Misc. reports relating to Crandon Project. 1986

[s.l.]: [s.n.], 1986

EXXON COAL AND MINERALS COMPANY

P.O. BOX 813, RHINELANDER, WISCONSIN 54501-0813, (715) 369-2800

CRANDON PROJECT

October 16, 1986

Mr. Ken Wiesner
Bureau of Wastewater Management
Department of Natural Resources
P. O. Box 7921
Madison, WI 53707

Dear Mr. Wiesner:

This letter is to transmit to the Department of Natural Resources revisions to the WPDES Application dated December 1985 and revised May 1986. The attached revisions (five copies) are a result of recent discussions with the Department relating to wastewater characteristics, excess discharge lagoon liner system, and contingency mitigation plans. In addition, the attached drawings reflect minor changes in the plot plan.

The corrected pages are as follows:

Discharge 001, Swamp Creek Outfall

-- Page II-5, Item 16. Wastewater Characteristics

-- Item 17. Table 1, "Projected Concentration of combined Effluent Streams"

-- Item 17. Table 2, "Water Quality Based Effluent Limits for the Proposed Discharge to Swamp Creek

-- Figure 001-4 "Preliminary General Arrangement, Excess Discharge Lagoon System Conceptual Design"

Discharge 002, Erosion Control Facilities

-- Figure 002-3 "Grading and Drainage Plan

-- Figure 002-4 "Plot Plan Extension"

Discharge 004, Contingency Mitigation for Surface Waters

-- Page II-4. Item 15b. Waste Abatement Codes. Change to the proper spelling of the word "described."

-- Item 202b. Pages II-8a through II-8j.

-- Figure 004-2 "Typical Discharge Structure for Streams, Springs and Lakes

The remaining information regarding Discharges 001, 002, 003, and 004 not included with this letter remains the same as submitted in the Application dated December 1985 as revised May 1986.

If you have any questions or comments on this submittal, please contact me.

Sincerely,

EXXON COAL AND MINERALS COMPANY

Barry J. Hansen
Permitting Manager

BJH:ef
0436E

Enclosures

DISCHARGE SERIAL NUMBER

001

FOR DEPT. USE

16. Wastewater Characteristics

Check the box beside each constituent which is present in the effluent (discharge water). This determination is to be based on actual analysis or best estimate.(see instructions)

Parameter 216	Present	Parameter 216	Present
Color 00080		Copper 01042	X
Ammonia 00610	X	Iron 01045	X
Organic nitrogen 00605	X	Lead 01051	X
Nitrate 00620	X	Magnesium 00927	X
Nitrite 00615		Manganese 01055	X
~~Phosphorus~~ Phosphate 00665	X	Mercury 71900	X
Sulfate 00945	X	Molybdenum 01062	1
Sulfide 00745		Nickel 01067	1
~~Sulfite~~ Thiosulfate 00740	X	Selenium 01147	X
Bromide 71870		Silver 01077	X
Chloride 00940	X	Potassium 00937	X
Cyanide 00720	X	Sodium 00929	X
Fluoride 00951	X	Thallium 01059	
Aluminum 01105	X	Titanium 01152	
Antimony 01097	1	Tin 01102	1
Arsenic 01002	X	Zinc 01092	X
Beryllium 01012		Algicides* 74051	
Barium 01007	X	Chlorinated organic compounds* 74052	
Boron 01022		Pesticides* 74053	
Cadmium 01027	X	Oil and grease 00550	
Calcium 00916	X	Phenols 32730	
Cobalt 01037	1	Surfactants 38260	
Chromium 01034	X	Chlorine 50060	
Fecal coliform bacteria 74055	X	Radioactivity* 74050	
		Bismuth	1
		Platinum	1

*Specify substances, compounds and/or elements in Item 26.

(1) See Table 1, Item 17.

DISCHARGE SERIAL NUMBER

001

FOR DEPT. USE

17. Description of Intake and Discharge

For each of the parameters listed below, enter in the appropriate box the value or code letter answer called for.(see instructions)

In addition, enter the parameter name and code and all required values for any of the following parameters if they were checked in Item 16: ammonia, cyanide, aluminum, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, phenols, oil and grease, and chlorine (residual).

Parameter and Code 217a	Influent		Effluent					
	Untreated Intake Water (Daily Average) (1)	In-Plant Treated Intake Water (Daily Average) (2)	Daily Average (3)	Minimum Value Observed or Expected During Discharge Activity (4)	Maximum Value Observed or Expected During Discharge Activity (5)	Frequency of Analysis (6)	Number of Analyses (7)	Sample Type (8)
Flow* ~~Gallons per day~~ Million gallons ~~00056xx~~ 50050 per day	N/A(a)	N/A	1.71	N/A(b)	4.32	N/A	N/A	N/A
pH Units 00400	N/A	N/A	X	6	9	N/A	N/A	N/A
Temperature (winter) ° F 74028	N/A	N/A	<55	32	55	N/A	N/A	N/A
Temperature (summer) ° F 74027	N/A	N/A	<70	N/A	N/A	N/A	N/A	N/A
Biochemical Oxygen Demand (BOD 5-day) mg/l 00310	N/A	N/A	<20	N/A	N/A	N/A	N/A	N/A
Chemical Oxygen Demand (COD) mg/l 00340	N/A	N/A	5	N/A	N/A	N/A	N/A	N/A
Total Suspended (nonfilterable) Solids mg/l 00530	N/A	N/A	10	1	<30	N/A	N/A	N/A
Specific Conductance micromhos/cm at 25° C 00095	N/A	N/A	X	N/A	N/A	N/A	N/A	N/A
Settleable Matter (residue) ml/l 00545	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Other discharges sharing intake flow (serial numbers).(see instructions)

(a) Intake water values not required for mining operations.

(b) Data not applicable. Not in operation.

Item 26. Additional Information (continued)

Item 17. (continued)

TABLE 1

PROJECTED CONCENTRATION OF COMBINED EFFLUENT STREAMS

PARAMETER AND CODE		EFFLUENT (mg/l) DAILY[1,2] AVERAGE	MINIMUM VALUE EXPECTED	MAXIMUM VALUE EXPECTED
Cyanide	00720	0.006	<0.006	<0.096
Fluoride	00951	2	1	<12.5
Arsenic	01002	0.05	0.025	<1.48
Barium	01007	0.03	0.016	<2
Cadmium	01027	0.0006	0.00028	<0.074
Chromium III	01034	0.06	0.03	<11.1
Chromium VI		0.012	<0.012	<0.059
Copper	01042	0.01	0.005	<0.025
Iron	01054	0.4	0.2	--
Lead	01051	0.04	0.02	<0.6
Mercury	71900	0.00017	<0.00017	<0.002
Selenium	01147	0.06	0.027	<1.0
Silver	01077	0.003	0.0017	<0.007
Zinc	01092	0.06	0.032	<0.44
TDS		700	<700	<1055

Based on the presence of the substances footnoted [1] on page II-5 in the ore, it is possible that they could be present in the effluent. Industry experience and geochemistry, however, would suggest that they will probably be present in mine seepage at near or below the standard (AA) detection limits. If they are present at more elevated concentrations the literature and our investigations indicate that the maximum effluent concentrations would be as follows:

Nickel	01067	<0.02
Antimony	01097	<0.05[3]
Boron	01022	<0.1
Cobalt	01037	<0.02
Molybdenum	01062	<0.05
Tin	01102	<0.02[3]
Bismuth	N.A.	<0.05
Platinum	N.A.	<0.01[3]

[1] Monthly average of daily values.

[2] Some concentrations are flow dependent. Presented here for 1175 gpm.

[3] Inductively coupled Plasma Emission Spectroscopy detection limit.

Item 26. Additional Information (continued)

Item 17. (continued)

TABLE 2

WATER QUALITY BASED EFFLUENT LIMITS
FOR THE PROPOSED DISCHARGE TO SWAMP CREEK

PARAMETER[a]	DAILY MAXIMUM[b]	MONTHLY AVERAGE LIMITS[c] BASED ON EFFLUENT FLOWS (Q_e) OF <1,300 gpm	1,301-2,000 gpm	2,001-3,000 gpm
Toxic Pollutants				
Arsenic	1.48[d]	0.626/0.663[d]	0.508/0.533[d]	0.436/0.452[d]
Cadmium	0.073	0.0045/0.0048	0.0037/0.0039	0.0032/0.0033
Chromium (VI)	0.058	0.051/0.053	0.042/0.043	0.036/0.037
Chromium (III)	11	0.27/0.28	0.22/0.23	0.19/0.19
Copper	0.025	0.025/0.025	0.021/0.022	0.019/0.019
Cyanide	0.093	0.010/0.011	0.010/0.011	0.010/0.011
Lead	0.6[e]	0.118/0.125	0.096/0.10	0.082/0.085
Mercury	0.0022	0.0002[f]	0.0002[f]	0.0002[f]
Selenium	1.0	0.165/0.174	0.134/0.140	0.115/0.119
Silver	0.007	no rec'd value	no rec'd value	no rec'd value
Zinc	0.44	0.14/0.14	0.11/0.12	0.10/0.10
Conventional Pollutants				
BOD		20 (summer)[g] 40 (winter)[g]	15 (summer)[g] 30 (winter)[g]	15 (summer)[g] 30 (winter)[g]
Total Suspended Solids	30[e]	20[e]	20[e]	20[e]
pH (S.U.)	6 - 9			
Nonconventional Pollutants				
Barium		10.8/11.4	8.8/9.2	7.5/7.8
Fluoride		14.6/15.5	11.9/12.4	10.2/10.6
Iron		1.8/1.9	1.5/1.6	1.4/1.4
Total Dissolved Solids[h]	1,210/1,000[i]			

(a) All values are in mg/l unless noted differently.

(b) For most of the toxic pollutants (except land), the maximum limits were derived from the available acute toxicity information for resident Wisconsin aquatic species.

(c) The monthly average limits were calculated based on the following mass balance equation:

$$Ce = \frac{Qm\ Cm - Qs\ Ca}{Qe}$$

(d) The water quality criterion for arsenic to protect human health is being reviewed. The above limits are based on the acute and chronic toxicity affects to resident Wisconsin aquatic species.

Item 26. Additional Information (continued)

Item 17. (continued)

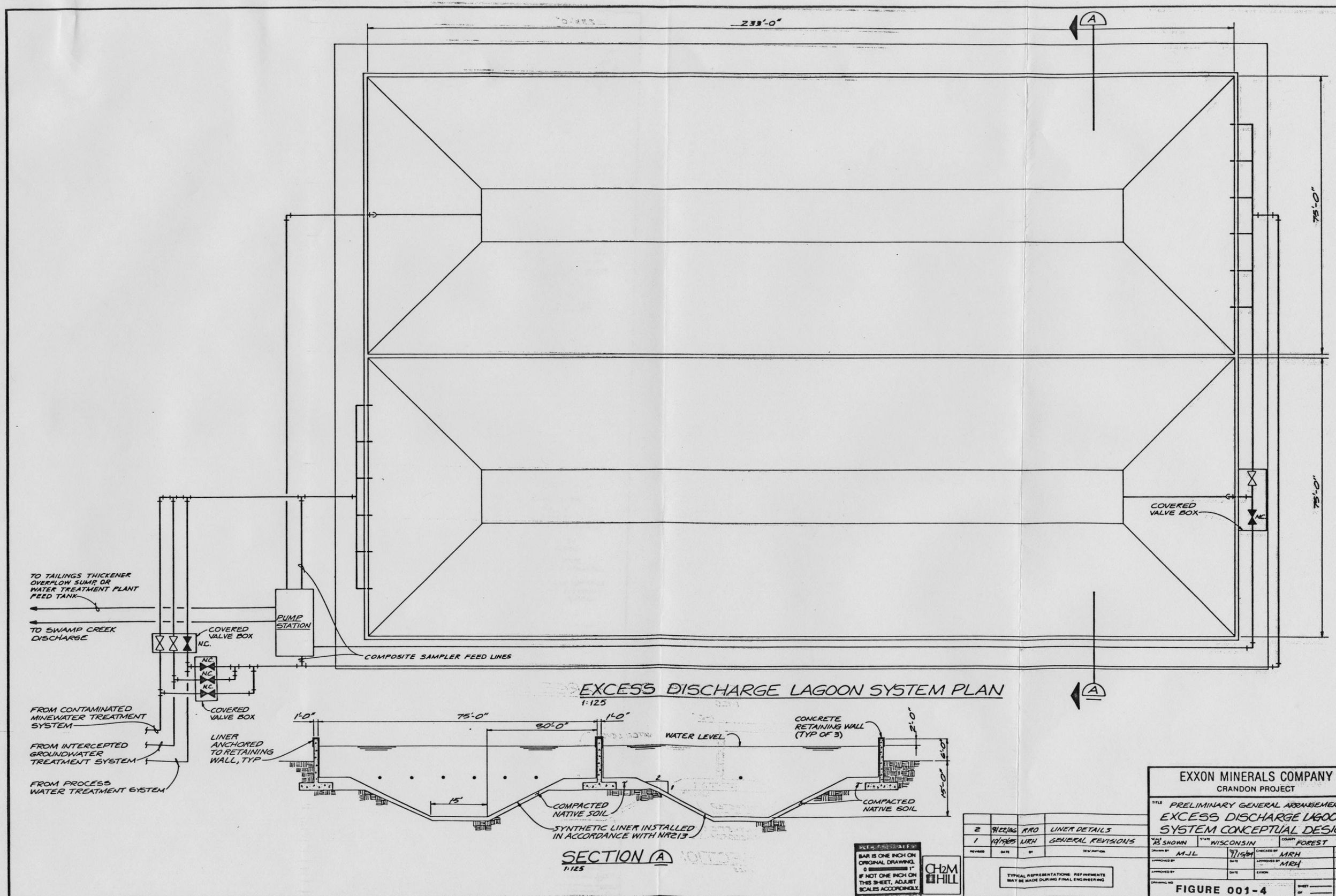
TABLE 2 (continued)

(e) Categorical limits (New Source Performance Standards) apply because they are more stringent than the water quality numbers.
(f) The monthly average water quality criterion necessary to prevent exceedance of FDA action limits in fish and thus protect human health is 0.0002 mg/l. This criterion value is near the detection limit of most current analytical techniques.
(g) BOD limits are supplied as weekly rather than monthly acerages.
(h) Limits for chlorides and sulfates are regulated as part of the TDS number.
(i) The maximum limit for TDS is 1,210 mg/l when Q_e <1,300 gpm and 1,000 mg/l when Q_e is between 1,301 and 2,000 gpm.

Note: Two scenarios were assumed in determining the monthly average effluent limits. The first set of numbers (before the slash) were calculated based on an upstream $Q_{7,10}$ of 13.5 cfs (assuming no flow mitigation for Upper Swamp Creek). The second set of numbers were calculated based on an upstream $Q_{7,10}$ of 15 cfs (assuming that there will be flow mitigation to Upper Swamp Creek).

Source of 1,300 and 1,301 to 2,000 gpm data: Letter from B. Baker, Bureau of Water Resources Management to B. J. Hansen, Crandon Permitting Manager, dated February 19, 1986.

Source of 2,001 to 3,000 gpm data: Provided by Mr. Ronald Martin, Depatment of Natural Resources, on August 27, 1986.



