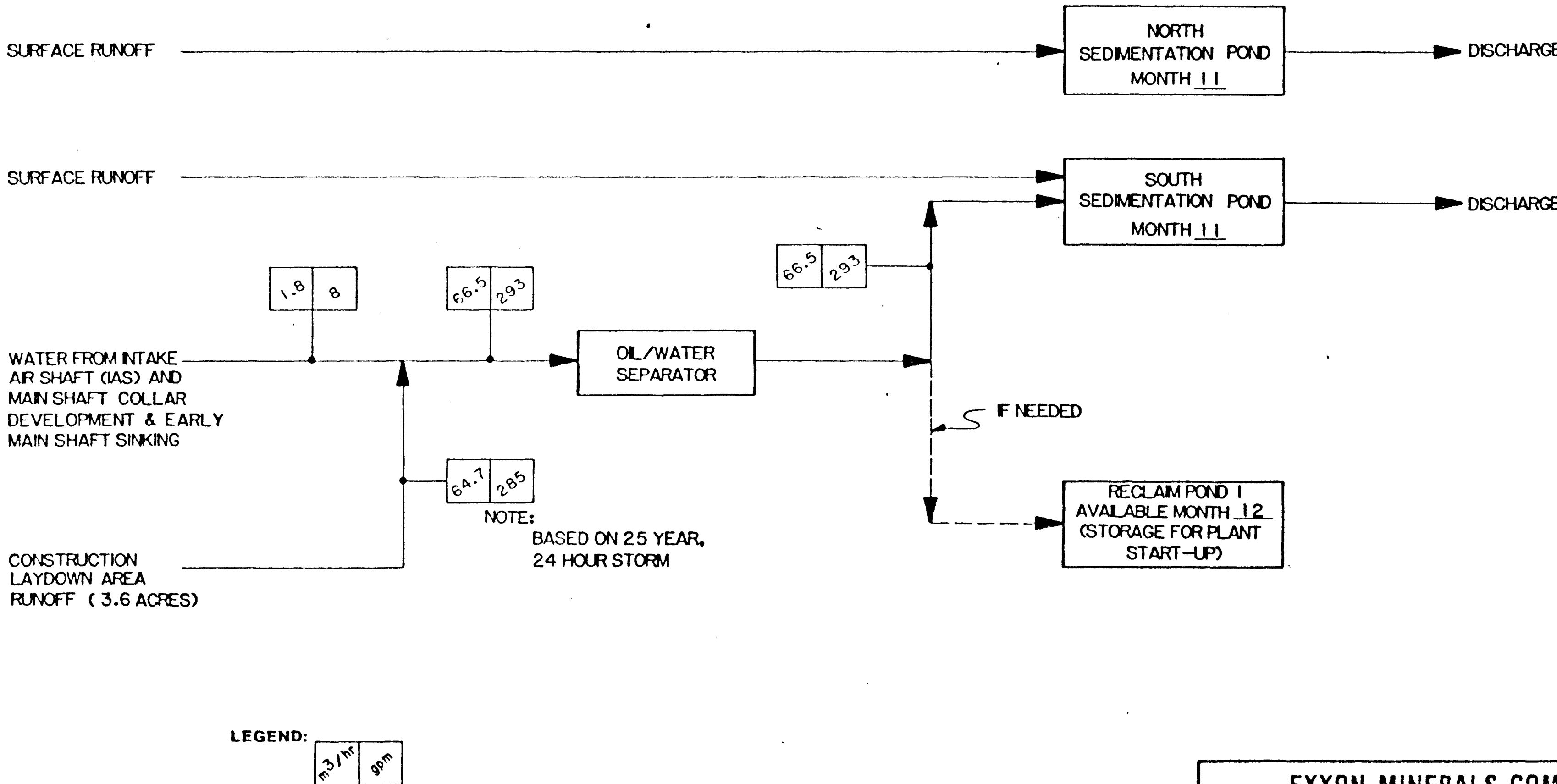
Response:

Water balances for construction, start-up, and mine closure cannot be accurately shown because they represent periods when conditions will change continuously. However, Figures 1 and 2 (attached) show conceptually how water will be handled during these periods; volumes shown on these figures are the flow rates currently being considered in the design.

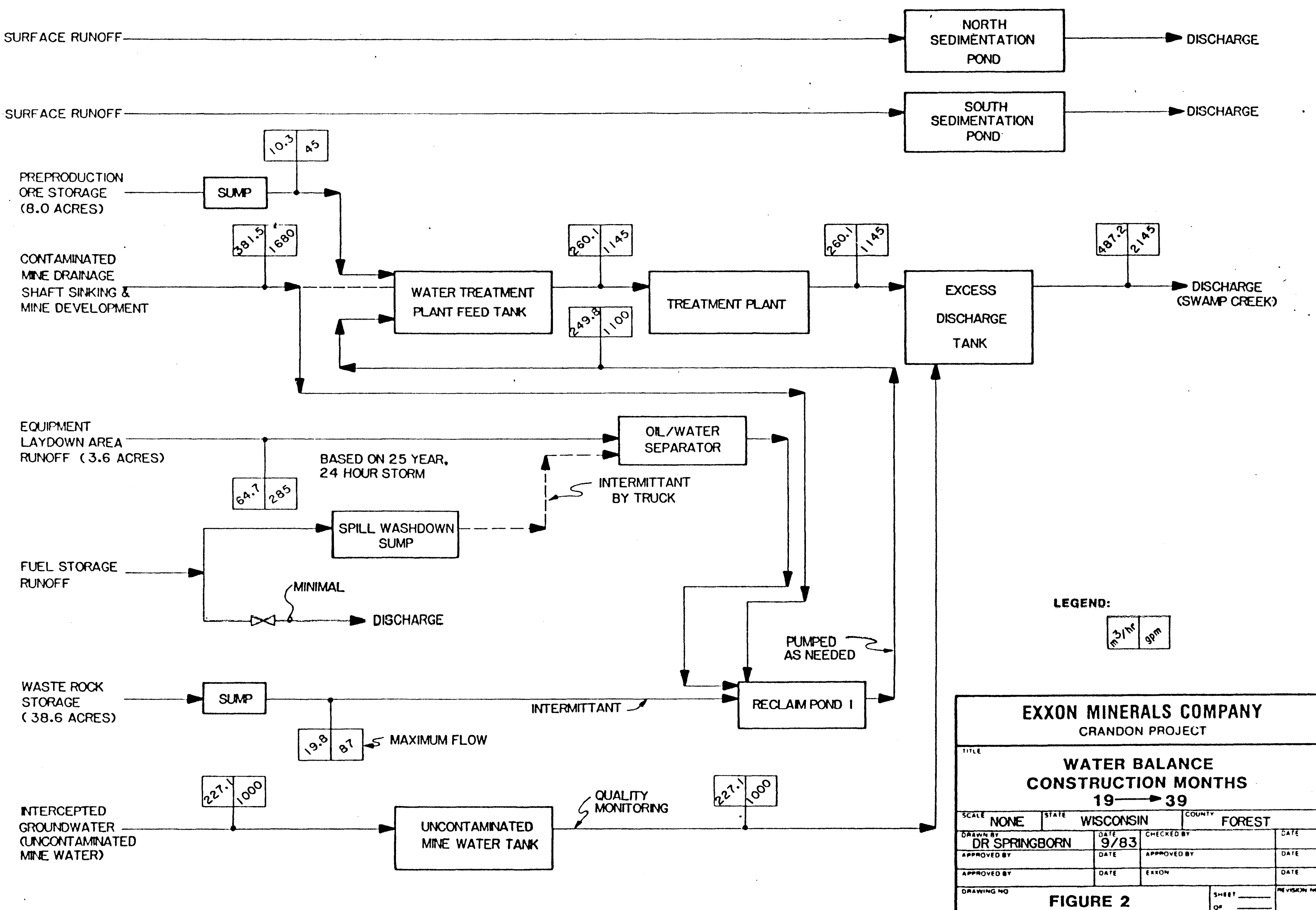
Figure 1 shows the balance for the first 18 months of actual construction. The north and south sedimentation ponds would be constructed early and will remain in use throughout the life of the Project as part of the erosion control system; they will serve to remove sediments from surface runoff and control the direction and rate of discharge of the runoff. Water from the intake air shaft sinking and main shaft collar development will be collected and sent to the oil/water separator near the northwest corner of the south sedimentation pond. Water from the separator will flow into the south sedimentation pond. During this same period, allowance has been made to collect runoff from a 1.45-ha (3.6-acre) area designated "Construction Laydown Area." There is potential for oil contamination in this water and it will also go to the oil/water separator. The flow rate shown is 64.7 m^3/h (285 gallons per minute) which is equivalent to a 25-year, 24-hour storm event. The average flow rate from this area is estimated to be about 1.3 m^3/h (5.7 gallons per minute) over the year.

Figure 2 shows how water will be handled during construction months 19 through 39. Again both sedimentation ponds are available to receive surface runoff from the Project site. Runoff from the preproduction ore storage area will be collected in an adjacent sump and pumped directly to the water

(FIGURE FOR RESPONSE TO COMMENT NO. 131.)



EXXON MINERALS COMPANY CRANDON PROJECT				
TITLE **WATER BALANCE CONSTRUCTION MONTHS 1 → 18**				
SCALE NONE	STATE WISCONSIN		COUNTY FOREST	
DRAWN BY DR SPRINGBORN	DATE 8/83	CHECKED BY		DATE
APPROVED BY	DATE	APPROVED BY		DATE
APPROVED BY	DATE	EXXON		DATE
DRAWING NO **FIGURE 1**			SHEET ___ OF ___	REVISION NO



(FIGURE FOR RESPONSE TO COMMENT NO. 131.)

treatment plant feed tank or, alternatively, it could go to the reclaim pond if necessary. The runoff volume shown in Figure 2 of 10.3 m^3/h (45.2 gallons per minute) assumes collection of runoff from a 25-year, 24-hour storm and pumping that volume to the treatment plant over a 14-day period. The contaminated water from mine shaft sinking and mine development will reach a peak flow rate of about 382 m^3/h (1680 gallons per minute) and then decrease to 227.1 m^3/h (1000 gallons per minute) or less. This water will be sent to the reclaim pond and pumped to the water treatment plant feed tank as necessary. It should be noted that the peak flow of contaminated mine water of 382 m^3/h (1680 gallons per minute) occurs before significant quantities of uncontaminated mine water (intercepted ground water) are encountered. Therefore, the total water flow from the mine should not exceed 454.2 m^3/h (2000 gallons per minute). Storage in the reclaim pond will provide water needed for mill start-up. Water from the equipment laydown area will continue to be treated by an oil/water separator and pumped to the reclaim pond. Runoff from the fuel storage areas will be discharged in a controlled manner by opening a valve to allow collected precipitation to drain. If a small fuel spill occurs, the spill and wash down water will be collected in a blind sump. The contents of the sump will be pumped into a tank truck and hauled to the oil/water separator; water effluent then goes to the reclaim pond. Runoff collected from the waste rock storage area will be collected in a drainage basin and pumped to the reclaim pond and stored for use as process water during plant start-up. The volume shown is the water volume that accumulates during a 10-year, 24-hour storm event and is pumped to the reclaim pond over a 30-day period.

The mill is currently expected to start processing ore 40 months after the start of construction. A water balance for early operation is shown in Figure 3 (attached) and is a balance for milling a maximum of 5750 t/d (6340 short tons per day) of massive ore. The important point is that the handling of process water and mine water will be the same as for mature operation. The ore throughput during start-up will be increasing gradually during this period and water flows to and from the tailing pond and reclaim ponds will be increasing until they approach the volume flow rates for the mature operation of the mill.

It would be premature to develop a water balance for the closure of the Project, but the concepts can be discussed. Water will continue to be pumped from the mine until all salvageable equipment has been removed and mine closure operations have been completed. Contaminated water pumped from the mine will continue to be treated. Water coming from the tailings area will be retained in the reclaim ponds. Water will be pumped from the reclaim ponds at a controlled rate to the treatment plant, treated, and discharged. The treatment plant will continue to operate during the reclamation period as long as there is water requiring treatment prior to discharge.

KEY

m³/hr	gpm

ALL FLOWS SHOWN ARE ANNUAL AVERAGE RATES

FIGURE 3

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE OVERALL WATER BALANCE FOR CRANDON PROJECT- EARLY SUMMER OPERATION

SCALE NONE | STATE WISCONSIN | COUNTY FOREST

DRAWN BY DLA
APPROVED BY MRH

DRAWING NO. 051-7-L-011

CH2M HILL

GB8 5/1981

Comment No. 132

This section states that the average amount of water to be discharged is 1893 gpm yet Figure 3.5-16 indicates that this is the maximum value. Please clarify this discrepancy.

Response:

Subsection 3.5.6 states that the average amount of water to be discharged is 0.119 m^3/s (1893 gallons per minute). The discharge volume shown in Figure 3.5-16 includes 202.8 m^3/h (893 gallons per minute) of treated water and an allowance for a maximum of 227.1 m^3/h (1000 gallons per minute) of uncontaminated mine water. This gives a total discharge flow rate of 0.119 m^3/s (1893 gallons per minute). The designation "maximum" in Figure 3.5-16 will be removed in the revised Mine Plan.

Comment No. 133

Section 3.5.7.2, Treatment of Sanitary Wastes - Please explain how you arrived at an estimated average daily flow rate of 32 gpm.

Response:

The 7.3 m^3/h (32 gallons per minute) estimate was initially developed from a total work force estimate of approximately 920 people and a 0.19 m^3 (50 gallons) per day per person consumption of water which would become sanitary sewage. The current work force estimate is 703 people. With allowance for visitors and approximately 10 percent contingency, 800 people are now being used for estimating sanitary sewage waste generation.