EXCESS DISCHARGE LAGOON SYSTEM PLAN
1:125

SECTION A
1:125

REVISED	DATE	BY	DESCRIPTION
2	9/22/86	RRO	LINER DETAILS
1	10/17/85	MRH	GENERAL REVISIONS

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

CH2M HILL

TYPICAL REPRESENTATIONS. REFINEMENTS MAY BE MADE DURING FINAL ENGINEERING

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE: PRELIMINARY GENERAL ARRANGEMENT
EXCESS DISCHARGE LAGOON SYSTEM CONCEPTUAL DESIGN

SCALE: AS SHOWN	STATE: WISCONSIN	COUNTY: FOREST	
DRAWN BY: MJL	DATE: 7/15/84	CHECKED BY: MRH	DATE: 7-16-84
APPROVED BY:	DATE:	APPROVED BY: MRH	DATE: 7-18-84
APPROVED BY:	DATE:	EXXON:	DATE:
DRAWING NO: FIGURE 001-4	SHEET: — OF —		REVISION NO: 1

CONT. ON DWG. 051-1-G-002
N118029.00 MATCH LINE

MATCH LINE N118143.00

N118,000

E2,277,000

N117,000

E2,276,000

N116,000

T/R 1650.25

T/R 1650.26

T/R 1650.35

T/R 1661.74

T/R 1666.67

C-1 C-2 C-3 C-4 C-5 C-6 C-7 C-8 C-9 C-10 C-11 C-12 C-13 C-14 C-15 C-16 C-17 C-18 C-19 C-20 C-21 C-22 C-23

BENCH EL.1652.75

COPPER

LEAD

30"

ZINC

18" CMP O'FLOW

BENCH EL.1660.00

CONCENTRATOR BUILDING

WATER TREATMENT PLANT

REAGENT BULK STORAGE

PUMP HOUSE

PUMP CHAMBER

TRACK SCALE

PUMP HOUSE

¢ TAILINGS THICKENER

DISCHARGE LAGOONS

FUEL STATION

SANITARY WASTE TREATMENT PLANT

LUBRICANT STORAGE

CEMENT SILOS

MARCONAFLOS

WASTE ROCK STORAGE BIN

COVERED COARSE ORE STORAGE

COLD STORAGE

OIL/WATER SEPARATOR 051-1-C-002

TRUCK HOPPER & GRIZZLY

FINE BACKFILL BIN & BACKFILL CRUSHING BUILDING

COVERED STORAGE F.F.EL.1658.46

CONSTRUCTION LAYDOWN AREA

MAIN SUBSTATION

SUBSTATION BUILDING

OIL-WATER SEPARATOR NO. 1

NATURAL GAS METER STATION

SERVICES BUILDING

COLLAR HOUSE

24' DIA. PROD. SERVICE & AIR INTAKE SHAFT

HOIST HOUSE

COMPRESSOR COOLER

COMPRESSOR STATION

ORE PROCESSING & STORAGE

F.F.EL. 1660.08

TOPSOIL STORAGE AREA

TRUCK SCALE

GATE HOUSE

BASIN NO. 2

BASIN NO. 1

BULK FUEL STORAGE

PARKING

EQUIPMENT PARKING

OIL WATER SEPARATOR 051-1-C-002

OIL-WATER SEPARATOR NO. 2

MULCH STORAGE AREA EL.1637.1

BACKFILL HOLE #1

BACKFILL HOLE #2

FUEL TANKS

SURFACE DRAINAGE BASIN NO. 1

EL. 1648.62 TOP OF BERM

UNLINED EARTHEN BASIN

EAST VENT SHAFT

DISCHARGE 002(1)

051-1-C-002

S = +5%

S = -5%

1645.0 1651.5 1660.0 1669.5 1679.00 1678.00 1676.5 1664.0 1676.50 1666.66 1643.38 1663.5 1656.8 1655.5 1661.0 1662.87 1660.10 1650.2 1653.5 1648.1 1653.0 1659.00 1665.0 1664.0 1657.6 1665.0 1656.8 1656.80 1655.52 1655.16 1646.0 1633.8 1632.2 1630.6 1635.5 1640.4 1637.1 1616.7 1611.5 1614.5 1613.5

NOTES:

1. CULVERT DIAMETERS ARE BASED ON ABILITY TO PASS THE PEAK FLOW FROM 10YR. STORMS CALCULATED BY THE RATIONAL FORMULA AND USING THE FOLLOWING RUNOFF COEFFICIENTS:
   - PAVED AREAS AND ROOFS C = 0.90
   - GRAVEL AND NATURAL GROUND C = 0.50
   - COMPOSITE AREAS C = 0.70

   MINIMUM CULVERT DIAMETER = 15"
2. VOLUME OF SURFACE DRAINAGE BASIN NO.1 IS BASED ON THE FOLLOWING CRITERIA:
   - WATER CAPACITY IS BASED ON THE 25 YR., 24 HR STORM VOLUME 294,000 CU.FT. NOT INCL. FREEBOARD & SEDIMENT VOLUME)
   - RUNOFF/RAINFALL RATIO = 0.75
   - FREEBOARD = 3 FT.
   - SEDIMENT DEPTH = 3 FT.

LEGEND

- CUT OR FILL SLOPE
- INLET (TYPE I)
- INLET (TYPE II)
- STORM DRAIN MANHOLE C-1
- CULVERT
- DRAINAGE DITCH
- 1650 GRADE ELEVATION
- 1648 INVERT ELEVATION
- DIRECTION OF SURFACE FLOW
- SWALE
- F.F. 1650 FINISHED FLOOR ELEVATION
- PERFORATED UNDERDRAIN
- T/R 503 TOP OF RAIL ELEVATION
- VL VALLEY LINE
- RL RIDGE LINE
- WATERSHED BOUNDARY
- OILY RUNOFF COLLECTION AREA

0 100' 200' 300'

Typical Representation: Refinements May Be Made During Final Design.

Raymond Kaiser Engineers

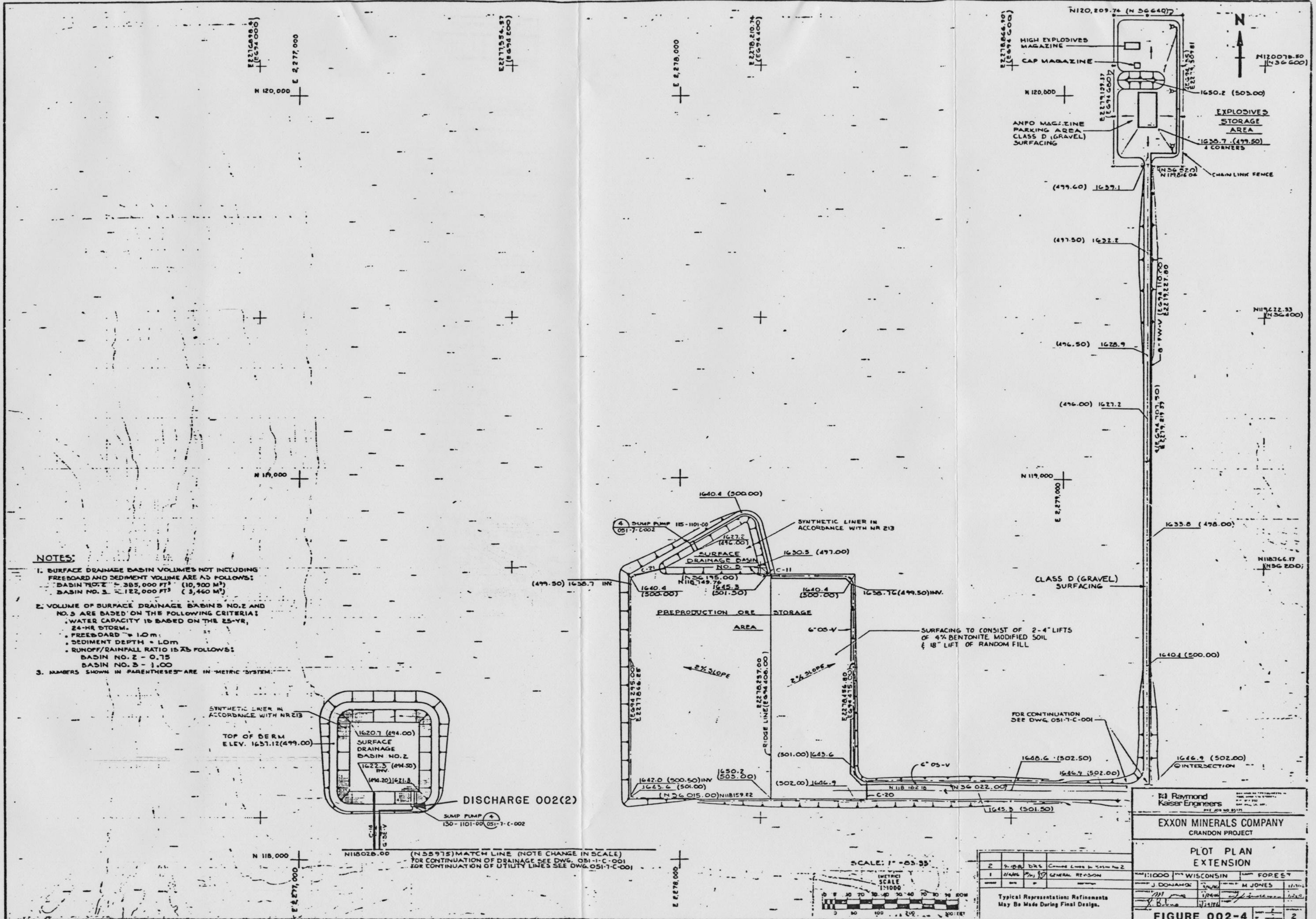
EXXON MINERALS COMPANY
CRANDON PROJECT

GRADING & DRAINAGE PLAN

SCALE 1" = 80'	STATE WISCONSIN	COUNTY FOREST	
DRAWN J. DONAHUE	1/26/84	CHECKED M. JONES	2/3/84
APPROVED	2/4/84	APPROVED	2/4/84
APPROVED	2/5/84		

FIGURE 002-3

SHEET — REVISION 0


N120,209.74 (N 56640)
HIGH EXPLOSIVES MAGAZINE
CAP MAGAZINE
N120078.50 (N 56600)
1650.2 (503.00)
EXPLOSIVES STORAGE AREA
ANFO MAGAZINE PARKING AREA CLASS D (GRAVEL) SURFACING
1630.7 (499.50) 4 CORNERS
CHAIN LINK FENCE
(499.60) 1639.1
(497.50) 1632.2
(496.50) 1628.9
(496.00) 1627.2
N 120,000
E 2,277,000
E 2,278,000
E 2,279,000
N 119,000
N 118,000
1640.4 (500.00)
SUMP PUMP 115-1101-00 051-7-C-002
SYNTHETIC LINER IN ACCORDANCE WITH NR 213
SURFACE DRAINAGE BASIN NO. 3
1630.5 (497.00)
(499.50) 1638.7 INV
1640.4 (500.00)
1645.3 (501.50)
1638.76 (499.50) INV.
PREPRODUCTION ORE STORAGE AREA
2% SLOPE
RIDGE LINE
SURFACING TO CONSIST OF 2-4" LIFTS OF 4% BENTONITE MODIFIED SOIL & 18" LIFT OF RANDOM FILL
CLASS D (GRAVEL) SURFACING
1633.8 (498.00)
1640.4 (500.00)
FOR CONTINUATION SEE DWG. 051-7-C-001
(501.00) 1643.6
1648.6 (502.50)
1646.9 (502.00)
1646.9 (502.00) @ INTERSECTION
(502.00) 1646.9
1650.2 (503.00)
1642.0 (500.50) INV
1643.6 (501.00)
1645.3 (501.50)
NOTES:
1. SURFACE DRAINAGE BASIN VOLUMES NOT INCLUDING FREEBOARD AND SEDIMENT VOLUME ARE AS FOLLOWS:
BASIN NO. 2 = 385,000 FT³ (10,900 M³)
BASIN NO. 3 = 122,000 FT³ (3,460 M³)
2. VOLUME OF SURFACE DRAINAGE BASINS NO. 2 AND NO. 3 ARE BASED ON THE FOLLOWING CRITERIA:
• WATER CAPACITY IS BASED ON THE 25-YR, 24-HR STORM.
• FREEBOARD = 1.0m
• SEDIMENT DEPTH = 1.0m
• RUNOFF/RAINFALL RATIO IS AS FOLLOWS:
BASIN NO. 2 - 0.75
BASIN NO. 3 - 1.00
3. NUMBERS SHOWN IN PARENTHESES ARE IN METRIC SYSTEM.
SYNTHETIC LINER IN ACCORDANCE WITH NR213
TOP OF BERM ELEV. 1637.12 (499.00)
1620.7 (494.00)
SURFACE DRAINAGE BASIN NO. 2
1622.3 (494.50) INV.
(494.20) 1621.3
DISCHARGE 002(2)
SUMP PUMP 4 130-1101-00 051-7-C-002
N118028.00
(N 55975) MATCH LINE (NOTE CHANGE IN SCALE)
FOR CONTINUATION OF DRAINAGE SEE DWG. 051-1-C-001
FOR CONTINUATION OF UTILITY LINES SEE DWG. 051-7-C-001
SCALE: 1" = 83.33'
(METRIC) SCALE 1:1000
Typical Representations: Refinements May Be Made During Final Design.
2 GENERAL REVISION
Raymond Kaiser Engineers
EXXON MINERALS COMPANY
CRANDON PROJECT
PLOT PLAN EXTENSION
1:1000 WISCONSIN FOREST
J. DONAHOE
M JONES
FIGURE 002-4
2

DISCHARGE SERIAL NUMBER

004

ADDENDUM

FOR DEPT. USE

15. **Waste Abatement**

a. **Waste Abatement Practices** Describe the waste abatement practices used on this discharge with a brief narrative. (see instructions)

218a

Narrative: The water discharged to Hoffman Spring/Creek

), Swamp Creek (004-6 and 004-7), Hemlock Creek (004-8), Little Sand Lake (004-9), Duck Lake (004-10), and Deep Hole Lake (004-11) will be of ambient ground water quality supplied from wells or the mine ground water intercept system as described in the additional information for Item 213a. No treatment of this water would occur prior to discharge. (continued below)

b. **Waste Abatement Codes** Using the codes listed in Table II of the Instruction Booklet, describe the waste abatement processes for this discharge in the order in which they occur if possible.

218b

(1) _____, (2) _____, (3) _____,

(4) _____, (5) _____, (6) _____,

(7) _____, (8) _____, (9) _____,

(10) _____, (11) _____, (12) _____,

(13) _____, (14) _____, (15) _____,

(16) _____, (17) _____, (18) _____,

(19) _____, (20) _____, (21) _____,

(22) _____, (23) _____, (24) _____,

(25) _____.

The water discharged to Skunk Lake (004-4) will be a blend of treated mine water and ground water from the potable water tank or from the mine ground water intercept system. The treated mine water will be the same as that discharged to Swamp Creek (001). The mine water treatment methods have been described in detail in Section II, Discharge 001.

DISCHARGE SERIAL NUMBER

004

ADDENDUM

FOR DEPT. USE

13. **Activity Description** Give a narrative description of activity producing this discharge.(see instructions)

213a

These eleven discharges are provided as a contingency for hydrological impacts that may occur to surface waters due to mine dewatering. These discharges would provide supplementary water to springs, creeks, and lakes to mitigate the effect that ground water drawdown may have on these surface waters.

Discharge points 004-1 through 004-3 and 004-5 through 004-11 will be discharging ground water from wells constructed in accordance with NR 115 or from the mine ground water intercept system. The discharge water lines will be constructed out of non-reactive piping. The discharge of the pumped ground water into the stream, spring or lake will be done in a manner so as to minimize any turbidity. Consequently, the schedules requested in Items 16 and 17 have not been completed because polluted water is not being discharged.

Discharge 004-4 is described under Item 15 below. For flow rates and specific water sources, see additional information.

14. **Activity Causing Discharge** For each SIC Code which describes the activity causing this discharge, supply the type and maximum amount of either the raw material consumed (Item 14a) or the product produced (Item 14b) in the units specified in Table I of the Instruction Booklet. For SIC Codes not listed in Table I, use raw material or production units normally used for measuring production.(see instructions)

a. **Raw Materials**

214a

SIC Code (1)	Name (2)	Maximum Amount/Day (3)	Unit (See Table I) (4)	Shared Discharges (Serial Number) (5)
1021	Copper Ores	8,200*	STPD**	None
1031	Lead and Zinc Ores	Design Capacity		

b. **Products**

214b

SIC Code (1)	Name (2)	Maximum Amount/Day (3)	Unit (See Table I) (4)	Shared Discharges (Serial Number) (5)
1021	Copper Concentrates	210	STPD**	None
1031	Lead and Zinc Concentrates	1,536	STPD**	
	(Product exists process as metal sulfide concentrates.)			

*8,200 STPD is the design production rate of the zinc, copper, and lead ore. Annual production expressed as a daily average is 7,400 STPD.

**Short tons per day.

Discharge Serial
No. 004

Item 26. Additional Information

Item 202b. The discharges described in this section are of two types: mitigation actions and contingency actions.

Mitigation actions will be undertaken before ECMC begins Crandon Project dewatering activities and are addressed to designated primary ground water flow systems. Contingency actions will be undertaken in the event that impacts are observed on other designated area water bodies as a result of Crandon Project dewatering activities.

Although the facilities for the mitigation actions will be constructed prior to the start of dewatering activities, the actual discharges will not begin until specified criteria indicate that supplementary water flow to the described surface waters is required. The discharge for the contingency actions are also controlled by a set of specified criteria. The criteria that control the eleven discharges (004-1 through 004-11) described in this section include lake or spring levels or stream flow rates as measured at designated sites. These criteria are described in detail in the "Revised Hydrologic Impact Contingency Plan" (Exxon Coal and Minerals Company, September 1986) and are not restated in this permit application.

Item 26. Additional Information (continued)

Item 203. Detailed information on the contingency mitigation is described in the "Revised Hydrologic Impact Contingency Plan" (Exxon Coal and Minerals Company, September 1986).

Item 206a. The locations of the eleven discharges covered by this permit section are shown in Section I, Figure 1 of this Addendum. They are also shown in more detail in Figure 004-1 and Figures 004-3 through 004-12.

Item 213a. MITIGATION ACTIONS

Described below are the mitigation actions involving water discharge to surface waters. The locations of all mitigation facilities are presented in Figure 004-1. Mitigation actions are summarized in Table 1. See Figure 004-2 for a representation of a typical discharge structure.

Hoffman Spring/Creek System

The discharge to Hoffman Spring/Creek [004(1)] will be from well C-1 initially capable of delivering 130 gpm of pumped ground water. The locations of the well, pipeline and discharge structure are shown in Figure 004-3. This discharge structure and the other structures for the mitigation and contingency actions will include mechanisms to aerate the ground water supplements prior to discharge.

Item 26. Additional Information (continued)

Item 231a. (continued)

TABLE 1

MITIGATION ACTIONS

DISCHARGE 004	WATER BODY	MITIGATION WELL NUMBER	MITIGATION SUPPLEMENT (GPM)
1	Hoffman Spring/Creek	C-1	130
2	Martin Spring/Creek 11-4	C-5	60
3	Upper Pickerel Creek	C-6	150
4	Skunk Lake	NA[a]	45 to 150[b]

[a]NA = Not applicable.

[b]Range provided to cover from low for ECMC expected impact projections to high for DNR worst case impact projections.

Item 26. Additional Information (continued)

Item 213a. Hoffman Spring/Creek System (continued)

(continued) The supplement to the Hoffman Spring/Creek system will range from 50 to 130 gpm depending on the systems flow rate. If the 130 gpm supplement does not maintain the systems designated flow, additional supplement capacity will be installed and up to 250 gpm will be pumped as necessary.

Martin Spring/Creek 11-4 System

The discharge to Martin Spring [004(2)] will be from well C-5 initially capable of delivering 60 gpm of pumped ground water. The locations of the well, pipeline, and discharge structure are shown in Figure 004-4.

A supplement of 60 gpm will be added to Martin Spring as necessary to maintain the system's designated flow rate. If the 60 gpm supplement does not maintain the system's flow, additional supplement capacity will be installed and up to 180 gpm will be pumped as necessary.

Upper Pickerel Creek

The discharge to Upper Pickerel Creek [004(3)] will be from well C-6 initially capable of delivering 150 gpm of pumped ground water. The locations of the well, pipeline and discharge structure are shown in Figure 004-5.

Item 26. Additional Information (continued)

Item 213a. Upper Pickerel Creek (continued)

(continued) A supplement of 150 gpm will be added to Upper Pickerel Creek as necessary to maintain the system designated flow rate. If the 150 gpm supplement does not maintain the creek's designated flow rate, additional supplement capacity will be installed and up to 450 gpm will be pumped as necessary.

Skunk Lake

The discharge to Skunk Lake [004(4)] will be based on lake level. The supplement will range from 45 to 150 gpm depending on lake level. The locations of the pipeline and the discharge structure are shown in Figure 004-6. The supplement will consist of ground water from the mine ground water intercept system or ground water from the potable water tank (water from well WS-1) blended with treated mine water to meet the DNR effluent standards for Skunk Lake.

The treated mine water has been described in detail in Section II, Discharge 001 of the December 1985 Application. This section includes the treatment methods to be used and the range of discharge composition expected.

Item 26. Additional Information (continued)

Item 213a. Contingency Ground Water Supplementation Option

(continued) If the water supplement to Hoffman Spring/Creek, Upper Pickerel Creek and/or Skunk Lake provided by wells, C-1, C-6 and WS-1 create unacceptble secondary impacts, EMC may, at its option, pump ground water to these water bodies from the mine ground water intercept system in addition to or in substitution for ground water from these wells. Such optional supplementation may be provided by way of pipelines to Hoffman Spring/Creek and Upper Pickerel Creek from the mine/mill site area to existing discharge structures.

The mine ground water intercept system is described in the "Revised Hydrologic Impact Contingency Plan" (Exxon Coal and Minerals Company, September 1986). The water from this system will be of ambient ground water quality.

CONTINGENCY ACTIONS

The locations of all contingency wells and structures are presented in Figure 004-7. The contingency actions are summarized in Table 2.

The Plan for the streams (Creek 12-9, Swamp Creek, and Hemlock Creek) consists of installing and operating four wells located where the aquifer is large enough to provide sufficient water for supplementation. As described above in the Contingency Ground Water

Item 26. Additional Information (continued)

Item 213a. (continued)

TABLE 2

CONTINGENCY ACTIONS

DISCHARGE 004-	WATER BODY	CONTINGENCY WELL NUMBER	CONTINGENCY SUPPLEMENT (GPM)
5	Creek 12-9	C-2	250 to 355[b]
6	Swamp Creek Upstream from the Access Road	C-4 or mine ground water intercept system	140
7	Swamp Creek Downstream from the Access Road	C-3 or mine ground water intercept system	120
8	Hemlock Creek	WS-2 or mine ground water intercept system	290 to 345[b]
9	Little Sand Lake	-[a]	190 to 680[b]
10	Duck Lake	-[a]	6 to 12[b]
11	Deep Hole Lake	-[a]	30 to 100[b]

[a]Supplement to be provided from mine ground water intercept system, potable water tank (well WS-1) or well (WS-2).

[b]Range provided to cover from low for ECMC expected impact projections to high for DNR worst case impact projections.

Item 26. Additional Information (continued)

Item 213a. CONTINGENCY ACTIONS (continued)

(continued) Supplementation Option for the Mitigation Activities (the use of ground water from the mine ground water intercept system) may also be optionally used to supplement Swamp Creek and Hemlock Creek. This would be done to minimize secondary impacts caused by wells C-3, C-4 and WS-2 as described in the "Revised Hydrologic Impact Contingency Plan" (September 1986).

The Plan for the lakes consists of installing pipelines to provide ground water supplements from the potable water tank (well WS-1), well WS-2 and/or the mine ground water intercept system.

Creek 12-9

The discharge to Creek 12-9 [004(5)] will be from well C-2 which will be capable of delivering 355 gpm of pumped ground water. The locations of the well, pipeline, and discharge structure are shown in Figure 004-8. The flow rate of the supplement will be up to 355 gpm when operating and will be based on the creek flow rate.

Swamp Creek Upstream from Proposed Access Road

The discharge to Swamp Creek upstream from the proposed access road [004(6)] will be from well C-4, which will be capable of delivering 140 gpm of pumped ground water. The locations of the well, pipeline and discharge structure are shown in Figure 004-9. The flow rate

Item 26. Additional Information (continued)

Item 213a. (continued) Swamp Creek Upstream from Proposed Access Road (continued)

of the supplement will be 140 gpm when operating and will be activated or shut off based on the stream flow.

Swamp Creek Downstream from the Proposed Access Road

The discharge to Swamp Creek downstream from the proposed access road [004(7)] will be from well C-3, which will be capable of delivering 120 gpm of pumped ground water. The locations of the well, pipeline, and discharge structure are shown in Figure 004-10. The flow rate of the supplement will be 120 gpm when operating and will be activated or shut off based on the stream flow rate.

Hemlock Creek

The discharge to Hemlock Creek [004(8)] will be from well WS-2 which will be capable of delivering 345 gpm of pumped ground water. The locations of the well, pipeline and discharge structure are shown in Figure 004-11. The flow rate of the supplement will be up to 345 gpm when operating and will be activated or shut off based on the creek flow rate.

Little Sand Lake

The discharge to Little Sand Lake [004(9)] when operating will range from 190 to 680 gpm depending on the lake level. The locations of the pipeline and discharge structure are shown in Figure 004-12.

Item 26. Additional Information (continued)

Item 213a. Little Sand Lake (continued)

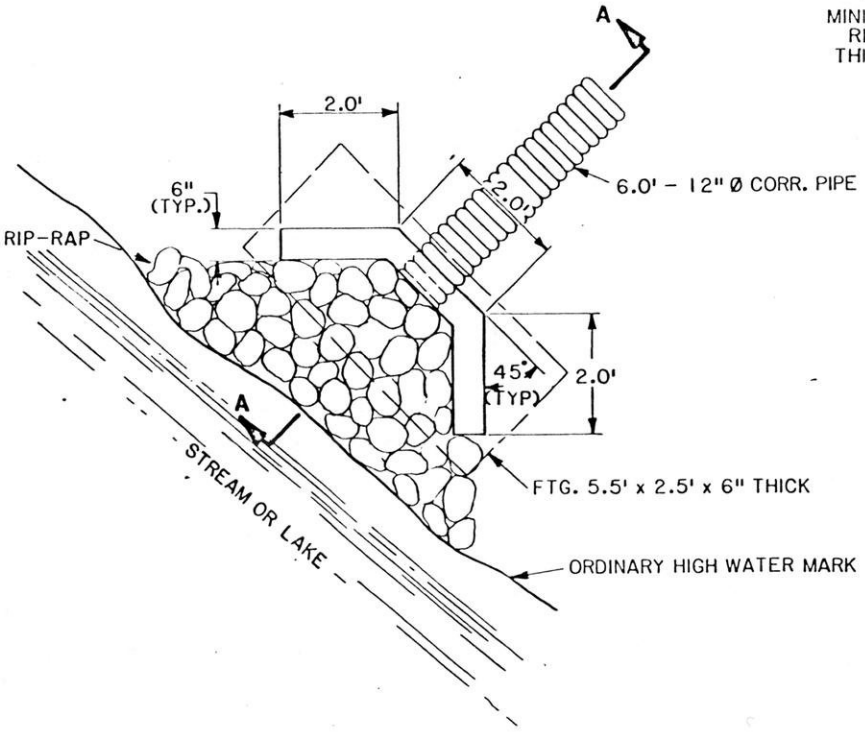
(continued) The buried pipeline will be constructed so as to enable ground water to be pumped from the potable water tank and/or the mine ground water intercept system to the discharge structure.

Duck Lake

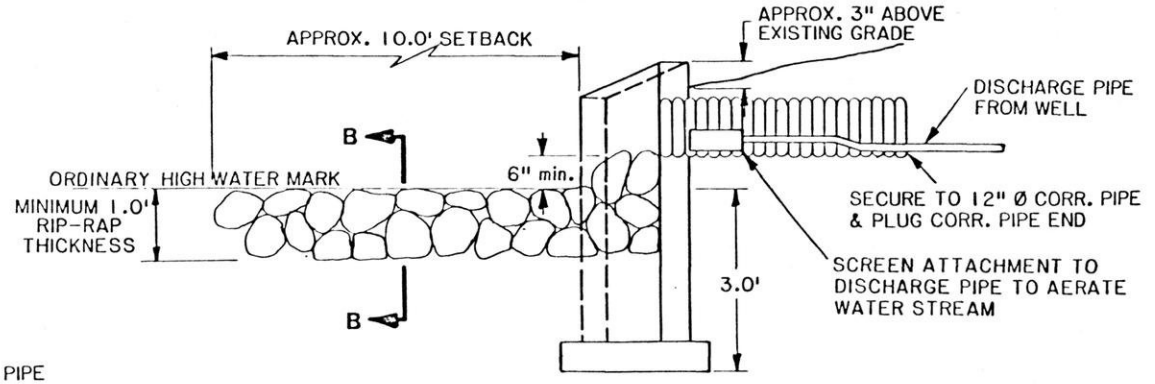
The discharge to Duck Lake [004(10)] when operating will range from 6 to 12 gpm depending on the lake level. The location of the pipeline and discharge structure are shown in Figure 004-12. The buried pipeline will be constructed so as to enable ground water to be pumped from the potable water tank and/or the mine ground water intercept system to the discharge structure.

Deep Hole Lake

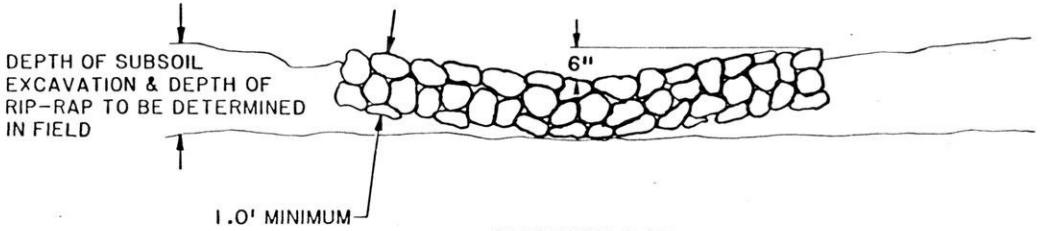
The discharge to Deep Hole Lake [004-(11)] when operating will range from 30 to 100 gpm depending on the lake level. The location of the pipeline and discharge structure are shown in Figure 004-12. The buried pipeline will be constructed so as to enable ground water to be pumped from the potable water tank and/or the mine ground water intercept system to the discharge structure.