Also, in following Wisconsin Administrative Code H63.15(3)(C)2 a total per day per person sanitary sewage waste generation rate of 0.13 m^3 (35 gallons), 20 gallons sanitary waste and 15 gallons for showers, is being assumed. Using these new criteria and adding 2.84 m^3 (750 gallons) per day of base flow (per code), the total daily sanitary sewage flow is estimated to be 108.8 m^3 (28,750 gallons). This daily flow is equivalent to an approximate average flow of 4.54 m^3/h (20 gallons per minute).

Comment No. 134

Final details of the septic system must be included in the mining permit application once they have been finalized.

Response:

Comment acknowledged. The Mining Permit Application will be updated when the sanitary waste disposal system is finalized. A soils report, covering the soil absorption field, has been submitted to DILHR and is currently undergoing review by them.

Comment No. 135

Indicate on a diagram where the soil absorption field is proposed to be located.

Response:

The mine/mill area plot plan (drawing No. 051-1-G-001 in Attachment No. 1) shows the soil absorption field located on the south side of the mine/mill site.

Comment No. 136

Section 3.5.7.3, Refuse - Where will the refuse (all types) be stored on the site prior to off-site disposal? What volume of each waste type is expected to be generated? The off-site disposal site for mill refuse will have to be specified.

Response:

The normal refuse for disposal is expected to total approximately 2000 tons per year and consist of the following wastes:

Waste Type	Percent
Paper and garbage	75
Metal (unsalvageable)	10
Plastic	5
Wood	5
Miscellaneous	5

These wastes will be collected in dumpsters located around the site. Periodically, garbage trucks will collect the waste and haul it to an approved landfill for disposal. Exxon Minerals Company is currently reviewing suitable facilities and will attempt to secure a committment for a facility for future disposal of Project waste.

Salvageable metal scrap will be removed from the site as soon as practical to avoid creating large temporary stockpiles on-site. Smaller scrap metal pieces will be collected in bins and larger pieces will be stored in a suitable outside area (such as the equipment laydown area southeast of the headframe). Scrap rubber for reuse or disposal will also be temporarily stored in the same area or a similiar one. Schedules will be developed with salvage haulers to pickup the salvage frequently enough to avoid creating large temporary stockpiles.

Comment No. 137

Section 4.0, Environmental Protection - (1)It should be stated in the mining plan what remedial actions will be taken if private water supply wells in the vicinity of the mine area are adversely affected by the mining operation. (2)Also, discuss what measures would be taken to reduce the effects of drawdown if mine inflow is much greater than anticipated.

Response:

(1) In 1979, the Towns of Lincoln and Nashville were informed that public or private ground water supplies which may be affected by Crandon mining operations would be replaced by Exxon Minerals Company. In 1983, owners of individual water supply wells within the drawdown area of the proposed Crandon Mine were given written notice that any impairment of ground water supply by mining operations would be corrected by Exxon Minerals Company. Replacement of the water supply would be accomplished by either deepening the existing well and installing a compatible pump, or by drilling a water supply well at some distance from the affected well and providing distribution from the central pressurized source to the affected property. A statement will be added to Section 4.3 of the Mine Plan noting that remedial actions have been planned for water supply wells that may be affected in the vicinity of the mine.

(2) The predicted steady state rate of uncontrolled ground water inflow to the proposed Crandon Mine is 0.118 m^3/s (1870 gallons per minute) (see response to comment No. 45 with respect to Prickett Associates' study). For the purposes of site area impact modeling, a stress of 0.126 m^3/s (2,000 gallons per minute) was employed, representing a contingency of 7 percent. Since, during mine development and operation, all practical efforts will be made to control and reduce this rate of ground water inflow, it is highly unlikely that flows in excess of 0.126 m^3/s (2,000 gallons per minute) will ever be experienced.

However, the disruptive effects of excess mine water are well known and prudent mine plans will therefore include contingency measures. For the Crandon Mine there will be several excess inflow contingency options.

First, the excess inflow could be controlled by surface source pumping or inflow path grouting as described in the Klohn Leonoff mine water control methods study (see response to comment No. 45). Secondly, mine pumping systems have been designed for the conservative maximum inflow of 0.126 m^3/s (2,000 gallons per minute) employed for site impact modeling, including pumps and shaft columns. Surface surge storage capacity will exist in the reclaim and tailing ponds for temporary handling of excess inflow. The response to comment No. 170 presents available freeboard volume in the reclaim ponds and estimates capacity of the system for handling excess water.

Ground water inflow to the mine will not occur in major quantities until mine level development intersects the orebody weathered zones (Prickett, December 1982). Mining plans provide for construction of the intercepted ground water and normal mine drainage sumps and pump stations at the very start of underground development. These facilities are located near the main shaft, exterior to the orebody weathered zones. They will, therefore, be available for full capacity duty prior to mining entry into any areas of potential ground water seepage.

Comment No. 138

Section 4.1, Air Quality Protection - Discuss the disposition of the dusts collected by the air pollution control devices.

Response:

All dusts and sludges collected by the air pollution control equipment will be recyclable. All concentrates will be recovered for shipment and other dusts and sludges will be recycled to the process streams.

Comment No. 139

The total pollutant emissions listed on page 4-1 are not correct. They were taken from Table 4.1-7, but the totals from that table do not agree with the totals from Tables 4.1-2, 4.1-4 and 4.1-6 which include all emissions from project operations. Table 4.1-7 does not include mobile source emissions during mill operations. The pollutant emission totals listed in this paragraph should be 118.0, 23.3, 167.9, 183.0, 15.7, and 0.9, respectively.

Response:

These tables are being revised as part of the Air Permit Application discussions with the DNR's Bureau of Air Management and corrected pages also will be provided for the Mine Plan.

Comment No. 140

In addition, this project is not necessarily exempt from the requirement to obtain a PSD (prevention of significant deterioration) permit. This determination depends on the amount of pollutants emitted, and emissions from some potentially major sources associated with the project (see next comment).

Response:

In a letter dated July 11, 1983 from the DNR's Bureau of Air Management the conditions were determined for the Project not to be subject to PSD requirements.

Comment No. 141

Tables 4.1-1 through 4.1-6 do not include emissions estimates for some air contaminant sources described or mentioned in the project description.

Those sources not included are:

1) Existing gravel access roads

2) Temporary on-site diesel power generators

3) Burning of stumps and brush during site clearing

4) Wind erosion from MWDF stockpiles

5) Screening and stacking plant to produce MWDF liner and underdrain materials

6) Primary crusher and related ore handling facilities

7) Ore loading, hauling and dumping in the mine

8) Removal of rock from shaft during underground mine construction

9) Sulfur dioxide emissions from SO_2 scrubbing tower

10) Fugitive dust emissions from MWDF during operation

11) Burnt pebble lime facility

Response:

These tables will be revised to reflect information provided as part of the revised Air Permit Application.

Comment No. 142

<u>Section 4.2.2, Erosion and Drainage Control</u> - Erosion control during construction of the proposed discharge structure on Swamp Creek should also be addressed in this section.

Response:

Area disturbance for construction of the discharge structure on Swamp Creek will be minimal. Lightweight equipment, swamp mats and other appropriate precautions will be taken to lessen working difficulties and disturbance in the wetlands in the area of the discharge structure.

In the construction zone for the discharge structure, straw bales or geotextile materials will be used to trap silts to minimize sediment runoff to Swamp Creek. These measures will be continued after completion of construction until the soils have stabilized and sediment runoff is no longer a problem.

Comment No. 143

Where will the mine water be routed prior to completion of the water treatment plant?

Respone:

See response to comment No. 131.

Comment No. 144

Where will the "influent surge system" with a volume of 2.75 MG be located? What will this system consist of?

Response:

Contaminated mine water and runoff water from the preproduction ore storage area will be pumped to the water treatment plant feed tank. This tank will have a capacity of 3,785 m^3 (1,000,000 gallons). Some water from the reclaim water tank will also be fed to the water treatment plant for treatment for reuse. These tanks are located just east of the water treatment plant along with other water tanks. These systems will consist of tanks and treatment plant feed pumps. The flow rate to the treatment plant will be controlled by automatic valves between the feed pump and treatment plant.

Uncontaminated mine water will be pumped to the uncontaminated mine water tank. This tank has a capacity of 946 m^3 (250,000 gallons). This water will be discharged from the site, but provisions are made to use this water as make-up if needed.

Comment No. 145

Discuss the expected water quality of the runoff collected from the waste rock storage area.

Response:

The exact chemical characteristics of surface water runoff from the waste rock can not be determined until operation. However, based on leach tests conducted on waste rocks, a water quality projection was made. This is shown in Appendix C of "Design Criteria - Water Management Program" contained in Appendix F, Volume 3, "Phase III Water Management Study," CH2M Hill, 1982 (previously provided to the DNR).

The following data for waste rock runoff quality were calculated based on leach test data and should be used for estimating purposes only:

Constituent	Concentrate mg/l
Cu	7.2
Fe	304.
Zn	15.7
As	0.9
Ca	8.3
Mg	78.7
Cd	0.01
Al	49.2
SO_4	1396.

Data presented in EIR Appendix 1.2A, Table 3.4 show that waste rocks are not classified as hazardous waste according to U.S. EPA extraction procedure tests. Any runoff from the storage pile will be collected in a sump and transferred to the reclaim pond.

Comment No. 146

The "approved disposal area" for the oil waste should be specified. The oil-water separator (interceptor system) will require a Department review.

Response:

Oily waste from the oil/water separators will not be permanently stored on the Project site. If the oily waste cannot be accepted by a secondary refinery and it is not classified as a hazardous waste, it will be taken along with other refuse to a disposal site that is licensed and operated according to procedures approved by the State of Wisconsin. If the oily waste is classified as a hazardous waste, arrangements will have to be made to dispose of the material in a hazardous waste disposal site. It is unlikely that this waste will be classified as hazardous.

The oil/water separator consists of a chamber with floating, oil-absorbent material. Water flow through the chamber and ability to collect oil are not affected by the water level in the chamber. The oil-absorbent material will be removed as necessary and replaced with fresh absorbent material. The design of the separator can be reviewed with the Department if necessary.

Recent correspondence received from B. Zellmer of the DNR included a list of 10 waste oil recyclers and/or haulers in the State of Wisconsin.

Comment No. 147

As stated previously, design details for all retention basins on the site must be provided.

Response:

The three civil drawings included in Attachment No. 8 indicate the locations for the two surface drainage basins to be used at the site. Typical drainage inlets for paved areas, ditches, and details of the surface drainage basins are included with the drawings.

Comment No. 148

Section 5.0, Risk Assesment (General)- As reflected in the following comments, some attempt should be made to present estimated frequencies of various occurrences. This information should be available since it is stated on page 5-2 that the risk assesment is based on historical data and semi-quantitative techniques. Further, the contingency measures for many of the potential incidents are not detailed as is required by s. NR 132.07(3)(i).

Response:

Additional data, where available, and amplification regarding frequencies of various occurrences are included in subsequent responses. Some accident probabilities such as in-plant spills are not catalogued by the mining industry or regulatory authorities and projections of probabilities are based on the field experience and judgement of personnel in the industry.

In subsequent responses, additional information on contingency measures has been provided where appropriate to satisfy the requirements of NR 132.07(3)(i). Further detail on contingency measures will be developed in later Project stages during final engineering and operation.

Comment No. 149

No risk scenarios were provided for the effect of reagent and fuel spills affecting the ground water. Given the volume of materials that will be present at the mine/mill and previous ground water contamination incidents in Wisconsin involving many of the same compounds, ground water contamination is a real risk and should be addressed.

Response:

Risk scenarios involving reagents and fuel spills affecting ground water were not presented since they do not constitute a calculable risk. Reagent storage areas and handling facilities in the mill will have concrete floors and be designed to contain spills. Solid spills will be thoroughly reclaimed. Liquid spills will be contained in blind sumps and the contents will be used as originally intended. Liquid spills will be recycled to original bulk containers or to mixing tanks as appropriate.

The fuel storage facility will be lined and have containment dikes sufficient to retain the entire contents of any tank (see response to comment No. 154).

Since these facilities are designed to contain any spilled reagent or fuel, there is no risk of ground water contamination from these sources.

Comment No. 150

Section 5.32, Concentrate Spills - The discussion of concentrate spills considers airborne transport off-site as the only plausible consequence to the environment. Given the number of wetlands, lakes and streams in the vicinity of the mining site, isn't it also possible for a spill to occur in or near one of these water bodies? The effects of a concentrate spill in or near a surface water body should be discussed along with any clean-up procedures that would be used. Is there any historical data for the mining industry regarding the frequency of spills and derailments? What impacts have such spills created in the past?

Response:

The possibility exists that an accident involving transportation of concentrate could result in a spill into a water body. However, the probability of such an occurrence is small and impacts minor. Accident probabilities are dependent on carrier and location. Although specific probabilities of accidents involving shipment of concentrates are not available, probabilities of various industrial accidents are provided in Reliability and Risk Analysis, by N. J. McCormick, Academic Press, 1981. The probability of a train crash is listed as 1×10^{-1} to 1×10^{-2} events per year. This range would probably be reduced to less than 1×10^{-2} to 1×10^{-3} events per year when considering the probability of the postulated accident occurring over water.

Even if such a low probability incident did occur the risks would be short-term, highly localized, and primarily a mechanical disturbance of the environment. The high density of the material would promote rapid settling, should it be introduced to a surface watercourse. There is very limited potential for heavy metal being leached from the concentrate because of the high insolubility of the metal sulfides in water. Under equilibrium conditions, the solubility of the metals in water is less than the U. S. Environmental Protection Agency (EPA) limits established for the protection of freshwater aquatic life or human health (U. S. EPA, 1980). Should very low pH water be encountered, it is possible for the concentrates to dissolve. However, even under these conditions, the metals would be attenuated by the sorption properties of soils. A persistent, high concentration source will not be established.