TYPICAL DISCHARGE HEADWALL



SECTION A-A
TYPICAL DISCHARGE HEADWALL



SECTION B-B
TYPICAL RIP-RAP INSTALLATION

0 2 4 6
SCALE IN FEET

REVISED	DATE	BY	DESCRIPTION
1	7-28-86	DRS	Added Section B-B

Typical Representations: Refinements May Be Made During Final Engineering

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
TYPICAL DISCHARGE STRUCTURE FOR STREAMS, SPRINGS & LAKES

SCALE: SHOWN	STATE: WISCONSIN	COUNTY: FOREST	
DRAWN BY: DR SPRINGBORN	DATE: 11/85	CHECKED BY:	DATE:
APPROVED BY:	DATE:	APPROVED BY: C.C. Schroeder	DATE: 11/13/85
APPROVED BY:	DATE:	EXXON: D.F. Mine	DATE: 11/15/85
DRAWING NO: FIGURE 004-2	SHEET: ___ OF: ___		REVISION NO: 1

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

BOX 7921
MADISON, WISCONSIN 53707

June 5, 1986

File: 1630
(Exxon)

Dear Librarian:

Please place this material with the rest of the December, 1985 Revised WPDES Permit Application sent to you in January for Exxon's proposed zinc/copper mine at Crandon, Wisconsin:

May, 1986 Addendum to 12/85 Revised WPDES Permit, Application by Exxon Minerals Company.

This Addendum provides revised information for the WPDES Permit Application Section II, Discharges 001, Swamp Creek Outfall, and 004 Contingency Mitigation for Surface Waters.

People who have questions or comments should contact Mr. Bob Ramharter at: (608) 266-3915 or at Box 7921, Madison, Wisconsin 53707.

Thank you for your assistance.

Sincerely,

Carol Nelson

Carol Nelson
Environmental Specialist
Bureau of Environmental Analysis and Review

Enclosure

ADDENDUM

CRANDON PROJECT

REVISED
WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTEWATER DISCHARGE PERMIT APPLICATION

(WPDES)

EXXON MINERAL COMPANY
RHINELANDER, WISCONSIN

MAY 1986

ADDENDUM

REVISED WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM (WPDES)
WASTEWATER DISCHARGE PERMIT APPLICATION

1.0 INTRODUCTION

This addendum provides revised information for the December 1985 WPDES Permit Application Section II, Discharges 001, Swamp Creek Outfall, and 004 Contingency Mitigation for Surface Waters. The remaining information regarding Discharge 001 and Discharges 002 and 003, not included with this addendum, remains the same as submitted in the Application dated December 1985. Discharge 004 subsection of the December 1985 Application has been replaced by the new subsection prepared as part of this addendum.

ADDENDUM

CRANDON PROJECT

WPDES PERMIT APPLICATION

SECTION II

DISCHARGE 001

APRIL 1986

FOR DEPT. USE

9. **All Facility Discharges and other Losses; Number and Discharge (see instructions) Volume** Specify the number of discharge points and the volume of water discharged or lost from the facility according to the categories below. Estimate average volume per day in thousand gallons per day.

		Number of Discharge Points		Total Volume Used or Discharged, Thousand Gal/Day	
Surface Water	109a1	12	109a2	1,714	See additional information.
Sanitary wastewater transport system	109b1	N/A	109b2	N/A	
Storm water transport s :tem	109c1	30	109c2	--	See additional information.
Combined sanitary and storm water transport system	109d1	N/A	109d2	N/A	
Surface impoundment with no effluent	109e1	--	109e2	--	See additional information.
Underground percolation	109f1	N/A	109f2	N/A	
Well Injection	109g1	N/A	109g2	N/A	
Waste acceptance firm	109h1	N/A	109h2	N/A	
Evaporation	109i1	3	109i2	218	See additional information.
Consumption	109j1	1	109j2	27	See additional information.
Other*	109k1	0	109k2	309	See additional information.
Facility discharges and volume Total Item 9.	109l1	41	109l2	1,959	See additional information.
*If there are discharges to 'other,' specify.	109m1	Retained in tailings and backfilled sands.			

10. **Permits, Licenses and Applications**
List all existing, pending or denied permits, licenses and applications related to discharges from this facility (see instructions).

	Issuing Dept.	For Dept. Use	Type of Permit or License	ID Number	Date Filed YR/MO/DA	Date Issued YR/MO/DA	Date Denied YR/MO/DA	Expiration Date YR/MO/DA
0	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1.	DNR		WPDES					
	DNR		Water Regulatory		Not Filed			
2.	COE		Sec. 404		Not Filed			
3.								

11. **Maps and Drawings**
Attach all required maps and drawings to the back of this application. (see instructions)

12. **Additional Information**

112 Item Number	Information		
108a	Non-contact cooling water:		
	Use	10^3 Gal/Day	gpm
	Compressor cooling	960	665
	NOTE: This water is not discharged; it is recycled through a cooling tower prior to reuse in the compressors.		

Item 12. Additional Information (continued)

109a The twelve discharges to surface water include one discharge of 1,190 gpm of treated water to Swamp Creek (Discharge 001). This includes 350 gpm of treated intercepted ground water, 825 gpm of treated contaminated mine water, and 15 gpm of treated sanitary effluent. *

The other eleven discharges are intermittent discharges to streams, springs, and lakes described in Section II - Discharge 004 (1-11). Since these discharges will not be routine, they are listed in 109a in number but not in volume discharged.

109c Contaminated storm water runoff will be collected and sent to reclaim pond cell A and does not constitute a separate discharge from the facility. Uncontaminated storm water runoff will be collected and directed to sedimentation ponds. See Section II - Discharge number 002 and Section II - Discharge 003. Discharge 002 includes storm water runoff from the mine/mill site and the MWDF. Discharge 003 includes storm water runoff from access road and railroad. Also see Section 1, Figure 1.

109e Information on infiltration from tailings ponds is included in the NR 182.08 application. The application is supported by the Mine Waste Disposal Feasibility Report dated November, 1985.

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*Vertical lines in the margin identify lines in which revisions have been made.

TABLE 2.

TOXIC POLLUTANT	HAZARDOUS SUBSTANCES	HAZARDOUS SUBSTANCES
Asbestos	Dichlorvos	Naled
	Diethyl amine	Naphthenic acid
HAZARDOUS SUBSTANCES	Dimethyl amine	Nitrotoluene
	Dintrobenzene	Parathion
Acetaldehyde	Diquat	Phenolsulfonate
Allyl alcohol	Disulfoton	Phosgene
Allyl chloride	Diuron	Propargite
Amyl acetate	Epichlorohydrin	Propylene oxide
Aniline	Ethion	Pyrethrins
Benzonitrile	Ethylene diamine	Quinoline
Benzyl chloride	Ethylene dibromide	Resorcinol
Butyl acetate	X Formaldehyde [1]	X Strontium Intake [2]
Butylamine	Furfural	Strychnine
Captan	Guthion	Styrene
Carbaryl	Isoprene	2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)
Carbofuran	Isopropanolamine	TDE (Tetrachlorodiphenyl ethane)
Carbon disulfide	Kelthane	2,4,5-TP (2-(2,4,5-Trichlorophenoxy) propanoic acid)
Chlorpyrifos	Kepone	Trichlorofan
Coumaphos	Malathion	Triethanolamine
Cresol	Mercaptodimethur	Triethylamine
Crotonaldehyde	Methoxychlor	Trimethylamine
Cyclohexane	Methyl mercaptan	Uranium
2,4-D (2,4-Dichlorophenoxyacetic acid)	Methyl methacrylate	Vanadium
Diazinon	Methyl parathion	Vinyl acetate
Dicamba	Mevinphos	Xylene
Dichlobenil	Mexacarbate	Xylenol
Dichlone	Monoethyl amine	Zirconium
2,2-Dichloropropionic acid	Monomethyl amine	

DDA 5/8/86

NOTE: The previous tables were taken from the May 19, 1980 Federal Register.

If you have reason to believe that none of these pollutants will be present in the effluent as a result or your operations/manufacturing processes, place an "X" in the adjacent blank. ____

This Addendum must be signed by the official representative of the facility who is: the owner, the sole proprietor for a sole proprietorship, a general partner for a partnership, or an executive officer of at least the level of vice president for a corporation, having overall responsibility for the operation of the facility.

D. B. Achttien
Typed Name of Official Representative

General Manager, Crandon Project
Title
Exxon Minerals Company,
Attorney-in-fact for Exxon Corp.

D. B. Achttien
Signature of Official Representative

January 16, 1986
Date Signed

Chpt. 147.21(4), Wisc. Stats., provides that: Any person who knowingly makes any false statement, representation or certification in this Addendum shall upon conviction be punished by a fine of not more than $10,000 or by imprisonment for not more than 6 months or both.

DDA 5/8/86

[1] Formaldehyde concentration is expected to be less than 7 ug/l in the discharge to Swamp Creek (Discharge 001).

[2] Strontium was not analyzed in the ground water. We expect that it would be present in low concentrations (less than 1 mg/l in ground water.

Item 26. Additional Information (continued)

Item 17 (continued)

TABLE 2

WATER QUALITY BASED EFFLUENT LIMITS FOR THE PROPOSED DISCHARGE TO SWAMP CREEK

(All values are in mg/L unless noted differently)

Parameters	Daily Maximum[1]	Monthly average limits[2] based on effluent flows (Q_e) of <1300 gpm	1301-2000 gpm
Toxic Pollutants			
Arsenic	1.48[3]	0.626/0.663[3]	.508/.535[3]
Cadmium	0.073	0.0045/0.0048	0.0037/0.0039
Chromium+6	0.058	0.051/0.053	0.042/0.043
Chromium+3	11	0.27/0.28	0.22/0.23
Copper	0.025	0.025/0.025	0.021/0.022
Cyanide	0.093	0.010/0.011	0.010/0.011
Lead	0.6[4]	0.118/0.125	0.096/0.10
Mercury	0.0022	0.0002[5]	0.0002[5]
Selenium	1.0	0.165/0.174	0.134/0.140
Silver	0.007	no rec'd value	no rec'd value
Zinc	0.44	0.14/0.14	0.11/0.12
Conventional Pollutants			
BOD		20 (summer)[6]	15 (summer)[6]
		40 (winter)[6]	30 (winter)[6]
Total Suspended Solids	30[4]	20[4]	20[4]
pH (S.U.)	6 - 9		
Non-Conventional Pollutants			
Barium		10.8/11.4	8.8/9.2
Fluoride		14.6/15.5	11.9/12.4
Iron		1.8/1.9	1.5/1.6
Total Dissolved Solids[7]	1210/1000[8]		

(1) For most of the toxic pollutants (except lead,), the maximum limits were derived from the available acute toxicity information for resident Wisconsin aquatic species.

(2) The monthly average limits were calculated based on the following mass balance equation: $\frac{Ce = Qm\ Cm - Qs\ Cs}{Qe}$.

(3) The water quality criterion for arsenic to protect human health is being reviewed. The above limits are based on the acute and chronic toxicity effects to resident Wisconsin aquatic species.

(4) Categorical limits (New Source Performance Standards) apply because they are more stringent than the water quality numbers.

(5) The monthly average water quality criterion necessary to prevent exceedance of FDA action limits in fish and thus protect human health is 0.0002 mg/l. This criterion value is near the detection limit of most current analytical techniques.

(6) BOD limits are applied as weekly rather than monthly averages.

(7) Limits for chlorides and sulfates are regulated as part of the TDS number.

(8) The maximum limit for TDS is 1210 mg/l when Q_e < 1300 gpm and 1000 mg/l when Q_e is between 1301 and 2000 gpm.

NOTE: Two scenarios were assumed in determining the monthly average effluent limits. The first set of numbers (before the slash) were calculated based on an upstream $Q_{7,10}$ of 13.5 cfs (assuming no flow mitigation for Upper Swamp Creek). The second set of numbers were calculated based on an upstream $Q_{7,10}$ of 15 cfs (assuming that there will be flow mitigation to Upper Swamp Creek).

SOURCE: Letter from B. Baker, Bureau of Water Resources Management to B. J. Hansen, Crandon Project Permitting Manager, dated February 19, 1986.

WELL C-4

DISCHARGE 004 (6)

WELL C-3

DISCHARGE 004 (7)

DISCHARGE 003 (1-23)

DISCHARGE 003 (1-10)

ACCESS ROAD

RAIL ROAD SPUR

DISCHARGE 004 (1)

DISCHARGE 002 (1 & 2)

MINE/MILL SITE

DISCHARGE 004 (4)

FUTURE BORROW AREA

RECLAIM POND

WELL

CELL

WS-2

CONSTRUCTION SUPPORT

DISCHARGE 004 (8)

MINE REFUSE DISPOSAL FACILITY

CRANDON FORMATION

MWDF ROAD

WELL C-1

DISCHARGE 004 (9)

DISCHARGE 002 (3-7)

POTABLE WATER WELL

WATER DISCHARGE PIPELINE

SEE INSERT

MINE WASTE DISPOSAL FACILITY

DISCHARGE 004 (10)

DISCHARGE 004 (3)

WELL C-6

DISCHARGE 004 (11)

WELL C-2

DISCHARGE 004 (5)

DISCHARGE 001

INSERT

SCALE IN METERS

DISCHARGE 004 (2)

WELL C-5

SCALE IN FEET

SCALE IN METERS

Typical Representation: Refinements may be made during final design.

EXXON MINERALS COMPANY

CRANDON PROJECT

TITLE

WATER DISCHARGE LOCATIONS

SCALE SHOWN | STATE WISCONSIN | COUNTY FOREST

DRAWN BY DR SPRINGBORN | DATE 10/85 | CHECKED BY C. Schroeder | DATE 12/6/85

APPROVED BY | DATE | APPROVED BY J.W. Wellen | DATE 1-27-86

APPROVED BY | DATE | ISSUED D.S. Max | DATE 12/9/86

DRAWING NO. SECTION 1, FIG. 1 | SHEET 4 of 36 | REVISION NO. 0

ADDENDUM

CRANDON PROJECT

WPDES PERMIT APPLICATION

SECTION II

DISCHARGE 004

APRIL 1986

STANDARD FORM C – MANUFACTURING AND COMMERCIAL DISCHARGERS

FOR DEPT. USE

SECTION II. BASIC DISCHARGE DESCRIPTION

Complete this section for each discharge indicated in Section I, Item 9, that is to surface waters. This includes discharges to municipal sewerage systems in which the wastewater does not go through a treatment works prior to being discharged to surface waters. Discharges to wells must be described where there are also discharges to surface waters from this facility. **SEPARATE DESCRIPTIONS OF EACH DISCHARGE ARE REQUIRED EVEN IF SEVERAL DISCHARGES ORIGINATE IN THE SAME FACILITY.** All values for an existing discharge should be representative of the twelve previous months of operation. If this is a proposed discharge, values should reflect best engineering estimates.

ADDITIONAL INSTRUCTIONS FOR SELECTED ITEMS APPEAR IN SEPARATE INSTRUCTION BOOKLET AS INDICATED. REFER TO BOOKLET BEFORE FILLING OUT THESE ITEMS.

1. **Discharge Serial No. and Name**

   a. **Discharge Serial No.** (see instructions) — 201a: 004 (1-11)

   b. **Discharge Name** Give name of discharge, if any. (see instructions) — 201b: Contingency Mitigation For Surface Waters

   c. **Previous Discharge Serial No.** If previous permit application was made for this discharge (see Item 4, Section I), provide previous discharge serial number. — 201c: N/A

2. **Discharge Operating Dates**

   a. **Discharge Began Date** If the discharge described below is in operation, give the date (within best estimate) the discharge began. — 202a: N/A (YR MO)

   b. **Discharge to Begin Date** If the discharge has never occurred but is planned for some future date, give the date (within best estimate) the discharge will begin. — 202b: ____ ____ (YR MO) (See Additional Information)

   c. **Discharge to End Date** If discharge is scheduled to be discontinued within the next 5 years, give the date (within best estimate) the discharge will end. — 202c: N/A (YR MO)

3. **Engineering Report Available** Check if an engineering report is available to reviewing agency upon request. (see instructions) — 203: ☒ (See Additional Information)

4. **Discharge Location** Name the political boundaries within which the point of discharge is located.

			For Dept. Use	
State	204a	Wisconsin	204d	
County	204b	Forest	204e	
(if applicable) City or Town	204c	--	204f	

5. **Discharge Point Description** Discharge is into (check one): (see instructions)

Stream (includes ditches, arroyos, and other intermittent watercourses)	205a	☒STR	(See Item 207a)
Lake		☒LKE	
Ocean		☐OCE	
Municipal Sanitary Wastewater Transport System		☐MTS	
Municipal Combined Sanitary and Storm Transport System		☐MCS	

This section contains 9 pages.

DISCHARGE SERIAL NUMBER

004

ADDENDUM

FOR DEPT. USE

Municipal Storm Water Transport System		☐ STS
Well (Injection)		☐ WEL
Other		☐ OTH
If 'other' is checked, specify	206a	

6. **Discharge Point — Lat/Long** Give the precise location of the point of discharge to the nearest second.

Latitude	206a	___DEG ___MIN ___SEC
Longitude	206b	___DEG ___MIN ___SEC (See Additional Information)

7. **Discharge Receiving Water Name** Name the waterway at the point of discharge.(see instructions)

207a Hoffman Spring/Creek, Martin Spring/Creek 11-4, Upper Pickerel Creek, Skunk Lake, Creek 12-9, Swamp Creek, Hemlock Creek, Little Sand Lake, Duck Lake, and Deep Hole Lake.

If the discharge is through an outfall that extends beyond the shoreline or is below the mean low water line, complete Item 8.

207b

For Dept. Use			207c	For Dept. Use
Major	Minor	Sub		303e

8. **Offshore Discharge**

a. **Discharge Distance from Shore** 208a N/A feet

b. **Discharge Depth Below Water Surface** 208b N/A feet

9. **Discharge Type and Occurrence**

a. **Type of Discharge** Check whether the discharge is continuous or intermittent. (see instructions) 209a ☐ (con) Continuous ☒ (int) Intermittent

b. **Discharge Occurrence Days per Week** Enter the average number of days per week (during periods of discharge) this discharge occurs. 209b N/A days per week

c. **Discharge Occurrence** —Months If this discharge normally operates (either intermittently, or continuously) on less than a year-around basis (excluding shutdowns for routine maintenance), check the months during the year when the discharge is operating. (see instructions) 209c ☐JAN ☐FEB ☐MAR ☐APR ☐MAY ☐JUN ☐JUL ☐AUG ☐SEP ☐OCT ☐NOV ☐DEC N/A

Complete Items 10 and 11 if "Intermittent" is checked in Item 9.a. Otherwise, proceed to Item 12.

10. **Intermittent Discharge Quantity** State the average volume per discharge occurrence in thousands of gallons. 210 N/A thousand gallons per discharge occurrence.

11. **Intermittent Discharge Duration and Frequency**

a. **Intermittent Discharge Duration Per Day** State the average number of hours per day the discharge is operating. 211a N/A hours per day

b. **Intermittent Discharge Frequency** State the average number of discharge occurrences per day during days when discharging. 211b N/A discharge occurrences per day

12. **Maximum Flow Period** Give the time period in which the maximum flow of this discharge occurs. 212 From N/A (month) to N/A (month)

DISCHARGE SERIAL NUMBER

004

ADDENDUM

FOR DEPT. USE

13. **Activity Description** Give a narrative description of activity producing this discharge.(see instructions)

213a

These eleven discharges are provided as a contingency for hydrological impacts that may occur to surface waters due to mine dewatering. These discharges would provide supplementary water to springs, creeks, and lakes to mitigate the effect that ground water drawdown may have on these surface waters.

Discharge points 004-1 through 004-3 and 004-5 through 004-11 will be discharging ground water from wells constructed in accordance with NR 115 or from the mine ground water intercept system. The discharge water lines will be constructed out of non-reactive piping. The discharge of the pumped ground water into the stream, spring or lake will be done in a manner so as to minimize any turbidity. Consequently, the schedules requested in Items 16 and 17 have not been completed because polluted water is not being discharged.

Discharge 004-4 is described under Item 15 below. For flow rates and specific water sources, see additional information.

14. **Activity Causing Discharge** For each SIC Code which describes the activity causing this discharge, supply the type and maximum amount of either the raw material consumed (Item 14a) or the product produced (Item 14b) in the units specified in Table I of the Instruction Booklet. For SIC Codes not listed in Table I, use raw material or production units normally used for measuring production.(see instructions)

a. **Raw Materials**

214a

SIC Code (1)	Name (2)	Maximum Amount/Day (3)	Unit (See Table I) (4)	Shared Discharges (Serial Number) (5)
1021	Copper Ores	8,200*	STPD**	None
1031	Lead and Zinc Ores	Design Capacity		

b. **Products**

214b

SIC Code (1)	Name (2)	Maximum Amount/Day (3)	Unit (See Table I) (4)	Shared Discharges (Serial Number) (5)
1021	Copper Concentrates	210	STPD**	None
1031	Lead and Zinc Concentrates	1,536	STPD**	
	(Product exists	process as	metal sulfid	e concentrates.)

*8,200 STPD is the design production rate of the zinc, copper, and lead ore. Annual production expressed as a daily average is 7,400 STPD.

**Short tons per day.

DISCHARGE SERIAL NUMBER

004

ADDENDUM

FOR DEPT. USE

15. **Waste Abatement**

a. **Waste Abatement Practices** Describe the waste abatement practices used on this discharge with a brief narrative. (see instructions)

218a

Narrative: The water discharged to Hoffman Spring/Creek

), Swamp Creek (004-6 and 004-7), Hemlock Creek (004-8), Little Sand Lake (004-9), Duck Lake (004-10), and Deep Hole Lake (004-11) will be of ambient ground water quality supplied from wells or the mine ground water intercept system as described in the additional information for Item 213a. No treatment of this water would occur prior to discharge. (continued below)

b. **Waste Abatement Codes** Using the codes listed in Table II of the Instruction Booklet, describe the waste abatement processes for this discharge in the order in which they occur if possible.

218b

(1) _____, (2) _____, (3) _____,

(4) _____, (5) _____, (6) _____,

(7) _____, (8) _____, (9) _____,

(10) _____, (11) _____, (12) _____,

(13) _____, (14) _____, (15) _____,

(16) _____, (17) _____, (18) _____,

(19) _____, (20) _____, (21) _____,

(22) _____, (23) _____, (24) _____,

(25) _____.

The water discharged to Skunk Lake (004-4) will be a blend of treated mine water and ground water from the potable water tank or from the mine ground water intercept system. The treated mine water will be the same as that discharged to Swamp Creek (001). The mine water treatment methods have been described in detail in Section II, Discharge 001.

DISCHARGE SERIAL NUMBER

004

ADDENDUM

FOR DEPT. USE

16. Wastewater Characteristics (See Item 13)

Check the box beside each constituent which is present in the effluent (discharge water). This determination is to be based on actual analysis or best estimate.(see instructions)

Parameter 216	Present	Parameter 216	Present
Color 00080		Copper 01042	
Ammonia 00610		Iron 01045	
Organic nitrogen 00605		Lead 01051	
Nitrate 00620		Magnesium 00927	
Nitrite 00615		Manganese 01055	
Phosphorus 00665		Mercury 71900	
Sulfate 00945		Molybdenum 01062	
Sulfide 00745		Nickel 01067	
Sulfite 00740		Selenium 01147	
Bromide 71870		Silver 01077	
Chloride 00940		Potassium 00937	
Cyanide 00720		Sodium 00929	
Fluoride 00951		Thallium 01059	
Aluminum 01105		Titanium 01152	
Antimony 01097		Tin 01102	
Arsenic 01002		Zinc 01092	
Beryllium 01012		Algicides* 74051	
Barium 01007		Chlorinated organic compounds* 74052	
Boron 01022		Pesticides* 74053	
Cadmium 01027		Oil and grease 00550	
Calcium 00916		Phenols 32730	
Cobalt 01037		Surfactants 38260	
Chromium 01034		Chlorine 50060	
Fecal coliform bacteria 74055		Radioactivity* 74050	

*Specify substances, compounds and/or elements in Item 26.

DISCHARGE SERIAL NUMBER
004

ADDENDUM

FOR DEPT. USE

17. **Description of Intake and Discharge** (See Item 13)

For each of the parameters listed below, enter in the appropriate box the value or code letter answer called for.(see instructions)

In addition, enter the parameter name and code and all required values for any of the following parameters if they were checked in Item 16; ammonia, cyanide, aluminum, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, phenols, oil and grease, and chlorine (residual).

Parameter and Code 217a	Influent		Effluent					
	Untreated Intake Water (Daily Average) (1)	In-Plant Treated Intake Water (Daily Average) (2)	Daily Average (3)	Minimum Value Observed or Expected During Discharge Activity (4)	Maximum Value Observed or Expected During Discharge Activity (5)	Frequency of Analysis (6)	Number of Analyses (7)	Sample Type (8)
Flow* Gallons per day 00056								
pH Units 00400			X					
Temperature (winter) ° F 74028								
Temperature (summer) ° F 74027								
Biochemical Oxygen Demand (BOD 5-day) mg/l 00310								
Chemical Oxygen Demand (COD) mg/l 00340								
Total Suspended (nonfilterable) Solids mg/l 00530								
Specific Conductance micromhos/cm at 25° C 00095			X					
Settleable Matter (residue) ml/l 00545								

*Other discharges sharing intake flow (serial numbers).(see instructions)

ADDENDUM

DISCHARGE SERIAL NUMBER
004

FOR DEPT. USE

17. (Cont'd.)

Parameter and Code 217a	Influent		Effluent					
	Untreated Intake Water (Daily Average) (1)	In-Plant Treated Intake Water (Daily Average) (2)	Daily Average (3)	Minimum Value Observed or Expected During Discharge Activity (4)	Maximum Value Observed or Expected During Discharge Activity (5)	Frequency of Analysis (6)	Number of Analyses (7)	Sample Type (8)

18. **Plant Controls** Check if the following plant controls are available for this discharge. 218

Alternate power source for major pumping facility. ☐ APS

N/A

Alarm or emergency procedure for power or equipment failure ☐ ALM

Complete item 19 if discharge is from cooling and/or steam water generation and water treatment additives are used.

19. **Water Treatment Additives** If the discharge is treated with any conditioner, inhibitor, or algicide, answer the following:

a. Name of Material(s) 219a No water treatment additives will be used for the intercepted mine water and the well water discharge.

b. Name and address of manufacturer 219b The additives used in the treatment of mine water are described in Section II Discharge 001 of the December 1985 Application.

c. Quantity (pounds added per million gallons of water treated). 219c N/A

FOR DEPT. USE

d. Chemical composition of these additives (see instructions). | 219d | N/A

Complete items 20-25 if there is a thermal discharge (e.g., associated with a steam and/or power generation plant, steel mill, petroleum refinery, or any other manufacturing process) and the total discharge flow is 10 million gallons per day or more. (see instructions)

20. Thermal Discharge Source Check the appropriate item(s) indicating the source of the discharge. (see instructions) | 220 | N/A

- Boiler Blowdown — ☐ BLBD
- Boiler Chemical Cleaning — ☐ BCCL
- Ash Pond Overflow — ☐ APOF
- Boiler Water Treatment — Evaporator Blowdown — ☐ EPBD
- Oil or Coal Fired Plants — Effluent from Air Pollution Control Devices — ☐ OCFP
- Condense Cooling Water — ☐ COND
- Cooling Tower Blowdown — ☐ CTBD
- Manufacturing Process — ☐ MFPR
- Other — ☐ OTHR

21. Discharge/Receiving Water Temperature Difference | | N/A

Give the maximum temperature difference between the discharge and receiving waters for summer and winter operating conditions. (see instructions)

Summer | 221a | _____ °F.

Winter | 221b | _____ °F.

22. Discharge Temperature, Rate of Change Per Hour | 222 | N/A °F./hour

Give the maximum possible rate of temperature change per hour of discharge under operating conditions. (see instructions)

23. Water Temperature, Percentile Report (Frequency of Occurrence) | | N/A

In the table below, enter the temperature which is exceeded 10% of the year, 5% of the year, 1% of the year and not at all (maximum yearly temperature). (see instructions)

Frequency of occurrence

		10%	5%	1%	Maximum
a. Intake Water Temperature (Subject to natural changes)	223a	°F	°F	°F	°F
b. Discharge Water Temperature	223b	°F	°F	°F	°F

24. Water Intake Velocity (see instructions) | 224 | N/A feet/sec.

25. Retention Time Give the length of time, in minutes, from start of water temperature rise to discharge of cooling water. (see instructions) | 225 | N/A minutes

ADDENDUM

Discharge Serial
No. 004

Item 26. Additional Information

Item 202b. The discharges described in this section are of two types: mitigation actions and contingency actions.

Mitigation actions will be undertaken before EMC begins Crandon Project dewatering activities and are addressed to designated primary ground water flow systems. Contingency actions will be undertaken in the event that impacts are observed on other designated area water bodies as a result of Crandon Project dewatering activities.

Although the facilities for the mitigation actions will be constructed prior to the start of dewatering activities, the actual discharges will not begin until specified criteria indicate that supplementary water flow to the described surface waters is required. The discharge for the contingency actions are also controlled by a set of specified criteria. The criteria that control the eleven discharges (004-1 through 004-11) described in this section include lake or spring levels or stream flow rates as measured at designated sites. These criteria are described in detail in "High Capacity Well Approval Applications" (Exxon Minerals Company, April 1986) and are not restated in this permit application.

Item 26. Additional Information (continued)

Item 203. Detailed information on the contingency mitigation is described in "High Capacity Well Approval Applications" (Exxon Minerals Company, April 1986).

Item 206a. The locations of the eleven discharges covered by this permit section are shown in Section I, Figure 1 of this Addendum. They are also shown in more detail in Figure 004-1 and Figures 004-3 through 004-12.

Item 213a. MITIGATION ACTIONS

Described below are the mitigation actions involving water discharge to surface waters. The locations of all mitigation facilities are presented in Figure 004-1. Mitigation actions are summarized in Table 1. See Figure 004-2 for a representation of a typical discharge structure.

Hoffman Spring/Creek System

The discharge to Hoffman Spring/Creek [004(1)] will be from well C-1 initially capable of delivering 130 gpm of pumped ground water. The locations of the well, pipeline and discharge structure are shown in Figure 004-3. This discharge structure and the other structures for the mitigation and contingency actions will include mechanisms to aerate the ground water supplements prior to discharge.

Item 26. Additional Information (continued)

Item 231a. (continued)

TABLE 1

MITIGATION ACTIONS

DISCHARGE 004	WATER BODY	MITIGATION WELL NUMBER	MITIGATION SUPPLEMENT (GPM)
1	Hoffman Spring/Creek	C-1	130
2	Martin Spring/Creek 11-4	C-5	30
3	Upper Pickerel Creek	C-6	110
4	Skunk Lake	NA[a]	2 to 115[b]

[a]NA = Not applicable.

[b]Based on EMC impact projections and DNR impact projections.