Because the concentrates are both inert and immobile, remedial measures can occur in a timely manner to recover the spilled material. Because of the economic value of the concentrate, recovery operations would occur immediately. Specific techniques used to recover spilled concentrate will depend on the amount of concentrate spilled and the location. However, the concentrate will be recovered to the maximum extent practicable.

Comment No. 151

It is stated on p. 5-6 that "Health effects caused by inhalation of particles in the respirable range are generally exhibited after long-term (chronic) exposure." However, short-term exposure can also cause health problems, especially in sensitive populations such as people with chronic respiratory ailments, children and older people. It is possible that short-term localized health problems could be caused by derailment of concentrate cars in a town under dry, windy weather conditions.

Response:

Derailment of concentrate cars in a town under unusually dry, windy weather conditions will present neither short-term nor long-term risks to people with respiratory sensitivities. As stated in the response to comment No. 150, the concentrates are dense and inert and their economic value dictates that recovery of the product would occur as soon as practicable after the spill.

Also, the concentrate is not a dry powder and will not be readily suspended by wind unless the material is not recovered and dries. The concentrate will be shipped at 8 to 12 percent moisture which will preclude immediate dusting of the material after an accident. Following the spill and before the concentrate is allowed to dry, sufficient time would be available to clean the area to preclude any impact to sensitive populations.

Comment No. 152

<u>Section 5.3, Reagent Spills</u> - Simply stating that the likelihood of reagent spills is negligible is insufficient. Some statistical information regarding reagent spills in the mining industry should be presented.

Response:

Documentation of reagent spills in the mining industry is not available. The statement made in Section 5.3 is based on judgement and personal experience of professionals in the industry. The reagent transport, handling and storage facilities were selected to reduce the potential for spills and the containment facilities in the mill will prevent any spills from affecting the environment off-site. Based on the experience of mill workers in Exxon Minerals Company, the probability of a major spill resulting from transportation of reagents to the Crandon Project is very low and we would not anticipate a major reagent spill over the life of the Project.

Comment No. 153

It is stated on p. 5-9 that sulfur dioxide, sodium cyanide, sodium dichromate, and sulfuric acid are the only reagents considered to present a potentially significant risk. The polypropylene glycol methyl ether, methyl isobutyl carbinol and possibly the aryldithiophosphoric acid could also present potentially significant risks.

Response:

The risks associated with the three additional reagents mentioned, polypropylene glycol methyl ether, methyl isobutyl carbinol and aryldithiophosphoric acid are minor to nonexistent. In-plant controls and containment facilities will preclude environmental impact from reagent spills in the mill and associated facilities. Transportation of these reagents, as with the other reagents discussed in Section 5.3, is the only mode of potential environmental risk.

The likelihood of these kinds of spills occurring within the Project boundary is considered negligible. The access road will be maintained and the posted speed will ensure safe operation. The railroad spur will be inspected and maintained regularly. In addition, the grade will be less than one percent and the operating speed will be slow. All equipment will be maintained in a condition which complies with all the Department of Transportation requirements. Therefore, equipment failure also becomes a negligible factor. Should a spill occur in transit, the effects would be short-term, reversible, and would constitute little to no threat to human health.

Polypropylene glycol methyl ether and methyl isobutyl carbinol are common reagents used as frothers in the flotation process. They are relatively stable, non-corrosive, and non-reactive agents, requiring no special handling, and present no special health or safety hazard from acute or chronic exposure. Methyl isobutyl carbinol will be stored outside the mill building.

Aryldithiphosphoric acid is listed as a secondary process reagent and its routine use is not currently planned. It was one of the collector reagents used in metallurgical test work; however, it is not as selective in the flotation process as the combination of xanthate reagents that are proposed for use. It is seldom used in the treatment of massive sulfide ores. This product is sold in the ammonium salt form and shipped as an 80 percent aqueous solution; there is little or no acid form of the compound in the shipped product. The low potential for use of this material and the fact that it is shipped as an aqueous solution of a neutralized material accounts for the low level of risk associated with this reagent.

Comment No. 154

Section 5.4 Fuel Spills - Why does this assessment focus only on small quantity spills and totally disregard larger scale spills such as rupture of a storage tank? How would large scale spills be handled?

Response:

Storage tank ruptures were not addressed in the risk assesment because the fuel storage facilities are designed to ensure a tank rupture would result in no environmental impact. The fuel storage tanks will be located within containment dikes sufficient in size to hold the entire tank volume.

The area within the containment dikes surrounding the fuel storage facility will be lined with an elastomer membrane to prevent spills and contaminated runoff from reaching soil, surface water or ground water. Any minor spills, washdown, or runoff from this area will be transferred to the industrial wastewater treatment system. (This system also collects washdown and runoff from around the shops and other areas of potential oil/grit contamination.) Precipitation collected within the containment berms would not normally be contaminated in any way since the fuel storage and handling systems are totally enclosed and sealed. A valved outlet pipe through the embankment at the lowest portion of the diked area will allow a control mechanism for uncontaminated precipitation release. When the valve is opened, precipitation or any uncontaminated water which was contained would simply be permitted to flow into the surrounding area.

Comment No. 155

What will be done with the contaminated soil that is removed from a spill site if the spill occurs during the construction period?

Response:

If a fuel spill occurs that dictates removal of the contaminated soil, the soil will be disposed such that water contamination will not occur. As stated, however, in the response to comment No. 154, the fuel storage tanks will be contained, even during construction, in lined facilities.

If a major tank rupture occurs, the recoverable fuel will be removed and stored in suitable containers and, if necessary, the soil can be removed. The actual disposition of any affected soil will be specified in the SPCC plan which will be developed at a later stage in Project development.

Comment No. 156

Section 5.5, Leachate Control System Failure - The discussion of liner, cap and underdrain systems should include documentation of similar installations being used at other mill facilities or other industries along with an evaluation of their performance.

Response:

The liner proposed for the leachate control system will be developed from processed till (soil material larger than 3/4 inches removed) mixed with bentonite. This mixture would be "blended" and moisture conditioned to a uniform consistency using a batch system similar to that used in the concrete industry; transported to the liner construction area by truck; and dumped, spread and compacted. However, further study is planned for other methods of liner construction including in-situ mixing techniques to assess facility performance variability.

Techniques for spreading a processed aggregate in constructing the underdrain layer would be similar to those used in highway construction with special considerations developed to protect the underlying liner. Grade control and soil material quality assurance methods are well established. Drainage performance characteristics of the underdrain system can be established either in large scale laboratory tests orfrom in-situ field measurement (i.e., determination of the in-situ permeability of base and subbase soil materials).

The combination of liner, drainage and filter layers is an application of technology which has been used in landfill and other waste containment facilities. The following list includes sites where either similar concepts, in part or in total, have been implemented, are under construction, or have recently been designed:

SITE	LOCATION	TYPE OF WASTE	STATUS
Oaks Sanitary Landfill	Montgomery Co., MD	Municipal waste	Under construction
Key Lake	North Saskatchewan	Uranium tailings	Operating
Crystal Lake Landfill	McHenry Co., IL	Municipal waste	Operating
Landfill No. 2	Virginia Beach, VA	Municipal waste	Under construction
Hawkins Point	Baltimore, MD	Hazardous waste	Designed
Loudoun Co. Landfill	Loudoun Co., VA	Municipal waste	Designed

To date, all Exxon Minerals Company sponsored studies related to the seepage control system have been submitted to the DNR including:

1) General Properties of Common Liners, Crandon Project, Project Report 6.1, Golder Associates, December 1981.

2) Evaluation of Prospective Common Liners, Crandon Project, Waste Disposal System, Project Report 6.2, Golder Associates, December 1981.

3) Geotechnical Review, Crandon Project Waste Disposal System, Project Report 2, Vols. 1-3, Golder Associates, October 1981.

4) Parametric Seepage Rate Estimates, Crandon Project, Waste Disposal System, Project Report 3.1, Golder Associates, March 1982.

5) Underdrain Review, Crandon Project, Waste Disposal System, Project Report 3.2, Golder Associates, March 1982.

6) Laboratory Testing Programs, Crandon Project, Waste Disposal System, Project Report 5, Golder Associates, May 1982.

Comment No. 157

It is stated on page 5-18 that the long-term effect on ground water is reversible. Please expand on this statement.

Response:

The statements on page 5-18 relate to the assessment of risk associated with the low probability of failure in the leachate control system. Although this unlikely event is mentioned, the potential effects are further mitigated by the attenuative capacities of the soil beneath the MWDF. However, if an increase in MWDF seepage occurs, for whatever reason, it is likely to have slightly higher (i.e., because of larger water quantity not quality) than predicted concentrations of those substances which have little attenuation by the soil beneath the MWDF. The most likely substance for which this scenario (i.e., risk) might occur is sulfate.

However, sulfate is readily dispersed and diluted in water. Therefore, the statement indicating that any effects are reversible provides an assessment of the long-term implications of the unlikely event. Two major factors are related to this statement. First, any cause of an increase in the sulfate concentration will be evaluated and the failure mechanism corrected as soon as possible (e.g., repair of the reclamation cap). The quantity of increased seepage will occur for a short time period, and after repairs are completed, will return to the previous water flow rates. As this occurs, the dilution and dispersion of any substance will also return to its previous condition (i.e., "reversible"). The second factor is that with time the concentration of substances in the leachate will decrease and smaller and smaller contributions will be dispersed and diluted by the water. Therefore, greater and greater dilution and dispersion will occur "reversing" any effect the previous temporary increases in seepage may have caused.

Finally, because the MWDF is in a recharge area, percolating water is readily available to disperse and dilute any substance from a source it is close to and prior to its reaching an environment which would have exposures to any organisms. This is particularly important to prevent violations of any standards and to assure a "reversible" effect prior to the substances being available to the environment beyond the compliance boundary.

Comment No. 158

What measures will be taken if various degrees of failure or inadequate performance occur? Is pumping the only remedial action?

Response:

Many redundant measures have been designed for the MWDF to have a low probability of failure or inadequate performance (see Mine Permit, p. 5-19). However, as stated in the Monitoring and Quality Assurance Plan, several monitoring programs and associated parameter measurements will be obtained to determine the operating conditions of Project facilities and to assure compliance with issued permits and standards. The Contingency Plan provides the implementation procedures to be followed in the unlikely events of failure or inadequate performance.

The measures presented in the Contingency Plan involve early analysis and evaluation of a problem, followed by a determination of its consequences and the time-frame for manifestation, and finally implementation of mitigation and corrective actions. The degree of failure or inadequate performance would also dictate the degree of response. Proper evaluation and cost-effective correction would be dependent on the nature and severity of the problem.

Since no particular failure or inadequate performance is anticipated, and since no such "hypothetical" problem was presented in the comment, no preconceived remedy or corrective action can be presented at this time. However, pumping is not the only remedial action which might or could be implemented. Other possible contingency measures include localized grouting of a failure area of the pond liner, installation of supplemental underdrain pumping wells in the event of an underdrain collection pipe failure, intermediate resealing of a pond, and replacement of the reclamation cap. Again, the Contingency Plan provides for a full and thorough evaluation of any developed problem with provisions for rapid and adequate remedial actions as necessary.

Comment No. 159

Section 5.6, Accidental Detonation of Surface Stored Explosives - There is no such agency as the Wisconsin Department of Industrial Health and Labor Relations as referenced on page 5-22. What is the expected frequency of accidental detonations based on historical data from the mining industry?

Response:

The correct citation for the agency referred to in Section 5.6 is the "Wisconsin Department of Industry, Labor and Human Relations." With regard to detonation of surface stored explosives, Exxon Minerals Company does not expect any. Historical data from the mining industry indicate accidental detonation of surface stored explosives would constitute an extremely rare event. A report prepared by the U. S. Department of Labor, Mine Safety and Health Administration, January 1981, The Explosion Hazard in Mines, does not cite any surface explosions being caused by detonation of surface stored explosives. Verbal communications with Mr. Dick Watson with the Bureau of Mines in Pittsburg, Pennsylvania confirm the rarity of such an event.

Comment No. 160

Section 5.7, Forest Fires - Discuss the measures that will be taken to prevent forest fires resulting from the controlled burning during the site preparation phase.

Response:

If controlled burning is conducted to eliminate waste wood that remains following Project clearing activities, a DNR burning permit will be obtained if any burning is to occur during the fire season. Measures specified on the burning permit will be followed to prevent forest fires.

Comment No. 161

What is the expected frequency of on-site fires during construction and operation? How many incidents are projected to occur over the life of the project?

Response:

Because of safety standards employed during construction and operation, there is little probability of an on-site fire during the life of the Project. On-site fires have not historically been a serious problem in zinc, copper, and lead mining and milling facilities.

Using data on surface fires at underground mines published by the Bureau of Mines in "An Annotated Bibliography of Metal and Nonmetal Mine Fire Reports," December 5, 1980, we would estimate the probability of a surface fire at the Crandon Project at less than one fire during the life of the Project. The duration of this postulated fire based on the same report would be less than 4 hours. Because of the fire prevention standards, and detection systems to be used at the Crandon Project, the probability of fires and their duration should be less than the probability presented here and as such on-site fires do not represent a serious risk.

Comment No. 162

Discuss the potential for fires starting along the power line corridor and the railroad spur and also the prevention measures to be taken.

Response:

In general, the potential of electrical fires starting along the powerline corridor is very low based on the experience of Wisconsin Public Service Corporation in their service area (personal communication, Wisconsin Public Service Corporation, October 25, 1983). Following preparation of the corridor for the powerline, it will be maintained in a vegetative cover of herbaceous plants and low growing shrubs. Growth of undesirable woody plant species in the corridor will be controlled through the use of EPA-approved herbicides. The edges of the corridor will be maintained by periodically trimming the limbs that may extend into the right-of-way. The powerline corridor and adjacent access road will serve as a fire break for any local fires that may occur in areas bordering these Project-related facilities.