Item 26. Additional Information (continued)

Item 213a. Hoffman Spring/Creek System (continued)

(continued) The supplement to the Hoffman Spring/Creek system will range from 50 to 130 gpm depending on the systems flow rate. If the 130 gpm supplement does not maintain the systems designated flow, additional supplement capacity will be installed and up to 250 gpm will be pumped as necessary.

Martin Spring/Creek 11-4 System

The discharge to Martin Spring [004(2)] will be from well C-5 initially capable of delivering 130 gpm of pumped ground water. The locations of the well, pipeline, and discharge structure are shown in Figure 004-4.

A supplement of 30 gpm will be added to Martin Spring as necessary to maintain the system's designated flow rate. If the 30 gpm supplement does not maintain the system's flow, additional supplement capacity will be installed and up to 180 gpm will be pumped as necessary.

Upper Pickerel Creek

The discharge to Upper Pickerel Creek [004(3)] will be from well C-6 initially capable of delivering 110 gpm of pumped ground water. The locations of the well, pipeline and discharge structure are shown in Figure 004-5.

Item 26. Additional Information (continued)

Item 213a. Upper Pickerel Creek (continued)

(continued) A supplement of 110 gpm will be added to Upper Pickerel Creek as necessary to maintain the system designated flow rate. If the 110 gpm supplement does not maintain the creek's designated flow rate, additional supplement capacity will be installed and up to 450 gpm will be pumped as necessary.

Skunk Lake

The discharge to Skunk Lake [004(4)] will be based on lake level. The supplement will range from 2 to 115 gpm depending on lake level. The locations of the pipeline and the discharge structure are shown in Figure 004-6. The supplement will consist of ground water from the mine ground water intercept system or ground water from the potable water tank (water from well WS-1) blended with treated mine water to meet the DNR effluent standards for Skunk Lake.

The treated mine water has been described in detail in Section II, Discharge 001 of the December 1985 Application. This section includes the treatment methods to be used and the range of discharge composition expected.

Item 26. Additional Information (continued)

Item 213a. (continued) Contingency Ground Water Supplementation Option

If the water supplement to Hoffman Spring/Creek, Upper Pickerel Creek and/or Skunk Lake provided by wells, C-1, C-6 and WS-1 create unacceptble secondary impacts, EMC may, at its option, pump ground water to these water bodies from the mine ground water intercept system in addition to or in substitution for ground water from these wells. Such optional supplementation may be provided by way of pipelines to Hoffman Spring/Creek and Upper Pickerel Creek from the mine/mill site area to existing discharge structures.

The mine ground water intercept system is described in the "High Capacity Well Approval Applications" (Exxon Minerals Company, April 1986). The water from this system will be of ambient ground water quality.

CONTINGENCY ACTIONS

The locations of all contingency wells and structures are presented in Figure 004-7. The contingency actions are summarized in Table 2.

The Plan for the streams (Creek 12-9, Swamp Creek, and Hemlock Creek) consists of installing and operating four wells located where the aquifer is large enough to provide sufficient water for supplementation. As described above in the Contingency Ground Water

Item 26. Additional Information (continued)

Item 213a. (continued)

TABLE 2

CONTINGENCY ACTIONS

DISCHARGE 004-	WATER BODY	CONTINGENCY WELL NUMBER	CONTINGENCY SUPPLEMENT (GPM)
5	Creek 12-9	C-2	250
6	Swamp Creek Upstream from the Access Road	C-4 or mine ground water intercept system	140
7	Swamp Creek Downstream from the Access Road	C-3 or mine ground water intercept system	120
8	Hemlock Creek	WS-2 or mine ground water intercept system	290
9	Little Sand Lake	-[a]	305 to 740[b]
10	Duck Lake	-[a]	6 to 12[b]
11	Deep Hole Lake	-[a]	20 to 180[b]

[a]Supplement to be provided from mine ground water intercept system, potable water tank (well WS-1) or well (WS-2).

[b]Based on EMC impact projections and DNR impact projections.

Item 26. Additional Information (continued)

Item 213a. CONTINGENCY ACTIONS (continued)

(continued) Supplementation Option for the Mitigation Activities (the use of ground water from the mine ground water intercept system) may also be optionally used to supplement Swamp Creek and Hemlock Creek. This would be done to minimize secondary impacts caused by wells C-3, C-4 and WS-2 as described in the "High Capacity Well Approval Applications" (April 1986).

The Plan for the lakes consists of installing pipelines to provide ground water supplements from the potable water tank (well WS-1), well WS-2 and/or the mine ground water intercept system.

Creek 12-9

The discharge to Creek 12-9 [004(5)] will be from well C-2 which will be capable of delivering 250 gpm of pumped ground water. The locations of the well, pipeline, and discharge structure are shown in Figure 004-8. The flow rate of the supplement will be up to 250 gpm when operating and will be based on the creek flow rate.

Swamp Creek Upstream from Proposed Access Road

The discharge to Swamp Creek upstream from the proposed access road [004(6)] will be from well C-4, which will be capable of delivering 140 gpm of pumped ground water. The locations of the well, pipeline and discharge structure are shown in Figure 004-9. The flow rate

Item 26. Additional Information (continued)

Item 213a. Swamp Creek Upstream from Proposed Access Road (continued)

(continued) of the supplement will be 140 gpm when operating and will be activated or shut off based on the stream flow.

Swamp Creek Downstream from the Proposed Access Road

The discharge to Swamp Creek downstream from the proposed access road [004(7)] will be from well C-3, which will be capable of delivering 120 gpm of pumped ground water. The locations of the well, pipeline, and discharge structure are shown in Figure 004-10. The flow rate of the supplement will be 120 gpm when operating and will be activated or shut off based on the stream flow rate.

Hemlock Creek

The discharge to Hemlock Creek [004(8)] will be from well WS-2 which will be capable of delivering 290 gpm of pumped ground water. The locations of the well, pipeline and discharge structure are shown in Figure 004-11. The flow rate of the supplement will be 290 gpm when operating and will be activated or shut off based on the creek flow rate.

Little Sand Lake

The discharge to Little Sand Lake [004(9)] when operating will range from 305 to 740 gpm depending on the lake level. The locations of the pipeline and discharge structure are shown in Figure 004-12.

Item 26. Additional Information (continued)

Item 213a. Little Sand Lake (continued)

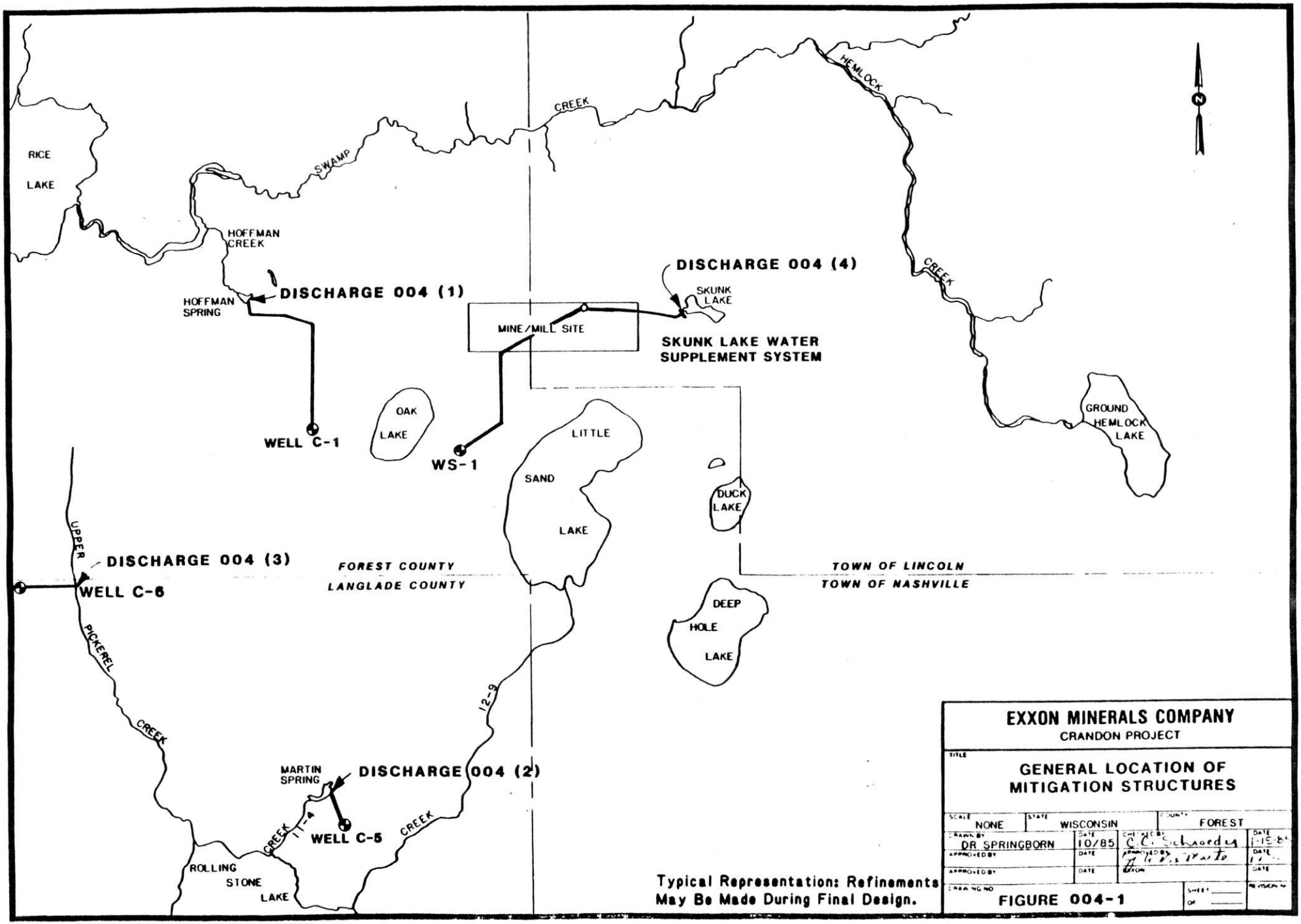
(continued) The buried pipeline will be constructed so as to enable ground water to be pumped from the potable water tank and/or the mine ground water intercept system to the discharge structure.

Duck Lake

The discharge to Duck Lake [004(10)] when operating will range from 6 to 12 gpm depending on the lake level. The location of the pipeline and discharge structure are shown in Figure 004-12. The buried pipeline will be constructed so as to enable ground water to be pumped from the potable water tank and/or the mine ground water intercept system to the discharge structure.

Deep Hole Lake

The discharge to Deep Hole Lake [004-(11)] when operating will range from 20 to 180 gpm depending on the lake level. The location of the pipeline and discharge structure are shown in Figure 004-12. The buried pipeline will be constructed so as to enable ground water to be pumped from the potable water tank and/or the mine ground water intercept system to the discharge structure.

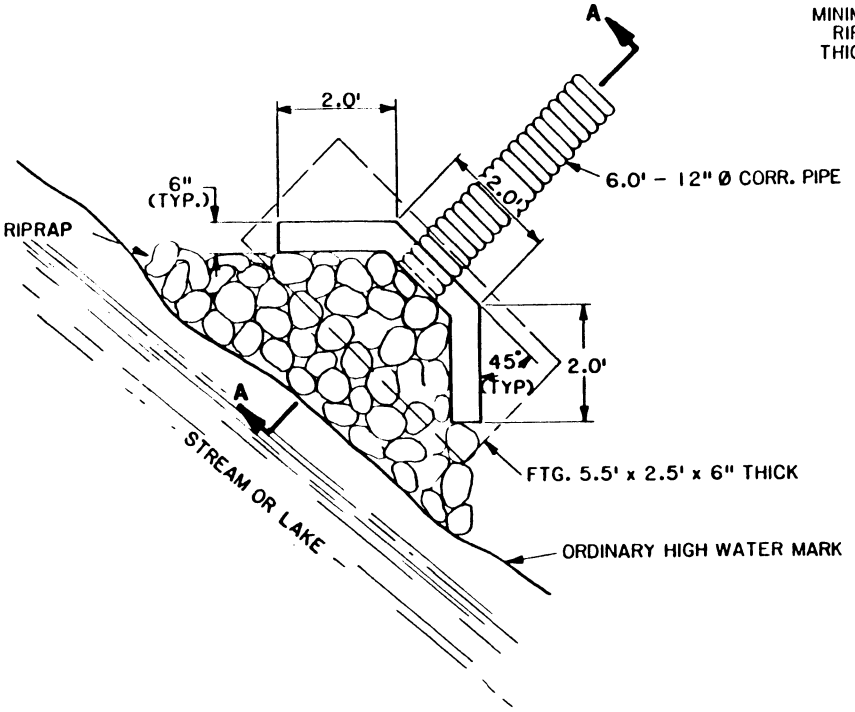


EXXON MINERALS COMPANY
CRANDON PROJECT

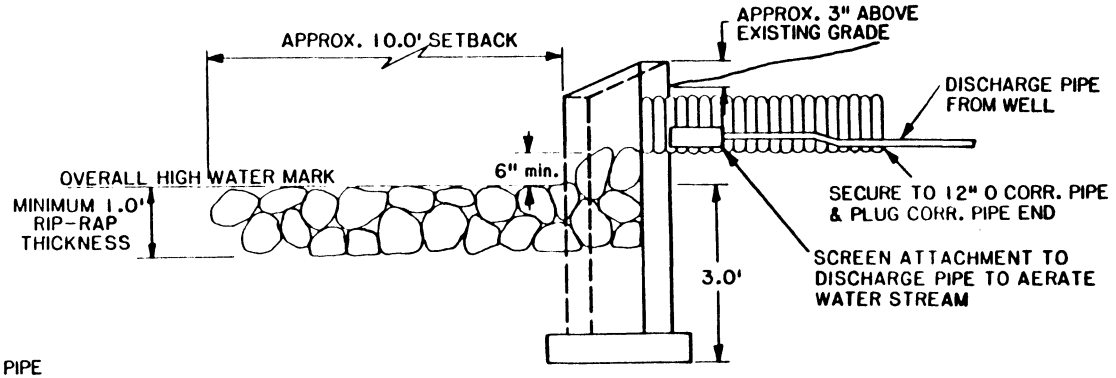
TITLE
GENERAL LOCATION OF MITIGATION STRUCTURES

SCALE NONE	STATE WISCONSIN		COUNTY FOREST	
DRAWN BY DR SPRINGBORN	DATE 10/85	CHECKED BY C.C. Schaeffer		DATE 1-15-86
APPROVED BY	DATE	APPROVED BY		DATE
APPROVED BY	DATE	EXXON		DATE
DRAWING NO. FIGURE 004-1		SHEET ___ OF ___		REVISION NO.

Typical Representation: Refinements May Be Made During Final Design.



TYPICAL DISCHARGE HEADWALL



SECTION A-A
TYPICAL DISCHARGE HEADWALL

0 2 4 6
SCALE IN FEET

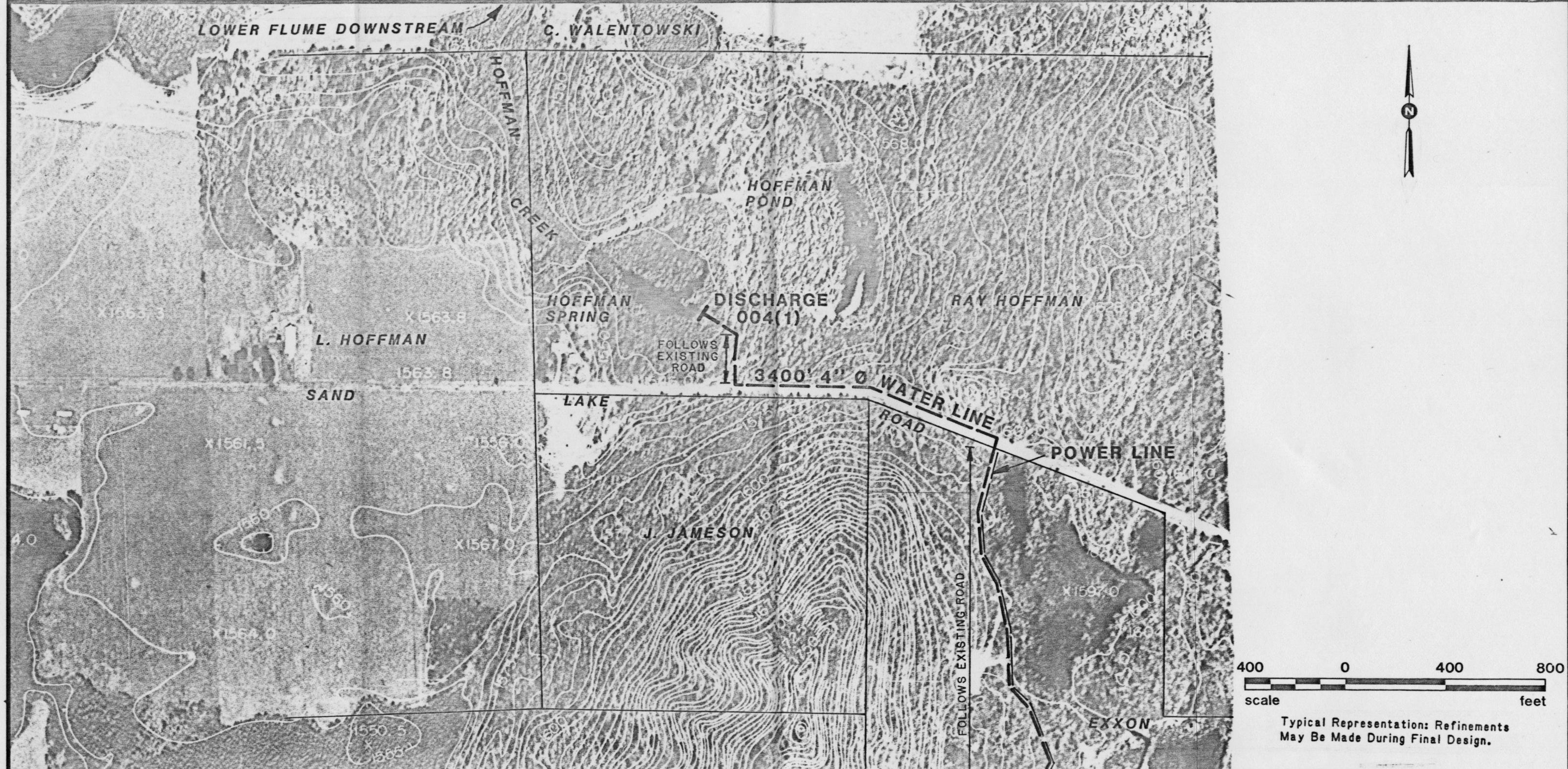
REVISED	DATE	BY	DESCRIPTION

Typical Representations: Refinements May Be Made During Final Engineering

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
TYPICAL DISCHARGE STRUCTURE FOR STREAMS, SPRINGS & LAKES

SCALE SHOWN	STATE WISCONSIN	COUNTY FOREST	
DRAWN BY DR SPRINGBORN	DATE 11/85	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY C.C. Schroeder	DATE 11/13/85
APPROVED BY	DATE	EXXON D.C. Mac	DATE 11/11/85
DRAWING NO FIGURE 004-2		SHEET OF	REVISION NO



Typical Representation: Refinements May Be Made During Final Design.

EXXON MINERALS COMPANY

CRANDON PROJECT

TITLE **CONTINGENCY SYSTEM FOR HOFFMAN SPRING & HOFFMAN CREEK**

SCALE SHOWN	STATE WISCONSIN	COUNTY FOREST	
DRAWN BY DR SPRINGBORN	DATE 8/85	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO **FIGURE 004-3**		SHEET ___ OF ___	REVISION NO

K. MIHALKO

LANGLADE COUNTY

STATE OF WISCONSIN

DISCHARGE
004(2)

MARTIN
SPRING

1250' 2" Ø
WATER LINE

(FOLLOWS EXISTING ROAD)

VAKAYSHUN

STAFF GAGE

POWER LINE
(BURIED)

WELL C-5

OWENS-ILLINOIS

CREEK

HARLEY JOHNSON

ROLLING

STONE

LAKE

12-9

CREEK

Typical Representation: Refinements
May Be Made During Final Design.

400 0 400 800
scale feet

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
CONTINGENCY SYSTEM FOR MARTIN SPRING & CREEK 11-4

SCALE	STATE	COUNTY
SHOWN	WISCONSIN	LANGLADE

DRAWN BY	DATE	CHECKED BY	DATE
DR SPRINGBORN	8/85	C.C. Schroeder	1-16-86
APPROVED BY	DATE	APPROVED BY	DATE
		G.W. DeMarte	1/16-87
APPROVED BY	DATE	EXXON	DATE

DRAWING NO
FIGURE 004-4

SHEET ____ OF ____

REVISION NO

POWER LINE APPROX. 2600'

WELL C-6

2600' 4" Ø WATER LINE

(FOLLOWS EXISTING ROAD)

FOREST COUNTY
LANGLADE COUNTY

DISCHARGE
004(3)

N

UPPER PICKEREL CREEK

STATE OF WISCONSIN

LANGLADE COUNTY

(STAFF GAGE DOWNSTREAM AT SG 19 LOCATION)

1699.0
1683.0
1696.0
1694.0
1683.0
1691.3
1637.0
1627.0
1626.0
1650.5
1641.0
1638.0
1548.0
1547.5

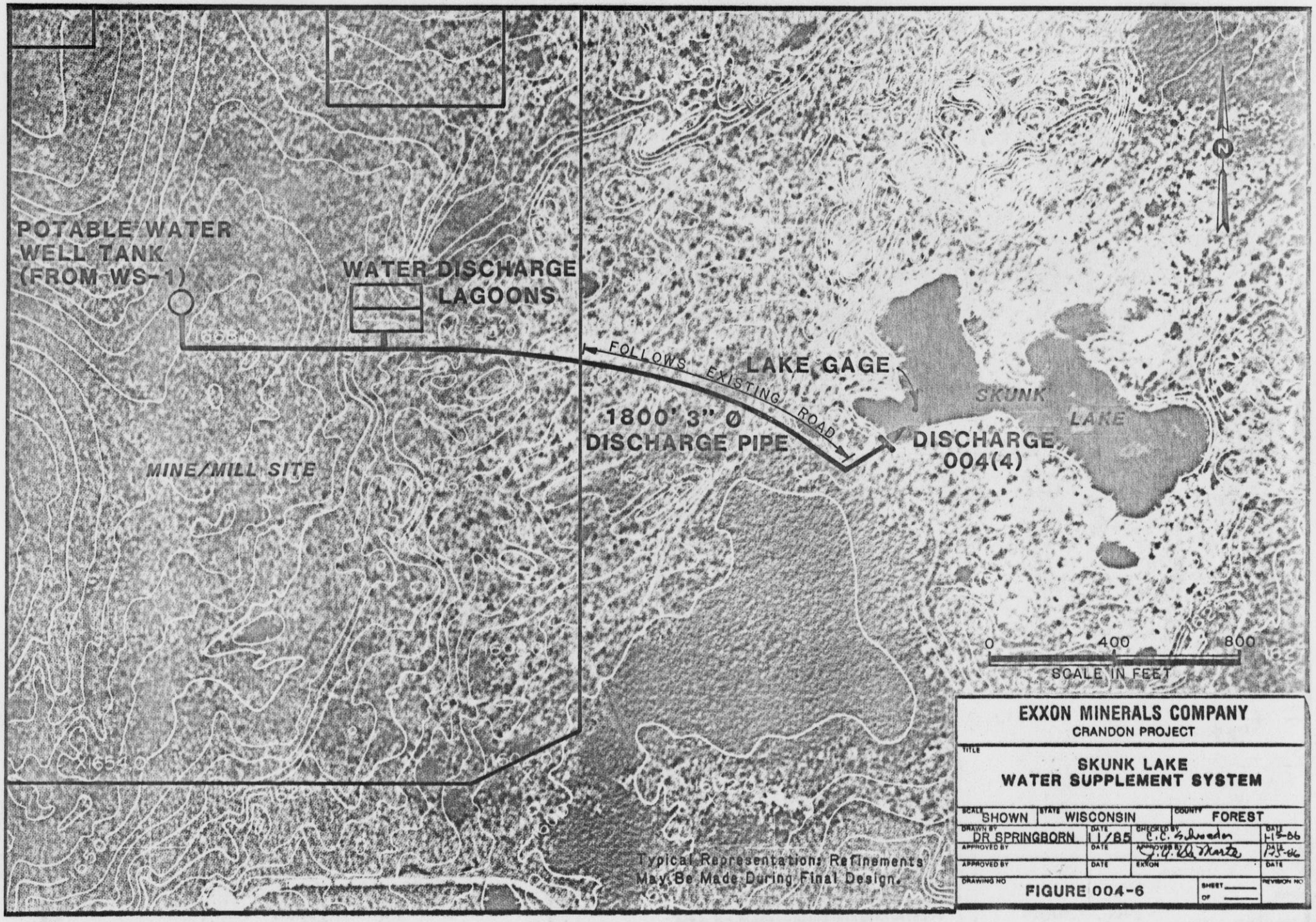
Typical Representation: Refinements May Be Made During Final Design.

400 0 400 800
scale feet

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
CONTINGENCY SYSTEM FOR UPPER PICKEREL CREEK

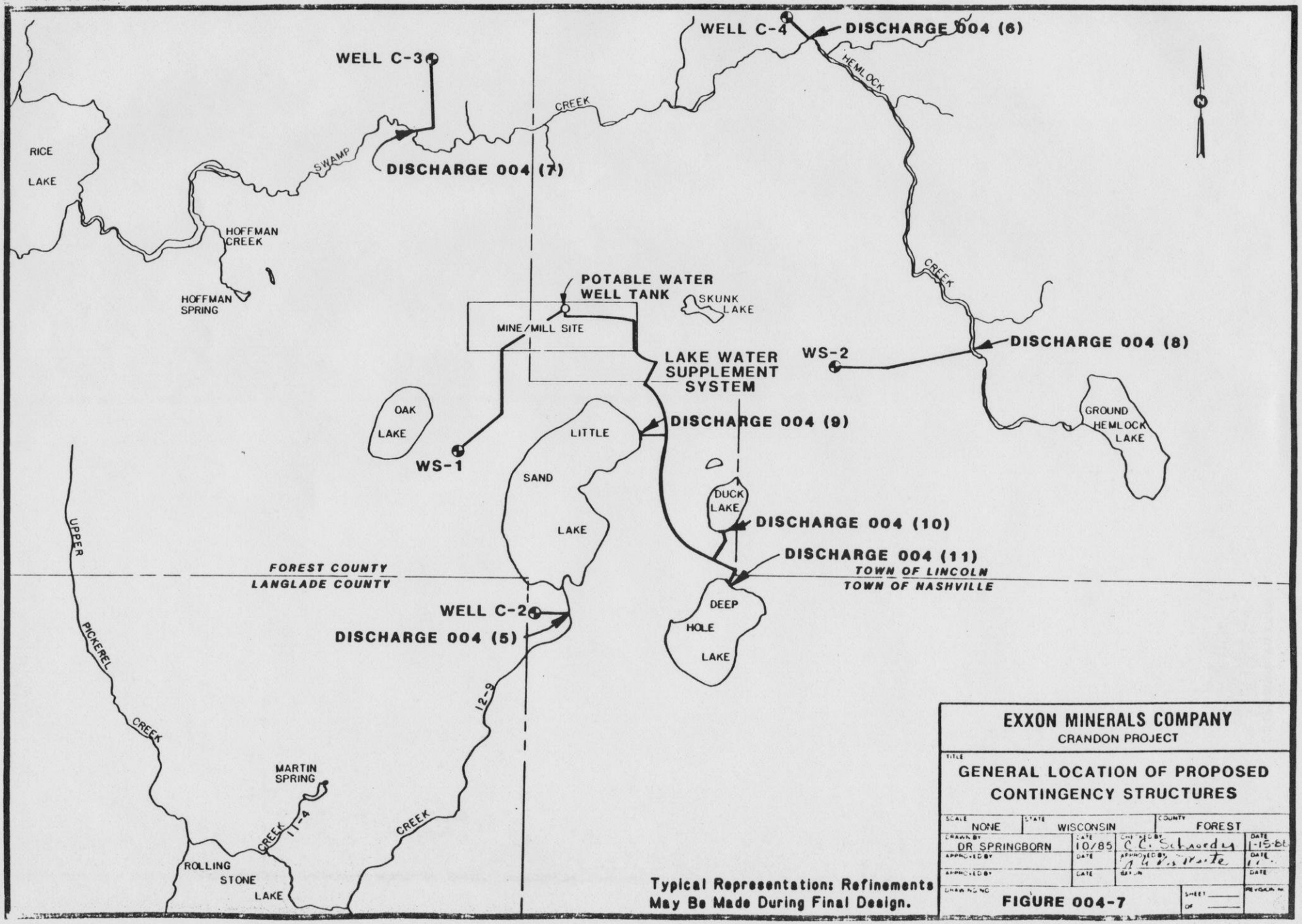
SCALE SHOWN	STATE WISCONSIN	COUNTY LANGLADE	
DRAWN BY DR SPRINGBORN	DATE 4/86	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO. **FIGURE 004-5**		SHEET ___ OF ___	REVISION NO.