As indicated in the response to comment No. 73, the ballast section of the railroad spur will be kept entirely free of vegetation through the use of EPA-approved herbicides. Undesirable weeds and woody plants within the right-of-way also will be controlled by mowing or through the use of EPA-approved herbicides. During Project operation the railroad spur will receive limited use (approximately 15 round trips between the siding and the mine/mill site per week). These conditions will minimize the potential for fires along the railroad spur. The railroad spur also will provide a fire break which will help to control spreading of local fires originating in forest land along either side of the corridor. In summary, the design of the railroad spur and the operations on it will be very similar to other industrial spur tracks.

Comment No. 163

Section 5.8, Mine Subsidence - Simply because mine subsidence does not represent a hazard to people off-site does not mean that it is not a credible source of risk. The evaluation of mine subsidence must be redone in much greater detail especially when one considers the fact that potential for significant surface subsidence is grounds for denial of the mining permit.

Response:

The original ground surface above the proposed Crandon Mine will be maintained by a permanent bridge or "crown pillar" of bedrock left undisturbed above the mine workings.

The mining methods and stope sequences planned for extraction of the Crandon orebody were selected to control mine area rock mass stability and preclude surface subsidence. A permanent bridge or "crown pillar" of bedrock directly beneath the glacial overburden will be purposely excluded from mining activity. This bedrock barrier will maintain surface stability and prevent piping of overburden materials into active mine workings.

Beneath the orebody crown pillar, stoping methods and sequences will be arranged to maintain local rock mass integrity and avoid disturbance of the crown pillar. All proposed mining methods provide for backfilling of stopes immediately following ore extraction. Depletion of reserves will generally proceed from depth and the orebody extremities toward the surface, with mining directly below the permanent crown pillar planned for the final third of mine life. These practices, combined with the fact that approximately 8 percent of the mineable ore will be left in place as pillars throughout the mine, will assure perpetual stability of the mine area bedrock surface and glacial overburden.

The selection of mining methods for preservation of the crown pillar was based on a suite of physical testing programs including soil mechanics, rock mechanics, and mine backfill. These studies determined the soil characteristics, rock mass strengths, inherent rock stresses, and backfill properties such as density, compaction, and percent cement addition necessary for a structurally safe mine design.

John D. Smith Engineering Associates Limited, mine rock mechanics specialist, prepared a summary report, "Evaluation of Surface Effects" in April 1982. Their analysis integrated all the related test work and described and quantified potential subsidence mechanisms:

1) Overburden Compaction - Because of the consolidated nature of the glacial overburden, partial dewatering of these soils will result in little additional compaction and resultant subsidence.

2) Gross Rock Failure - Mine stope dimension, methods, development sequences, and backfilling practices have been designed to preclude failure of the crown pillar or rock surrounding the ore deposit during

and after normal mine operations. Maintenance of the surface is contingent on the stability of the bedrock subcrop.

3) Backfill Compression - Long-term, post-operation, rock failure mechanisms investigated included rotational failure of the hanging wall, wedge failure of the hanging wall, and crown pillar collapse. Each of these failure modes is related to backfill compressibility and placement practices. The properties are such that with proper placement, particularly beneath the crown pillar, the bedrock surrounding the mine workings should remain perpetually stable.

The summary conclusion of all subsidence evaluations is that the combined effects of any bedrock/soil movements will result in less than 0.15 m (6 inch) maximum change in surface elevations over the ore deposit. Settlements of this magnitude distributed through glacial overburden of varying thickness will have a negligible effect on surface topography or land use.

Comment No. 164

Section 5.9 Mine Fires - What is expected frequency of mine fires?

Response:

The frequency and consequences of mine fires at Crandon are expected to be small. Based on information in a report by the Bureau of Mines entitled "An Annotated Bibliography of Metal and Nonmetal Mine Fire Reports," the Crandon Project would not expect mine fires at a frequency greater than 0.2 fires per year. These fires would be minor in nature and as stated in Section 5.9 of the Mine Plan they will have short duration and be highly localized.

The estimate of no more than one fire in 5 years is much more than Exxon Minerals Company expects will actually occur. The estimate is based on industry records from all types of copper, lead, and zinc operations from 1968 to 1979. Over 40 percent of the fires reported were ignited by electrical short circuits which should be a minor potential source in a mine using primarily diesel production equipment. Also, over 40 percent of the applicable industry fires resulted from combustion of timber or insulation which should be a minor problem in a mine using limited amounts of timber for support and little or no insulation.

Comment No. 165

Section 5.10, Tailing Pipeline Failure - This section should discuss industry experience with HDPE pipelines. Exxon should expand on how leaks would be detected, repaired and cleaned up. Will there be a backup pipeline system if the tailing pipeline requires massive repair and is thus temporarily unusable?

Response:

The anticipated life of HDPE pipe has been assessed largely from manufacturers' literature and experience. In water transport service, a 50 year pipeline life might be achieved. This is much longer than the proposed Project life for active pipeline use of approximately 25 years.

Additional information on the characteristics of HDPE pipe and industry experience with HDPE pipelines is presented below:

Resistance to Corrosion

Corrosion tests performed by PSI, Inc. (Conceptual Engineering Study by PSI, Inc.," Tailings Slurry and Solution Transport Pipeline System," p. 10 of Laboratory Report) indicated that corrosion rates for steel in contact with tailings slurry would be high. In contrast, HDPE is inert to a wide variety of chemicals as evidenced by corrosion tests performed by a leading manufacturer of HDPE materials. In addition, HDPE does not rot, pit, corrode, or lose wall thickness by reaction with the surrounding soil. It is unaffected by algae, bacteria, or fungi.

Abrasion Resistance

The abrasivity of the tailings slurry is low as evidenced by Miller number determinations performed by PSI, Inc. (Exhibit 1 of PSI, Inc., report). In addition, test work performed for a leading manufacturer by Williams Brothers Engineering, Tulsa, Oklahoma, compared a proprietary brand of HDPE pipe to steel in controlled pipe loop pumping tests. HDPE out performed steel by a factor of four to one.

Friction Factor

Friction pressure loss in HDPE pipe is less than pressure loss in steel or cement lined pipe. Typical "C" valves used in the "Hazen and Williams" formula for calculating pressure loss are:

HDPE Pipe	155
New Steel Pipe	140
Cast Iron Pipe	130
Concrete Pipe	120

The favorable friction factor for HDPE pipe results in lower pumping energy consumption and reduced pipeline pressure.

Fusion Welding

Steel and HDPE pipe can be installed in a continuous fusion welded line. Lined steel pipes are joined by flanged connections. A pipeline with many flanged connections is more prone to leakage than a welded line. On this basis, the unflanged fusion welded HDPE pipeline will be superior to flanged pipeline. Therefore, this review indicated that the superior corrosion and abrasion resistance exhibited by HDPE pipe and the life and reliability of HDPE pipelines can be expected to be superior to the life of pipelines fabricated from competing materials, including steel.

In addition, several recent applications of slurry pipeline transport have selected HDPE over other materials. Examples of the use of HDPE in mining industry slurry service are:

1) Pinto Valley (Miami, Arizona);

2) Lornex (Highland Valley, British Columbia);

3) Phelps Dodge (Morenci, Arizona);

4) Inspiration Consolidated Copper Company (Miami, Arizona); and

5) Exxon Minerals Company (Highland, Wyoming).

Information on leak detection and repair of damaged pipe and clean-up around a pipeline break is presented in the response to comment No. 66.

Spare plastic pipe will be retained in storage for repair purposes; however, there will not be a separate backup pipeline system.

Comment No. 166

<u>Section 5.11, Pond Embankment Failure</u> - Discuss the industry's experience with embankment failures (major and minor) and also specify the contingency measures to be implemented if failure does occur.

Response:

There is no mining industry experience of embankment failures with an underdrain system design as proposed for the Crandon Project. There is almost no possibility of such a failure.

Although we do not expect any partial or complete sectional failures of the embankments, in the unlikely event something of this nature occurred, immediate response would be implemented to provide public safety. After that, appropriate reclamation and restoration of the affected areas would be initiated in conjunction with a thorough evaluation of the resulting consequences. Additional evaluation would occur to enable necessary remedial actions to prevent another failure.

However, in the unlikely event that embankment leakage would occur, the Contingency Plan (see p. 12) would implement a program of immediate repair of any such location and the additional construction and/or design for the facility to prevent any further erosion. Following these activities, further evaluation of the cause of any leakage would occur immediately, and necessary design or construction improvements would be implemented as an additional preventative mechanism.

Comment No. 167

The possibility of a failure of the liner and underdrain on the side slopes of the ponds, causing leakage into the dikes thus destabilizing the embankments, should be addresssed.

Response:

The unlikely possibility of failure of the liner and underdrain on the side slopes of the tailing ponds embankments and the consideration of contingency measures have been discussed in the Mine Plan in subsection 5.5.1, pp. 5-18, 5-19; Section 5.11, p. 5-27; and in the Contingency Plan on pp. 11 and 12. The discussions and plans presented in these documents were supported by studies conducted by Golder Associates (see Project Report 11 - Miscellaneous Details and Analyses, Crandon Project Waste Disposal System; previously provided to the DNR)

In Section 12, Slope Stability Analysis, of the Golder report is a discussion of the safety factors inherent in the embankment design. One of the conservative assumptions used in the analysis was that seepage from the pond would saturate a large portion of the embankment. As Golder indicates, in reality this cannot occur. However, an analysis was completed to determine the seepage effect related to forces exerted on the embankment and foundation. Results indicated a minimum safety factor against slope failure of 2.1. This is greater than the recommended minimum safety factor of 1.5 (see Golder Report, reference 4). Golder concluded that the embankments, even if saturated, have stable slopes. Therefore, it is unlikely that the liner and underdrain will fail, and that even if they did, the embankments would be stable above the minimum safety factor and likely preclude any embankment failure.

Comment No. 168

How was the Probable Maximum Precipitation Event (PMP) calculated?

Response:

The value for the Probable Maximum Precipitation event (PMP) and the other storm frequency and intensity values were taken from the "Rainfall Frequency Atlas of the United States," Technical Paper 40, May, 1961, from the United States Department of Commerce, Weather Bureau.

Comment No. 169

Section 5.12, Water Treatment System - Discuss the frequency of shutdown and need for maintenance of this type of system as experienced at other facilities.

Response:

Data showing the frequency and duration of equipment shutdowns for water treatment plants of similar or identical design are shown in the attached tables (data from CH2M Hill, 1983). Reasons for equipment shutdowns are

(TABLE FOR RESPONSE TO COMMENT NO. 169)

LIME PRECIPITATION TREATMENT OF MINE WATER FOR DISCHARGE EQUIPMENT SHUTDOWN AND MAINTENANCE DATA

UNIT OPERATION	REASON FOR SHUTDOWN	FREQUENCY	DURATION OF SHUTDOWN
Neutralization	• Lime Addition Valve Plugs	Unplanned	• No downtime; back-up system available.
	• Loss of Ferric Sulfate Pump	Unplanned	• No downtime; back-up system available.
	• Agitator Motor Failure	Unplanned	• 1-3 days; stop treating process water and use softening equipment for process water treatment to treat mine water.
	• pH Control System Failure	Unplanned	• 1/2 day replacement; plant continues to operate.
Clarification	• Rake Drive Motor Failure	Unplanned	• 1-3 days; stop treating process water and use softening equipment for process water treatment to treat mine water.
	• Loss of Polymer Feed Pump	Unplanned	• No downtime; replace with backup.
	• Sludge Pump or Valve Failure	Unplanned	• 1/2 day; replace with backup.
	• Shutdown for Normal Cleanout	1 per year	• 1-2 days; stop treating process water and use softening equipment from process water treatment to treat mine water.
Filtering	• Filter Media Replacement	1 every 3 to 5 yrs.	• 1 week; operate treatment line at about 67% capacity.
	• Feed or Outlet Valve Failure	Unplanned	• 1-2 days; operate at 67% capacity.
	• Air Blower Failure	Unplanned	• No downtime; 1-3 day repair; air scouring for filter net used.
	• Backwash Pump Failure	Unplanned	• No downtime; replace with backup.
	• Backwash or Air Line Failure	Unplanned	• 1 week; operate at 67% capacity.
pH Adjustment	• Agitator Motor Failure	Unplanned	• No downtime; 1-3 day repair.
	• pH Control System Failure	Unplanned	• No downtime; 1/2 day to replace signal transmitter.
	• Loss of Acid Pump	Unplanned	• No downtime; replace with backup.

(TABLE FOR RESPONSE TO COMMENT NO. 169)

TREATMENT OF MINE AND PROCESS WATER FOR RECYCLE TO PROCESS
EQUIPMENT SHUTDOWN AND MAINTENANCE DATA

UNIT OPERATION	REASON FOR SHUTDOWN	FREQUENCY	DURATION OF SHUTDOWN
Neutralization	Same as for treatment of mine water for discharge		
Reactor/Clairfier	• Loss of Soda Ash Feed Pump	Unplanned	• No downtime; replace with backup.
	-- Others; same as for clarification in treatment of mine water for discharge		
Filtering	Same as for treatment of mine water for discharge		
Reverse Osmosis (RO)	• Membrane Replacement	3-yr Interval	• 1 week; stop treating process water.
	• Cleaning of RO Module	6-12 times/yr	• 1 day; operate at 67% capacity.
	• Replace Cartridge Filter	12-15 times/yr	• No downtime; 2 to 4 hours to replace.
	• Booster Pump Failure	Unplanned	• No downtime; replace with backup.
	• Feed or Reject Control Valve Failure	Unplanned	• 1 day; operate at 67% capacity.
	• Membrane Failure	Unplanned	• 1 day; operate at 67% capacity or immediately replace with backup.
	• SHMP or Acid Pump Failure	Unplanned	• No downtime; replace with backup.
	• Flow element or pH Element Failure	Unplanned	• 4 hours; operate at 67% capacity.
Evaporator	• Feed or Condensate Pump Failure	Unplanned	• No downtime; replace with backup.
	• Recirculation pump-Impeller Failure	Unplanned	• 1-2 days.
	• Recirculation Pump-Other	Unplanned	• 1 day-2 weeks depending on problem.
	• Compressor Failure-Impeller	Unplanned	• 1-2 days.
	• Compressor Failure-Other	Unplanned	• 2 days to 3 weeks depending on problem.
	• General Maintenance Inspection	1 per year	• 1-2 weeks.
Brine Softener	Same as for Reactor/Clarifier		
Crystallizer	• General Maintenance Inspection	1 per year	• 1 week.
	• Feed, Product, or Condensate Pump Failure	Unplanned	• No downtime; backup available.
	• Recirculation Pump Failure-Impeller	Unplanned	• 1-2 days.
	• Recirculation Pump Failure-Other	Unplanned	• 2 days to 3 weeks depending on problem.

also shown. The reasons for shutdown are those that could occur during the operating life of the treatment systems. Note that for many of the unplanned or unpredictable reasons for a shutdown, there is spare equipment, pumps for example, that will enable nearly continuous operation with no significant loss in operating time.

During partial or complete shutdown of either the mine water or process water treatment system, Crandon Project water can be held within the storage capacity of the facilities (i.e., reclaim or tailing ponds) until full operating conditions are restored as needed. In no case would water not meeting WPDES Permit standards be expected to be discharged.

A number of unplanned occurrences are shown in the attached tables. This does not imply that a large number of failures are expected nor that there will be frequent failures. Unplanned failures may never occur and not constitute high frequency risks. However, the list is provided to indicate that we are aware that certain failures could occur and that sufficient redundancy (spares, both installed and available standbys) will prevent long shutdowns of the treatment plant.

There will be a preventive maintenance program for the water treatment plant designed to keep unplanned equipment failures to a minimum. This is represented in the attached tables by the normal shutdowns for general inspection, cleanout, filter media replacement, and reverse osmosis (RO) module cleaning and replacement. As part of normal maintenance, a pump, for example, will be taken out of service periodically for general maintenance and the installed spare started. This causes no shutdown and ensures that unplanned failure of the pump would be a rare occurrence.

Equipment such as mixers and reactor/clarifiers are quite simple, very reliable, and require little maintenance beyond normal inspection and cleaning. An unplanned shutdown of a reactor clarifier is estimated by one equipment vendor (EIMCO) to occur possibly once in 10 years; however, with normal maintenance, this event should never occur.

There will be six mixed media filters installed in the plant, three will be used for treating mine water, and three for treating a combination of mine water and reclaim pond water for recycle. If a filter used for treating mine water is shutdown for media replacement, the plant can still operate at about 67 percent capacity. During this short period of reduced capacity, excess contaminated mine water would be collected in the overflow system on the water treatment plant feed tank and be pumped to the reclaim pond. If a filter used for treating water for process recycle is taken out of service for media replacement, the treatment capacity for that part of the plant will simply be reduced. This will have no effect on other operations, because additional makeup water, if needed at that time, can be pumped from the uncontaminated mine water tank.

Reverse osmosis systems operate quite reliably. At the water treatment plant for the R. D. Nixon Power Plant in Colorado Springs, Colorado, there have been no shutdowns due to a failure of the RO systems. The availability of spare high pressure booster pumps and periodic cleaning of the RO modules ensures operating availability. As indicated, membranes would be replaced after about 3 years of operation.

Vapor compression evaporators use very reliable equipment. The water treatment plant at the R. D. Nixon Power Plant has experienced only one shutdown of their evaporators. This was a planned shutdown to replace the original compressor impeller with an impeller having different alloy steel.

Most reagent feeding systems will have backup capability. For example, if a lime addition system to the neutralizing mixer plugs, a parallel system will take over. Other reagent feeding systems have backup metering pumps available.

Comment No. 170

How many days of water treatment plant outage can be tolerated by the system? Given the sophisticated nature of the equipment and technology to be used, it will probably take more than "several days" to put the water treatment plant back on line if certain pieces of the equipment (the VCE or RO units) need servicing. If the capacity of the reclaim ponds is exceeded due to extensive maintenance, where would the wastewater be routed?

Response:

Assuming that the total water pumped out of the mine is 530 m^3/h (2335 gallons per minute) and that none of it can be discharged, and that 194.6 m^3/h (857 gallons per minute) are still required as make up in the mill, the remaining 335.6 m^3/h (1478 gallons per minute) would be pumped to the reclaim ponds if the treatment plant was completely shutdown. Assuming 310,950 m^3 (82,153,000 gallons) of available freeboard volume (75 percent of total freeboard) in two reclaim ponds, the mine and mill could continue to operate for 39 days before this freeboard volume is used up. This still leaves 25 percent of the freeboard available for the 100-year, 24-hour storm with allowance for wave run-up. In addition, there is freeboard volume available in the operating tailing pond that could be used to store additional water. However, it is highly unlikely that the treatment plant would be totally shutdown for extended periods of time.

Contaminated water from mine	1335 gpm
Uncontaminated	1000 gpm
	2335
Less water needed in mill	857
	1478 gpm

Freeboard available 82,153,000 gal (75 percent of total)

$$\frac{82{,}153{,}000 \text{ gal}}{1478 \text{ gal/min}} = 55{,}584 \text{ min or about 39 days}$$

If the uncontaminated water does not require treatment, then more than 40 days of downtime could be accommodated without infringing on the freeboard volume of the reclaim ponds. Although the proposed treatment technology appears to be "sophisticated," it represents well proven technology in use throughout the world. If the volumes of the

the reclaim ponds are nearing capacity because mine water is being pumped to them and the treatment plant is not operating, operating procedures could be modified and water could be pumped to the operating tailings pond.

Comment No. 171

The probability of, and potential impacts associated with surface water discharge pipeline failures, should also be addressed.

Response:

There is little probability of failure of the surface water discharge pipeline. The pipeline will not be exposed to corrosive materials nor extremes in internal or external pressures which could result in pipe failure. At the current stage of Project engineering the water discharge pipeline is expected to be constructed of 0.36-m (14-inch) diameter high density polyethylene (HDPE) pipe and buried a minimum of 1.5 m (5 feet) below ground to beneath the frost line. Current engineering calculations show that HDPE pipe rated at 250 psi internal design pressure would be well above expected pipeline pressures.

The water discharge pipeline should not experience vacuum conditions because vacuum breakers will be installed prior to operation.

Blockage of the pipeline due to settled solids will not be a problem because solids in the discharge water will normally be less than 20 mg/l. Solids settled due to periodic pipeline shutdowns will be flushed out with start-up.

The depth that the pipeline will be buried will preclude pipeline freezing and eliminate vulnerability to deliberate or accidental damage from humans, vehicles or machines.

The pipe will be received in 11.6-m (38-feet) lengths. All pipe will be inspected for damage on-site. Sections of pipe with cuts or gouges will be removed and rejected.

Each piece of pipe will be fusion butt welded to form a continous pipeline from the pumping station on the mine/mill site to the discharge point.

Butt fusion welding involves heating both ends of the pipes to be joined, making contact between the two molten ends and joining them together under pressure. The operation is performed using commercially available equipment designed for this purpose. The equipment is easily transported and may be used at any point along the pipeline during the installation of new pipe or the repair of old pipe. The joint which is formed is stronger than the pipe it joins.

Buried pipelines are inherently safer than pipelines laid on the surface. They are silent in operation and not visible. Typically, vegetation covers the trenched area within 2 years.

In the unlikely event of a pipeline breakage, flow rate monitoring equipment would warn the operator to shut down the pipeline system.

Clean-up and removal of spilled water will not be necessary due to the good quality of the treated discharge. Repair of the pipeline will involve the removal of the damaged pipe and welding in new pipe using portable butt-welding equipment. The repaired pipeline would be leak tested using water before backfilling and returning the pipeline to normal service. Spare plastic pipe will be stocked for repair purposes.

Pipeline leaks in conventional flanged or mechanically coupled pipelines typically occur at the flanges or in areas of the pipe where sudden changes in direction are necessary. The use of welded plastic pipe eliminates the flange or other connections and reduces the possibility of leakage. Typically, HDPE pipe can be cold bent to a minimum radius of 25 times the pipe diameter. This allows gradual direction changes to be made and minimizes the possibility of leaks.

Comment No. 172

Contingency plans for the reclaim ponds are not discussed in this section. A contingency plan for these ponds might consist of taking one of the ponds off line and repairing the liner. Provide information on what effect this would have on the water treatment plant.

Response:

Removal of one of the reclaim ponds would have no effect on operation of the water treatment plant.

Comment No. 173

<u>Section 5.13, Air Pollution Control Systems</u> - Section NR 154.06(9) contains requirements for a malfunction prevention and abatement plan for air emission sources, and the plan should be included in this section.

Response:

The requirements for a malfunction prevention and abatement plan will be included as a part of the Air Permit.

Comment No. 174

<u>Section 5.15.3, High Precipitation</u> - Discuss the potential failure of the drainage and erosion control structures as a result of high precipitation, especially during construction. What remedial actions will be taken?

Response:

Except for the tailing and water reclaim ponds (discussed in Section 5.11), other Project water retention facilities retain relatively minor amounts of water. The largest drainage basin in the mine/mill area has a volume of approximately 8500 m^3 (6.9 acre-feet). Failure of a facility like this (either the embankment or the outlet structure) would cause localized erosion damage in the immediate area of the basin. However, the total water volume available is not large enough to cause more widespread or major damage. These failures are easily repaired.

The temporary facilities (straw bale berms or ditch checks and earth berms and overflow pipes) used during construction will be planned to impound water from relatively small areas and thus contain relatively small volumes of water. As with any construction project, facilities of this nature are continually maintained during their temporary use and rebuilt, enlarged or otherwise modified to assure they perform satisfactorily. However, even in the event of a complete failure, the water volumes are small and localized erosion would be the worst damage anticipated. Vegetation cover in the area would also reduce the extent of the erosion effects and act to stabilize the soils.

Remedial actions for failures of this nature or for similiar failures of other drainage structures such as the mine/mill site culverts would be corrected by rebuilding the failures. Regrading and reestablishment of washed out vegetation would be included to stabilize damaged area. If it was determined a facility was underdesigned, the design would be upgraded.

Comment No. 175

Section 5.18.1, Conclusions - The second to last line of this section should read "... pollution control ..." rather than "... population control ...".

Response:

Comment acknowledged and the last sentence of subsection 5.18.1, Conclusions will be revised to the following:

> For example, the safety systems incorporated to comply with MSHA and the pollution control measures taken in compliance with DNR and U.S. EPA provide a strong measure of protection to the environment and to public health.

Comment No. 176

Section 6.0, Emergency Notification Procedures - How will the Environmental Compliance Engineer (ECE) determine whether an incident presents a hazardous condition? How long will it take to implement the notification plan? What types of incidents will be channelled through Exxon Minerals Co. management before notifying the outside agencies?

Response:

The Environmental Compliance Engineer will review incidents with Project Operations Management and other Exxon Minerals Company management as appropriate. A determination will be made as to whether the incident will result in a potentially hazardous condition, including the movement or accummulation of toxic wastes in the ground or surface water, soils and vegetation, and other consequences of the operation of importance to public health, safety and welfare. If such a condition exists, then appropriate government agencies will be notified. The response time will be dependent on the nature of the event, but would not be expected to exceed 24 hours from the time the event is determined to be reportable. Normally, Exxon Minerals Company management will be notified prior to agency notification. However, procedures are in place to assure that this internal notification process will not adversely affect timely notification of the agency.

Comment No. 177

A record of all incidents reported to the ECE should be kept and periodically submitted to the Department. If an incident requires corrective action, the Department should be notified, regardless of whether or not hazardous conditions exist.

Response:

Various regulatory requirements governing the operation establish criteria for reporting of incidents. These criteria will be followed.

Comment No. 178

The spill reporting measures, as outlined in various codes, should be included.

Response:

Comment acknowledged.

Comment No. 179

It should be stated in this section that Exxon is required by Section NR 154.06(2)(f) to report air pollution control equipment malfunctions to the DNR within eight hours of their occurrence.

Response:

Comment acknowledged and appropriate revisions to Section 6.0 of the Mine Plan will be made.

Comment No. 180

<u>Section 7.0, Geological/Geotechnical Investigations</u> - As mentioned previously, the discussion of grouting the bedrock/overburden interface is inadequate. Exxon should expand the previous discussion of grouting in the mining plan so that this section could simply refer to that discussion. This section indicates that Exxon intends to conduct a pumping test over the ore body. The plans for this pumping test should be presented in detail and will require a high capacity well approval.

Response:

A more detailed discussion of grouting the bedrock/overburden interface is presented in the response to comments No. 45 and 96.

When the design of the pumping test program over the orebody has been established, the plans for such a test will be presented to the DNR in a High Capacity Well Permit Application.

Comment No. 181

Isn't Exxon planning on doing any more "exploratory" drilling into the orebody? This is the type of drilling that the code is referring to, since these holes would be exempt from regulation under ch. NR 130 as long as the mining plan details the termination procedures to be used for the drilling sites.

Response:

At the present time, Exxon Minerals Company has no plans to conduct additional drilling into the orebody from the surface for the purpose of orebody definition. Such drilling would be conducted from underground workings during the mine development and operational phases of the Project.

Surface drilling into bedrock and/or the orebody may occur during the final engineering and construction phases of the Project for the purpose of collecting hydrological information for the detailed design of the mine water control system.