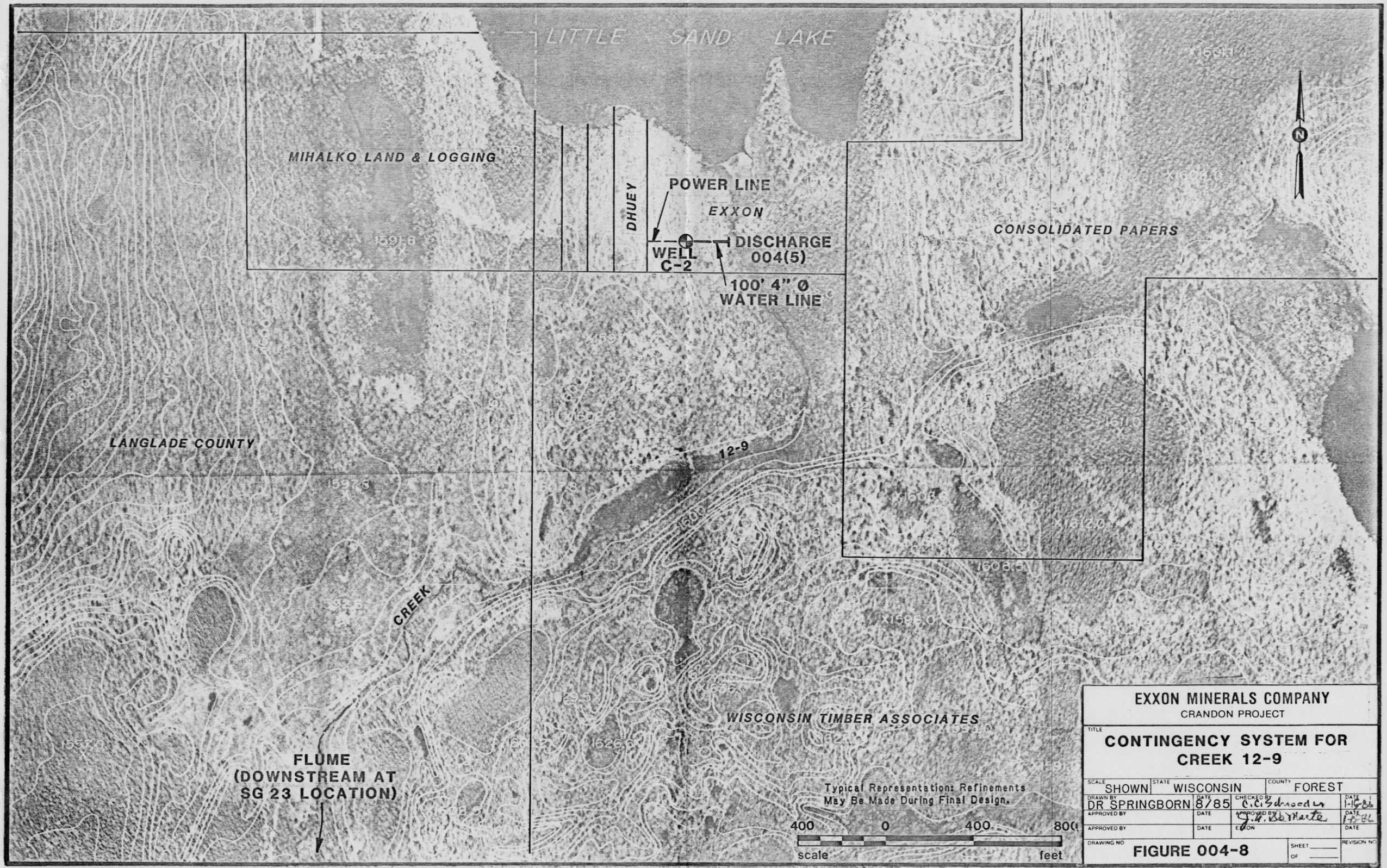


EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
SKUNK LAKE
WATER SUPPLEMENT SYSTEM

SCALE	STATE	COUNTY	
SHOWN	WISCONSIN	FOREST	
DRAWN BY: DR SPRINGBORN	DATE: 11/85	CHECKED BY: C.C. Schroeder	DATE: 1-15-86
APPROVED BY	DATE	APPROVED BY: J.G. Mantz	DATE: 1-15-86
APPROVED BY	DATE	EXXON	DATE
DRAWING NO: FIGURE 004-6		SHEET ___ OF ___	REVISION NO

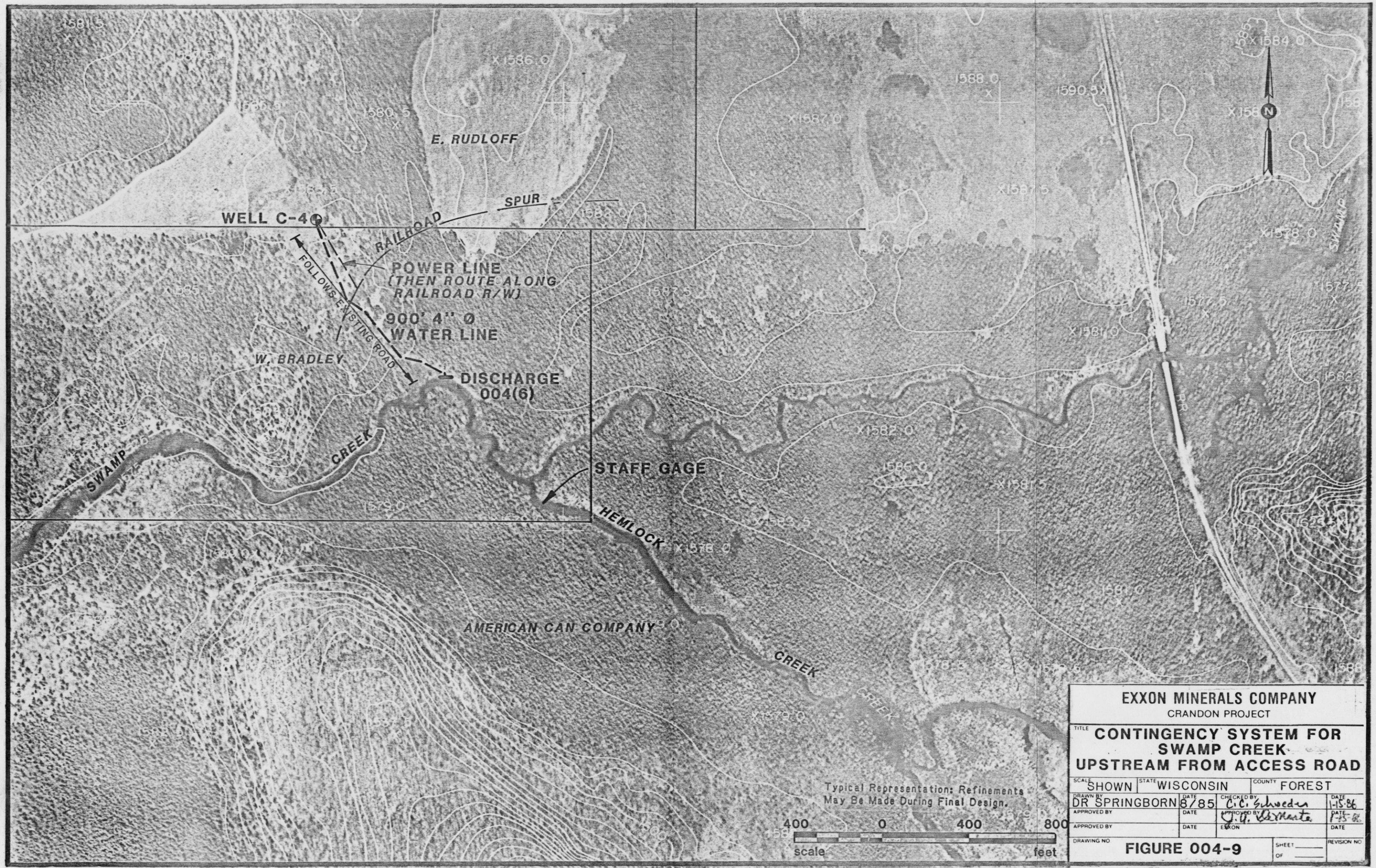

WELL C-3
WELL C-4
DISCHARGE 004 (6)
HEMLOCK
CREEK
RICE
LAKE
SWAMP
DISCHARGE 004 (7)
HOFFMAN
CREEK
HOFFMAN
SPRING
POTABLE WATER
WELL TANK
SKUNK
LAKE
MINE/MILL SITE
LAKE WATER
SUPPLEMENT
SYSTEM
WS-2
DISCHARGE 004 (8)
GROUND
HEMLOCK
LAKE
OAK
LAKE
WS-1
LITTLE
SAND
LAKE
DISCHARGE 004 (9)
DUCK
LAKE
DISCHARGE 004 (10)
DISCHARGE 004 (11)
TOWN OF LINCOLN
TOWN OF NASHVILLE
FOREST COUNTY
LANGLADE COUNTY
WELL C-2
DISCHARGE 004 (5)
DEEP
HOLE
LAKE
UPPER
PICKEREL
CREEK
MARTIN
SPRING
CREEK
11-4
CREEK
12-9
ROLLING
STONE
LAKE
Typical Representation: Refinements
May Be Made During Final Design.
EXXON MINERALS COMPANY
CRANDON PROJECT
GENERAL LOCATION OF PROPOSED
CONTINGENCY STRUCTURES
SCALE NONE
STATE WISCONSIN
COUNTY FOREST
DRAWN BY DR SPRINGBORN
DATE 10/85
APPROVED BY C.C. Schaerdig
DATE 1-15-86
APPROVED BY
DATE
APPROVED BY
DATE
DRAWING NO.
FIGURE 004-7
SHEET
OF
REVISION NO.



EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
CONTINGENCY SYSTEM FOR CREEK 12-9

SCALE SHOWN	STATE WISCONSIN		COUNTY FOREST		
DRAWN BY DR SPRINGBORN	DATE 8/85	CHECKED BY C.C. Sheedy	DATE 1-15-86		
APPROVED BY	DATE	APPROVED BY J.H. DeMarte	DATE 1-15-86		
APPROVED BY	DATE	EXXON	DATE		
DRAWING NO **FIGURE 004-8**	SHEET ___ OF ___	REVISION NO			



EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE **CONTINGENCY SYSTEM FOR SWAMP CREEK UPSTREAM FROM ACCESS ROAD**

SCALE SHOWN	STATE WISCONSIN		COUNTY FOREST		
DRAWN BY DR SPRINGBORN	DATE 8/85	CHECKED BY C.C. Schweden	DATE 1-15-86		
APPROVED BY	DATE	APPROVED BY C.H. Clements	DATE 1-15-86		
APPROVED BY	DATE	EXXON	DATE		
DRAWING NO **FIGURE 004-9**		SHEET ___ OF ___	REVISION NO		

(APPROX. 2600' FROM C-3 TO END OF SHERMAN LANE)

POWER LINE

WELL C-3

FOLLOWS EXISTING ROAD

MIHALKO LAND & LOGGING (LAND PURCHASE OPTION)

MIHALKO LAND & LOGGING (MINING LEASE)

1500' 4" Ø WATER LINE

SWAMP

DISCHARGE 004(7)

STAFF GAGE (FOR WELL C-4)

CREEK

MIHALKO LAND & LOGGING

EXXON

N

Typical Representation: Refinements May Be Made During Final Design.

400 0 400 800

scale feet

EXXON MINERALS COMPANY

CRANDON PROJECT

TITLE **CONTINGENCY SYSTEM FOR SWAMP CREEK DOWNSTREAM FROM ACCESS ROAD**

SCALE SHOWN	STATE WISCONSIN		COUNTY FOREST		
DRAWN BY DR SPRINGBORN	DATE 8/85	CHECKED BY C.C. Schroeder	DATE 1-15-86		
APPROVED BY	DATE	APPROVED BY J. L. Bermanta	DATE 1-15-86		
APPROVED BY	DATE	EXXON	DATE		
DRAWING NO **FIGURE 004-10**		SHEET ____ OF ____	REVISION NO.		

(STAFF GAGE LOCATED APPROX. 10,000ft
DOWNSTREAM FROM WS-2 DISCHARGE
NEAR SWAMP CREEK)

FOREST COUNTY

HEMLOCK CREEK

EXXON

CONSTRUCTION SUPPORT AREA

RECLAIM POND

MINE REFUSE DISPOSAL FACILITY

DISCHARGE 004(8)

2400' 6" Ø WATER LINE

WS-2

F. RICHTER

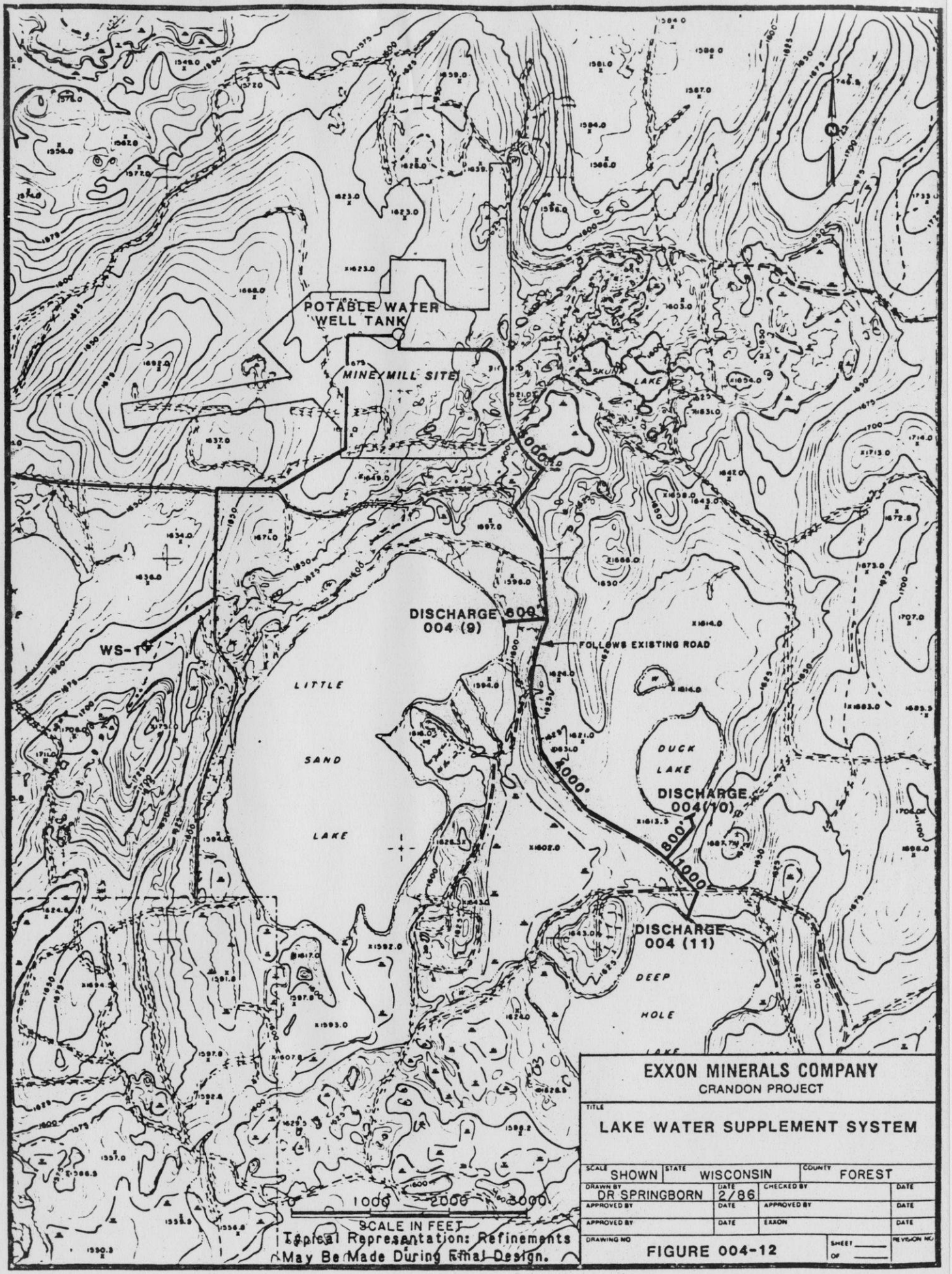
Typical Representation: Refinements May Be Made During Final Design.

400 0 400 800
scale feet

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
CONTINGENCY SYSTEM FOR HEMLOCK CREEK

SCALE SHOWN	STATE WISCONSIN		COUNTY FOREST
DRAWN BY DR SPRINGBORN	DATE 2/86	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO **FIGURE 004-11**		SHEET OF	REVISION NO



EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
LAKE WATER SUPPLEMENT SYSTEM

SCALE SHOWN	STATE WISCONSIN		COUNTY FOREST		
DRAWN BY DR SPRINGBORN	DATE 2/86	CHECKED BY	DATE		
APPROVED BY	DATE	APPROVED BY	DATE		
APPROVED BY	DATE	EXXON	DATE		
DRAWING NO FIGURE 004-12		SHEET ___ OF ___	REVISION NO.		