Any drilling into bedrock from the surface would be terminated in accordance with the procedures specified in Chapter NR 130.

Comment No. 182

Section 8.0, Pre-Blasting Survey - The pre-blasting survey is not optional or on an as-needed basis. The mining permit application must contain the plans (i.e., methodology) for the survey and the survey must be completed and submitted to the Department prior to blasting.

Response:

The plan for conducting the pre-blasting survey required in accordance with NR 132 is as follows:

1) All permanent structures within an 0.8-km (0.5-mile) radius of any of the four mine access or ventilation shafts will be inspected (see Attachment No. 12).

2) Such inspections will be made just prior to the start of site blasting, with an appropriate allowance of time for submission of survey results to state agencies prior to commencement.

3) Property inspection elements will include:

- Foundations
- Concrete Slabs
- Exterior and Interior Masonry
- Structural Framing
- Exterior and Interior Wall Treatments
- Ceiling and Floor Treatments
- Windows and Doors (framing and glass)
- Visible Plumbing
- Exterior Utility Services
- Exterior Structures (antennas, flag poles, etc.)
- Miscelleneous elements as required

Inspected elements will be fully documented, including photographs where appropriate. Element age and state of general maintenance will be noted. Inspections will be conducted by state licensed professionals.

4) Inspections will be made with property owner consent, and universally in the case of Exxon Minerals Company owned structures.

5) Copies of the pre-blasting survey inspection sheets, photographs, and property condition report will be submitted to each private owner and state agencies. File copies will be retained for use at the mine site.

The nominal 0.8-km (0.5-mile) survey radius planned will likely exceed the limit of any measurable blasting effects. In fact, neither seismic stress nor air blast concussion of a magnitude sufficient to cause structural damage is expected immediately adjacent to the shaft collars. Seismic motion from bedrock blasting will be dampened by the overlying glacial sands and gravels (minimum 21 m [70 feet] thick). Air blasts will be muffled by the length of shaft coursed to reach the surface.

VOLUME II, RECLAMATION PLAN

Comment No. R1

The reclamation plan as proposed is a good start towards completing the requirements of chapter NR 132, Wis. Adm. Code, but it is not considered complete at this time. Detailed comments follow which point out weaknesses in the plan, but a few general remarks are presented first.

Response:

Comment acknowledged.

FINAL USE

Comment No. R2

A basic weakness is that the final use of the mine site has not been discussed satisfactorily. Final use should be a unifying factor throughout reclamation planning, but is largely ignored in this document. Section 4.4.1 provides the general statement that the tailings area will be "reclaimed to a natural landscape in terms of vegetation and wildlife populations", but no attempt is made to provide a comprehensive plan that will assure such a result. Establishing a 500 acre black spruce and poplar forest (Appendix B, Mine Plan) is a return to neither natural conditions or good wildlife habitat. An acceptable reclamation plan geared to wildlife habitat must include a comprehensive site map showing proposed plant communities that provide food and cover for the wildlife species of choice (in this case probably deer/grouse/woodcock).

Response:

A final use plan compatible with the principal land uses currently existing in the site area will be determined based on recommendations provided by local governmental jurisdictions and the DNR. These discussions of final use are expected to occur in the next few months and are expected to focus on recreation and/or forestry use of the reclaimed area and the undisturbed adjacent lands owned by Exxon Minerals Company.

In the final plan, illustrations will be included of vegetative cover types and land use in the reclaimed areas at several intervals during and after Project development. The type of illustrations to be included and the periods of Project development to be illustrated will be determined jointly with the DNR. The long-term goal of the plan will be to allow ecological succession to occur in all the reclaimed areas. Also, the plan will be designed so that no long-term maintenance program will be required to maintain plant associations or communities that are atypical of the area or to perpetuate only selected species in certain areas (e.g., limiting plants on the reclamation cap to only those having shallow rooting systems).

To ensure the establishment of a variety of woody plant species in the MWDF area, selected plantings will be proposed at various locations on each of the reclaimed tailing ponds. This will ensure the establishment of diverse plant communities which will enhance the recreational attributes of the reclaimed areas and will provide habitat for a variety of indigenous wildlife species. As plant succession progresses in the reclaimed areas, the wildlife species inhabiting these areas also will change. The plan will not include a specific management scheme that will require maintenance of a certain stage of plant development or succession for the benefit of one or two target game species. Rather, the plant communities will be allowed to develop to be compatible with adjacent undisturbed communities.

To accommodate a variety of plant species with various rooting habits on the reclamation cap of the tailing ponds, it will be necessary to examine the cap design to ensure that its integrity and purpose are not adversely affected by the plant species expected to occupy this reclaimed area. If root penetration is determined to affect the performance of the cover to the extent that compliance with ground water quality or final use requirements is jeopardized, consideration will be given to the following alternatives which would allow progressive plant succession in the MWDF area: (1) increase the depth of till over the drain and seal layers, (2) incorporate a coarse sand or gravel layer in the cap design that would inhibit root penetration, and (3) a combination of the above two. These alternatives would allow ecological succession to occur in the reclaimed MWDF area and would not require a long-term maintenance program to maintain a vegetative cover consisting of only selected plant species. Any changes in cap design will be described in the revised Mine Plan and Reclamation Plan.

Ultimately, a revised Reclamation Plan will include a new subsection on the agreed final use of the Project site. This comprehensive final use plan will include a narrative discussion and supporting graphics which illustrate how the Project area will be unified with the adjacent lands not disturbed by mining activities.

Comment No. R3

Whether reclaiming for wildlife or some other use, the area would still require a greater diversity of species. Black spruce is adapted to wet areas, and the reclamation cap may be too droughty for optimal growth of this species. In addition, black spruce is very susceptible to windthrow. Tip ups can be expected to occur regardless of species planted, but covering a 500 acre plateau with this species seems especially risky.

Response:

As indicated in the response to comment No. R2, a comprehensive final use plan for the Project area, including the MWDF area, will be included in the revised Reclamation Plan. This plan will allow the establishment of a variety of plant species on the reclamation cap over the tailing ponds. Some of the species that eventually become established will be susceptible to windthrow; however, the cap will be designed so that tip ups will have no adverse effect on the seal layer.

Comment No. R4

It appears that reclamation of the tailings cap is not being approached from the correct perspective, that the wrong question is being answered. The question should be: How can the cap be designed to accommodate naturally invading species?, instead of: How can the vegetative cover be controlled to minimize damage to the cap as it is now proposed? A well thought out final use goal may provide direction in revising this plan.

Response:

Comment acknowledged and the revised Reclamation Plan will include a comprehensive final use plan (see the response to comment No. R2). The design of the reclamation cap will be reexamined to determine what changes may be required to accommodate all plant species that could invade the cap following final reclamation.

SURFACE DRAINAGE

Comment No. R5

Another topic deserving more attention is surface drainage/erosion control. Though erosion control is discussed in different sections throughout the report, no attempt has been made to quantify the potential runoff. This information is necessary for determining the size and location of retention basins and other erosion control structures. A comprehensive view of runoff control for the entire mine site should also be provided.

Response:

One of the objectives in the development of the Reclamation Plan was to plan the reclamation of facilities in a manner that would avoid the need for long-term continual maintenance and attention. The handling of surface drainage and erosion control has been considered and planned for to avoid the need for retention basins and similiar structures since these would require some sort of continuing maintenance.

The location of the MWDF in Area 41 does not change the basic characteristic of the site as an upland area with surface drainage in all directions. Upon completion and reclamation of the MWDF the final grades will be some 10-20 m (33-66 feet) higher than existing grades but the area will remain an upland area with surface drainage in all directions. The design of the reclamation cap seepage control system reduces infiltration through the cap to a minimal level and changes the infiltration/runoff/evaporation - transpiration balances in the immediate area of the MWDF. However, this is expected to have minimal effects on the overall hydrological system as it is currently operating in Area 41. Precipitation that would normally infiltrate, but is now prevented from infiltration because of the seal, will move to the perimeter of the MWDF through surface runoff and through the drain layer overlying the reclamation seal. At the MWDF perimeter the excess water will infiltrate and provide ground water recharge. The hydrological system is altered in the vicinity of the MWDF, with reduced infiltration below the cap, but that is offset by having the infiltration occur around the perimeter of the MWDF.

This water balance for the MWDF reclamation cap was studied and estimated by Owen Ayres Inc. Their report "Waste Disposal Facility Reclamation Cap" has been provided to the DNR. Overall when considering the total area of Area 41 there is very little change in the hydrological system.

The reclamation grades planned for the MWDF are fairly flat and the overall surface grades are established to develop approximately uniform runoff rates around the perimeter of the MWDF. The objective in this design was to not concentrate or combine flows and therefore avoid the need for ditches, culverts, basins, or other structures to handle the flows.

However, it is important that this excess water does infiltrate in the MWDF perimeter area (within a few hundred feet of the facility) to assure the performance of the MWDF and maintain the overall hydrological balance in the area. This is also true for snowmelt during spring thaw. To assure the system works as intended there may need to be minor regrading in the MWDF perimeter area to eliminate existing surface drainage channels or possibly to add some swales or shallow basin areas to temporarily retain runoff and encourage infiltration. This work is minor in nature and would be accomplished during preparation of the MWDF Plan of Operations.

The reclamation of the mine/mill area has been planned to achieve the same objective, that is to eliminate the need for permanent drainage facilities that are required after reclamation. Again, the reclamation grades have been chosen to avoid concentrating flows and to the extent possible to reestablish drainage systems and flows existing prior to development of the Project.

Comment No. R6

In Appendix B of the Mining plan (Volume I) there is a statement that sediment basins on the mine waste disposal facility will be designed for the 10-year, 24-hour storm. NR 182.11(1) 1 requires that they be designed for the 100-year, 24-hour rainfall event. This error suggests that all the sediment basins on the mine site are similarly designed, since no other guidelines are given. Therefore data must be supplied to support the design plans.

Response:

The sediment basins presented with the construction and phasing plans for the MWDF are temporary basins, installed prior to a construction phase and removed after vegetation has been established and erosion control is no longer required. Later, however, as a phase of reclamation was to occur, when once again soils would be exposed to erosion, then the temporary silt control basins would again be utilized. As planned for these purposes, the silt retention basins are either to consist of straw bale dams or small earthen dams with overflow pipes to be located in existing drainage swales or depressions.

As indicated in response to comment No. R5, the MWDF is located in a topographical high area and there are no large quanities of surface flow through the site. Therefore, only minor surface water diversion is associated with the MWDF and there are no major water diversion or other water handling structures required. Also, during operation of the facilities with the tailings pond(s) open, total runoff in the area of the MWDF will be reduced by that amount falling in the pond(s).

Our studies have not identified any major problems in meeting our objectives in developing a surface water handling system with minimum facilities which effectively manages and controls surface runoff. This is true during the construction, operation, and reclamation periods when the temporary facilities are used and even more true after reclamation has been completed and only a very minimum of facilities are required. Work during Plan of Operations engineering will provide additional final detail for the temporary facilities and for any minor permanent facilities that would be required. Both of these categories of facilities will be designed following NR 182 regulation and using a 100-year, 24-hour rainfall event.

The surface drainage basins in the mine/mill area have been sized to contain runoff volumes from a 25-year, 24-hour rainfall event.

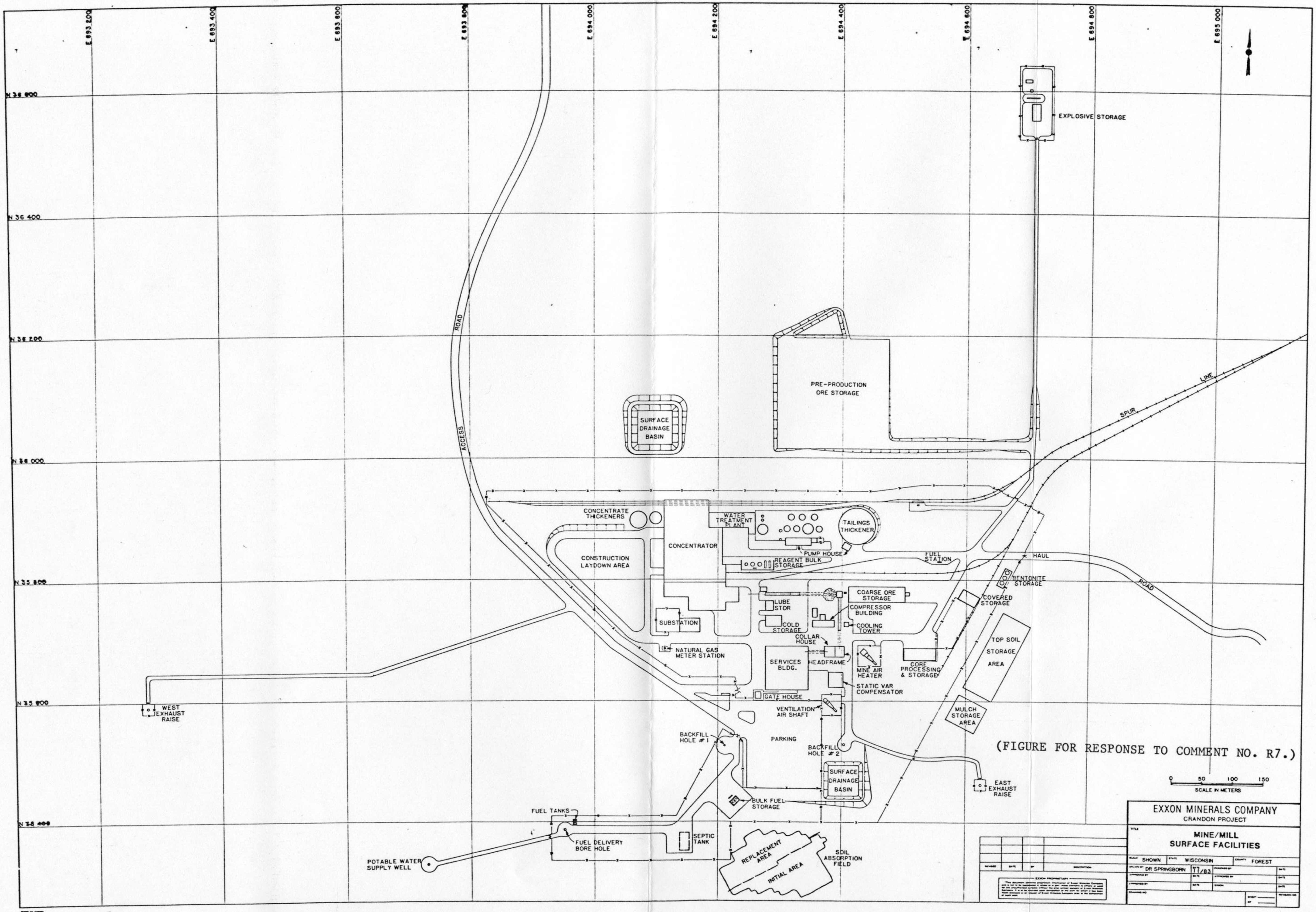
TOPSOIL STOCKPILES

Comment No. R7

During departmental review of the reclamation plan it became evident there was some confusion about the disposition of salvaged topsoil. Clarification is needed regarding excavating, storing, and controlling erosion of the topsoil. The figures provided do not clearly show locations of storage or erosion control practices. It is also not clear in the report if glacial till being saved for reclamation is considered separately or not.

Response:

The construction plan that has been developed for the mine/mill area includes clearing and grubbing of 35.7 ha (88.1 acres). Topsoils will then be stripped in this area to a depth of 0.15 m (6 inches), resulting in a topsoil volume of 53,500 m^3 (70,000 cubic yards). The topsoil will be stockpiled on the east side of the mine/mill site as shown in the attached figure. A vegetative cover will be established on the topsoil stockpile to control erosion. Excess glacial soils from the mine/mill site recovered during initial site grading will be removed to the MWDF for reuse there. There will be no glacial till stockpile at the mine/mill site. Glacial till required for reclamation regrading in the mine/mill site will be returned from the MWDF area at the time of reclamation.



(FIGURE FOR RESPONSE TO COMMENT NO. R7.)

DETAILS

Comment No. R8

Section 2.4.2, Fertilizer Use - This section should state clearly that each site will be analyzed to determine the best fertilizing and seeding practices.

Response:

The following statement will be added to subsection 2.4.2, Fertilizer Use:

As major Project facilities are constructed and the areas associated with, or adjacent to, these facilities are graded and ready for establishment of vegetative cover, soil samples will be taken and analyzed to determine the most appropriate fertilizer application. Each of these areas also will be analyzed (i.e., topography, exposure, drainage and future use) to determine the best seed mixture and practice for seeding.

Comment No. R9

Section 2.4.3, Species Selection - This section implies that erosion control will not always be important during the period from October to May. On the contrary, erosion control is a must all year round. If barren soils are not stabilized in the fall, the frozen exposed ground is susceptible to spring rains and erosion.

Response:

Subsection 2.4.3, Species Selection will be revised to indicate that erosion control during the period October to May is equally as important as from May to October. Construction areas having exposed soils that will not be disturbed from October to May will be stabilized in late summer or early autumn with grass-based seed mixtures. These seed mixtures will be supplemented with mulch and/or soil surface stabilizers to ensure establishment of vegetative cover prior to the non-growing season. Vegetative cover will be established as early as possible on these areas so that the soils are stabilized and erosion potential is minimized.

Comment No. R10

Section 3.2.2, Site Preparation - 1) If trees and stumps are chipped and stockpiled, a location for the stockpile must be designated. A permit may be required for burning the stumps and brush. 2) Where is the outlet to the storm water drainage system? The mining plan shows (Fig. 3.2-1) a single runoff retention basin during construction. No indication is given as to how water will be directed to it. The reclamation plan shows (Fig. 3.3) four retention basins will be constructed during the first year of the construction phase. The mining plan has the four drainage basins (Fig. 3.2-2) appear after constructon is completed. No contour lines are provided to substantiate the surface drainage plans.

Response:

The figure attached to the response to comment No. R7 shows an area designated for waste wood mulch storage on the east side of mine/mill site.

If burning is chosen for disposal of stumps or other wood waste a permit application will be submitted to the DNR.

The three attached civil drawings (Attachment No. 8) depict the surface water drainage system planned for the mine/mill site. The system utilizes two surface drainage basins for handling nearly all of the mine/mill site uncontaminated surface runoff. Details of the outlets for the basins are included in the drawings. As shown in the drawings, there are some other minor discharges from mine/mill site extremities where it is not practical to route runoff back to one of the drainage basins. Also, as shown in the plans all surface water with potential to be contaminated is collected and handled separately.

As described in the EIR, the entire site will be cleared, grubbed, and rough graded as necessary which will be one of the initial activities in the construction schedule. Since there is no phasing to this work, there will be no interim conditions for any length of time.

Erosion control will be developed as necessary with the rough grading. To the extent possible, the two permanent surface drainage basins will be used for runoff control. The basin areas will be excavated first with grading work generally progressing outward from the basins. Where portions of the storm drainage system are not installed concurrently with the rough grading, separate provision for runoff and erosion control will be made. These provisions will consist of temporary siltation basins or hay or straw bale ditch retention checks.

Graded areas not scheduled for immediate development would be revegetated with a temporary ground cover following the grading work to reduce siltation from runoff erosion. As an area is subsequently developed, any portions of the final storm drainage system not installed with the initial site work would first be installed for the area before beginning other construction. At that point, runoff would be controlled by the final system, although some hay or straw bale ditch checks might still be used to prevent downstream siltation of the system. Development of the site in this manner will reduce the need for short-term temporary erosion control measures. The long-term control will be through the final surface water drainage system.

Comment No. R11

<u>Figures 3.2, 3.3, and 3.4</u> - Fig. 3.2 shows the topsoil stockpile location on the mine and mill site. Figs. 3.3 and 3.4 show that location as a vegetated erosion control dike. Are these structures one and the same? The area depicted in the different figures is not the same.

Response:

The figure attached to the response to comment No. R7 presents the current revised layout of the mine/mill area facilities. The topsoil storage area has been relocated to the east side of the site. An approximate 1.4-ha (3.5-acre) area is required.

Comment No. R12

Figures 3.3, 3.4, 3.5 and 3.6 - Final paved areas are not clearly designated, especially around the tailings thickeners. The landscape phasing plan shows this area will be vegetated in construction year 5 (Fig. 3.5), but the erosion control plan for the operation phase (Fig. 3.4) specifically excludes vegetation from that area.

Response:

Drawing No. 051-1-C-003 in (Attachment No. 13) reflects the current revised mine/mill site configuration and depicts all paving in this area. The landscape plan, including phasing of the plan, is being revised and will be submitted to the DNR in December 1983. Any discrepancies between the landscape phasing plan and the erosion control plan will be corrected in the revised Reclamation Plan.

Comment No. R13

Section 3.2.3, Reclamation Phasing Plan - A report by the Sanborn Group, Inc. (1982) is cited as providing a comprehensive desciption of a typical landscape design. This document has been requested by the Department, but has not yet been received.

Response:

The report prepared by the Sanborn Group, Inc. entitled "Site Master Plan" is being revised to reflect changes in the construction schedule and minor modifications in the location and size of facilities in the mine/mill site. The landscape plan is a part of the Site Master Plan Report and it is also being revised to incorporate the above changes in Project design and schedule. This report will be provided to the DNR in December 1983.

Comment No. R14

Figures 3.2.3, Reclamation Phasing Plan - Two types of topsoil stockpiles are mentioned: temporary and permanent. These must be described in greater detail. How much salvageable topsoil is expected to be found? Will these stockpiles include the glacial till which will be substituted for topsoil during final reclamation.

Response:

In the revised mine/mill site plan there is only one topsoil area located on the east side of the site. Based on stripping the topsoils to a depth of 0.15 m (6 inches) in the cleared mine/mill site area, a quanity of

53,500 m^3 (70,000 cubic yards) of topsoil will be salvaged. Portions of this stockpile will be reused during construction as areas of the mine/mill site are completed and landscaping/reclamation work is performed. The majority of the topsoil stockpile will be maintained for the entire operating period to be reused during the final reclamation of the mine/mill site. Only the topsoil materials will be stockpiled at the mine/mill site.

In addition to the topsoil, earthwork calculations indicate an excess of approximately 70,700 m^3 (92,400 cubic yards) of material in the mine/mill site. This excess material will be transfered to the MWDF for use there; similiarly any till material needs for final reclamation grading work in the mine/mill area will be returned from the MWDF during final reclamation. Glacial till will be stockpiled separate from topsoil in the MWDF.

Comment No. R15

Section 3.2.3.1, Year 1 Landscaping - More information is needed on the planting of native species in the retention basins and power line corridor. What species will be selected, and what is their source? Section 3.9.3.3 states that existing retention basins will be stabilized with vegetation when reclamation begins. How does this tie in with the native plantings already present?

Response:

Within the powerline corridor from State Highway 55 to the mine/mill site the only areas proposed to be seeded are those that are entirely cleared of vegetation and where soils are disturbed, e.g., around transmission towers and the access road used during construction. Typical species that could be used in the powerline corridor and in the retention basins include: orchard grass, reed canary grass, cord grass, timothy, oats, perennial rye, creeping foxtail, birds foot trefoil, sweet clover, alsike clover, red clover, white clover, goldenrod, sunflower, and aster.

During final site reclamation, regrading will eliminate the retention basins to allow natural drainage. The vegetation established in the retention basins following construction will be removed during this reclamation grading. After the final grades have been established, these areas will be seeded with plant species similar to those identified above.

Seed suppliers within the State of Wisconsin, such as Wild Life Nurseries, Oshkosh; Sperka's Woodland Acres Nursery, Crivitz; and Strand Nursery, Osceola, will be the source of native plant seeds. Agricultural plant seeds will be obtained from local commercial suppliers.

Comment No. R16

Section 3.2.4.1, Plant Materials - A clearer description is needed of the source for transplanted native stock. Will the source be elsewhere on the mine site.

response:

If it is cost effective and suitable stock is available, some specimens for use in landscaping the mine/mill site will be taken from property owned by Exxon Minerals Company immediately around the mine/mill site or in those areas designated for future Project facilities, such as the tailing ponds area in the MWDF. Prior to transplanting, all stock selected in the Project area will be marked and inspected by a qualified horticulturalist to ensure the specimens are disease free, structurally acceptable and suitable for landscaping purposes. Commercially grown stock will be obtained from nurseries whose stock meets the requirements of the Wisconsin Nurserymen's Association. Examples of such nurseries include: Evergreen Nursery, Sturgeon Bay; Silver Creek Nursery, Manitowoc; and Bruce Company, Middleton.

Comment No. R17

Section 3.2.5.2, Long-Term Maintenance - A description should be provided on the methods for maintaining clear zones (e.g. herbicide use, burning or mowing).

Response:

As part of the long-term maintenance program, clear zones will be maintained around the perimeter fence surrounding the mine/mill facilities, in the rights-of-way for the access road, railroad spur, and haul road and slurry pipeline corridor. These areas will be maintained in herbaceous vegetation and/or low growing woody species to minimize the potential for fires.

Growth of woody species within these "clear" areas will be controlled by mowing and selective application of EPA approved herbicides. Also, see the response to comments No. 73 and 162.

Comment No. R18

Section 3.3, Railroad Spur - A map showing the entire length of the railroad spur is needed. This figure should depict the erosion control practices along the route, especially of the Swamp Creek and wetland crossings.

Response:

The attached plan and profile and detail drawings (Attachment No. 11) from the plan set of preliminary engineering drawings for the railroad spur depict the entire alignment from the Soo mainline to the mine/mill interface point. Drainage structure locations, typical sections showing revegetation, and settling basin details are included. The plan sheets also show the approximate slope intercept lines along the entire route, showing the limits of revegetation after construction.

Locations of the temporary erosion control facilities to be utilized during construction, such as the straw bale silt traps and the sheet piling at the area of the Swamp Creek crossing structure, would be determined during final engineering.

Comment No. R19

Section 3.3.3, Erosion and Vegetation Maintenance - If herbicides are being considered for brush control their use should be discussed. Use of herbicides may be subject to Department approval.

Response:

Herbicides will be used to selectively treat undesirable woody plant species that encroach within the railroad spur right-of-way. Only EPA approved herbicides will be applied. Selective applications of herbicides will be completed by a private contractor in accordance with standard railroad maintenance practices.

Comment No. R20

Section 3.4.1, Construction Procedures and Erosion Control - In the final Reclamation Plan, when construction practices adjacent to navigable water are described, reference should be made to the appropriate Chapter 30 approval.

Response:

In the final Reclamation Plan where construction practices adjacent to navigable water are discussed, reference will be made to the appropriate Chapter 30/31 Permit approval.

Comment No. R21

Section 3.5, Tailings Transport System - A map of the entire tailings transport corridor must be provided which shows specific erosion control measures to be used.

Response:

The attached drawings (Attachment No. 14) depict the preliminary plan and profile for the waste rock haul road and tailings transport system corridor. Drainage structure locations, approximate limits of revegetation and the typical cross-section are included. Specific details and locations of the temporary erosion control measures used during construction (straw bale silt traps or similiar measures) would be determined during final engineering.

Comment No. R22

Section 3.6, Water Discharge System - The crossing of wetland areas and the development of a discharge structure on the bank of Swamp Creek should be discussed in this section.

Response:

The water discharge pipeline corridor is shown on the attached figure. The corridor is approximately 9.8 km (6.1 miles) long and has a nominal width of 15.0 m (49.2 feet). The actual width of the corridor that will be disturbed during pipeline installation is estimated to be 6.0 m (19.7 feet) which results in a total estimated disturbed area of 5.9 ha (14.5 acres). Approximately 75 percent of the route length is across high ground which will present no special construction difficulties. Trench excavation, pipe laying, and backfilling will be completed in sections to avoid having open trenchs for extended periods.

Installation of pipe through the wetland areas will require additional precautions. Muck and organic soil conditions as well as season of the year will determine the most effective equipment to use. To the extent possible, the wetland soils will be kept separate from the subsoils as they are excavated and placed along the trench. The soils will be backfilled later in the original sequence, i.e., subsoils will be backfilled before the mucks. In areas where there is potential for erosion, the materials will be contained with silt fences (filter fabrics) or other appropriate methods. Because of the nature of wetland soils, wider disturbed areas will result in the wetlands. Lighter equipment and swamp mats will probably be used unless a winter time construction schedule is determined to be beneficial. Selection of a contractor with appropriate experience and prior satisfactory results on other similar projects will be an important criterion.

Comment No. R23

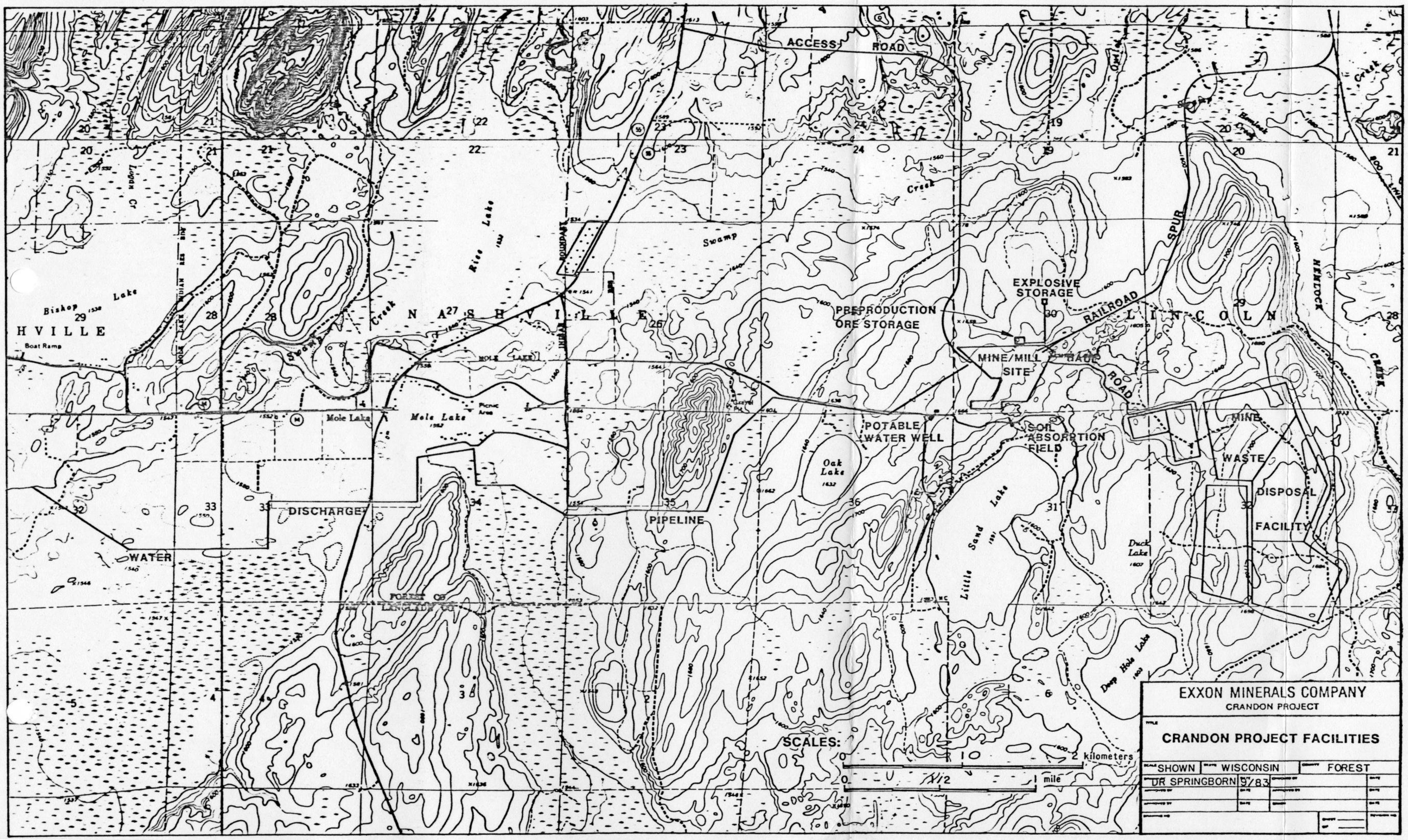
Section 3.9.1, Removal of Facilities - 1) Reclamation of the access road must be addressed. A plan for reclaiming the road must be in place in the event a 'permanent need' has not been established for it during the mine operating period. 2) The plan should state that the railroad corridor will be reclaimed so as to blend in with the surrounding area, in terms of both grading and revegetating.

Response:

The response to comment No. 5 presents a plan for the reclamation of the access road in the event no other use or need for the road becomes established during the Project life.

The grading work planned with the reclamation of the railroad spur (and the other corridors) is kept to a minimum in an attempt to preserve as much of a corridor as possible. This will provide a corridor which will be of benefit for wildlife movement, hiking, skiing, or other activities.

(FIGURE FOR RESPONSE TO COMMENT NO. R22.)



Comment No. R24

Figure 3.10, Final Landform Grades in Mine/Mill Area - This figure is far too site-specific. A map showing final grades for the entire mine site is needed to assess how the site will fit in to the surrounding area.

Response:

The attached drawing (Attachment No. 15) depicts the landform grades in the mine/mill site and the surrounding area after final reclamation. The final topography is shown by different contour lines types thoughout the area depicting: (1) existing surrounding topography that has not been altered; and (2) topography altered during construction and final reclamation

As indicated in the response to comment No. R2, a discussion will be included in the revised Reclamation Plan describing how the reclaimed mine/mill area will be unified with surrounding undisturbed lands.

Comment No. R25

Section 3.9.3, Reclamation Grading and Soil Placement - The sources for borrow fill used in final grading are not adequately described. this section states that "most borrow fill will be acquired from the SE portion of the site . . ." Where is the remainder expected to come from?

Response:

Required borrow to develop the final reclamation grades will come from materials maintained at the MWDF. The final reclamation grades have been planned so that the original drainage patterns are reestablished, to the extent possible, and also to minimize required earthwork. This minor borrow requirement is small considering the earthwork volumes managed in construction and reclamation of the MWDF.

Comment No. R26

Section 4.2.1, General Criteria - The glacial till excavated from the tailings disposal site is expected to be of adequate quality and quantity to build all embankments and complete the final cover. There must be a discussion of alternative sources in the event there is insufficient till available from the tailings area.

Response:

Extensive geotechnical investigation has determined the extent of glacial till throughout the MWDF area. The design of the MWDF was developed to achieve, to the extent possible, a balanced earthwork condition. Review of the existing earthwork balance will be an on-going activity, with the sequencing of the MWDF development providing the opportunity to manage the balance. Very minor pond depth adjustments can create large earthwork balance differences, affording the opportunity for achieving a final balanced earthwork condition at the completion of reclamation.

Comment No. R27

Section 4.2.3.4, Construction Support Area - Provide details on the design and construction of the runoff control structure. How will size be determined? To the extent possible the support area should be vegetated to prevent unnecessary runoff.

Response:

The attached drawing (Attachment No. 16) presents a plan and section of the proposed construction support area. The retention pond shown will collect surface runoff and also handle water used in processing soils to prepare underdrain materials. In addition to the process water requirements a 100-year, 24-hour rainfall event will be used to size the retention pond. There will be relatively little area in the construction support area that is unused; however, any open spaces will be revegetated to reduce erosion. The detailed design for the construction support area will be completed during Plan of Operations engineering.

Comment No. R28

Fig. 4.14, Approximate Reclaimed Surface of Tailings Ponds - This figure must be combined with Figure 4.17 (Reclaim Ponds). Presented separately, these figures are not very useful, especially since they are drawn to different scales.

Response:

The attached drawing (Attachment No. 17) presents the final reclamation grades in the MWDF area including the reclaim ponds.

Comment No. R29

Section 4.4.4, Permanent Vegetation - This section must include a discussion on establishment of ground layer species.

Response:

The following discussion on establishment of ground layer species will be added to subsection 4.4.4:

Following final grading of the area underlain by the reclamation cap of each tailings pond, herbaceous vegetation will be established to stabilize the soil surface and to minimize erosion. The plant species to be seeded on the reclamation cap will be similar to those identified in the response to comment No. R15. A drill seeder or broadcast seeder will be used for seeding. Invasion of woody plant species from adjacent communities will be allowed to occur in the grass/legume vegetative cover. If wet areas should develop where water drains from the drain layer of the reclamation cap, plant species, such as reed canary grass, giant smartweed, cord grass, three-square bulrush and cattail, will be established.

Comment No. R30

Section 4.4.4.3, Species Selection - This section reports that final species selection will be determined by on-site testing of trees on pond T1 following completion of the tailings cap. No further mention is made of the proposed study. According to the Feasibility Report (p. 9-26) a final cover of black spruce and poplar will be established, with no indication that research may identify better suited species. The idea of a well planned study should be further developed. Details of this study must be included in the reclamation plan. A list of test species appears in Table 4.3. These species all have shallow root systems, but other types of root systems should also be examined in this experiment. If tree roots do penetrate the seal, this ought to be studied during operation because natural invasion cannot be completely prevented, and cap improvements are best made prior to final closure.

Response:

The following information will be included in subsection 4.4.4.3 of the revised Reclamation Plan:

Assessment of species adaptability would utilize traditional means such as percent survival and growth rate measurements (e.g., Evans, 1972). Specific factors which could possibly affect plant survival and rate of growth would be incorporated into any finally selected experimental design. Included among those factors would be, for example, influence of ground cover types on species establishments, the use of seed, bare root and containerized stock, fertilizer requirements and ground preparation practices.

Separate plots would be established to evaluate the pattern of natural invasion by locally native species. The overall experimental design of the study would be such that the direct comparisons could be made between the direct seeding methods and the 'method' of natural invasion.

An investigation of rooting patterns of direct seeded species and of naturally occurring species as affected by various plot treatments would be initiated to obtain information on potential rooting patterns within the tailings cap system. Because of the complex nature of root system investigations (e.g., Evans, 1972), precise experimental outlines are not feasible until such time as site conditions have been more definitely established.

Reference:

Evans, G. C., 1972. The quantitative analysis plant growth. Studies in Ecology; Volume I. University of California Press, Berkeley. 734 p.

Comment No. R31

Section 5.1, Monitoring and Long-Term Maintenance - As written, this section is incomplete. Post-closure monitoring of vegetation must be described in detail. The monitoring will provide information on the relative success of the reclamation effort and highlight any problems that may arise.

Response:

As indicated in Section 5.1 of the Reclamation Plan, the specific details of the post-operation monitoring program will be determined in conjunction with the DNR. A monitoring program will be developed that will allow determination of plant species composition, relative frequency of occurrence, relative dominance and relative density. Measurements to determine percent cover (proportion of an area covered by the vertical projection of plant crowns or basal area to the ground surface) also will be included in the monitoring program. Biomass sampling will be performed to allow comparisons against biomass values recorded for other plant communities.

Data for the vegetation monitoring program will be collected using plots, plotless techniques, or a combination of the two methods. The details of the plot sampling (i.e., shape, size, number and method of distribution of the plots) will be determined jointly with the DNR. Monitoring will be conducted annually over a representative segment of the reclaimed area for the first 5 years following final reclamation. Upon completion of 5 years of monitoring, the results will be evaluated and will serve as the basis for determining the scope of any future monitoring.

Photographic evaluations will be included as part of the monitoring program to depict the vegetative conditions in as graphic a manner as possible. These photographs will be used to show the changes in vegetative composition which occur over time as a result of normal ecological succession. Photographs will be taken annually at marked points of reference to ensure a representative cross-section of the reclaimed area is included. These ground level photographs will be used in conjunction with the aerial photographs, as described in Section 5.1 of the Reclamation Plan, to monitor the development of vegetation in the reclaimed areas.

Comment No. R32

Section 6.0, Reclamation Costs - The estimated reclamation costs must be supported with a more detailed cost breakdown.

Response:

A breakdown of reclamation costs is included in the response to comment No. 5.

Comment No. R33

Appendix 1.1A cites this section as fulfilling the requirements of ch. NR 182.08 (2)(j), which specified the need for an engineer's cost estimate for site closing. Such a report is missing from this section, but must be provided before the reclamation plan is considered complete.

Response:

The estimated reclamation costs will be presented as an engineer's cost estimate prepared and signed by a engineer registered in the State of Wisconsin. Exxon Minerals Company will submit the certified cost estimate after final agreement on the Reclamation Plan with the DNR.

Comment No. R34

Section 7.0, Notification - This section is supposed to provide the names of persons legally and operationally responsible for long-term maintenance (ch. NR 132.08(e)(2)). This section merely directs all questions to the unnamed Technical Services Manager. This does not meet the requirements of the code.

Response:

The person who will be legally and operationally responsible for long-term maintenance has not been identified and probably will change periodically during the life of Project operation. The DNR will be notified prior to start-up of the name of the individual who will have the responsibility for long-term maintenance. The Department also will be notified of subsequent changes in the name of the individual having this responsibility.