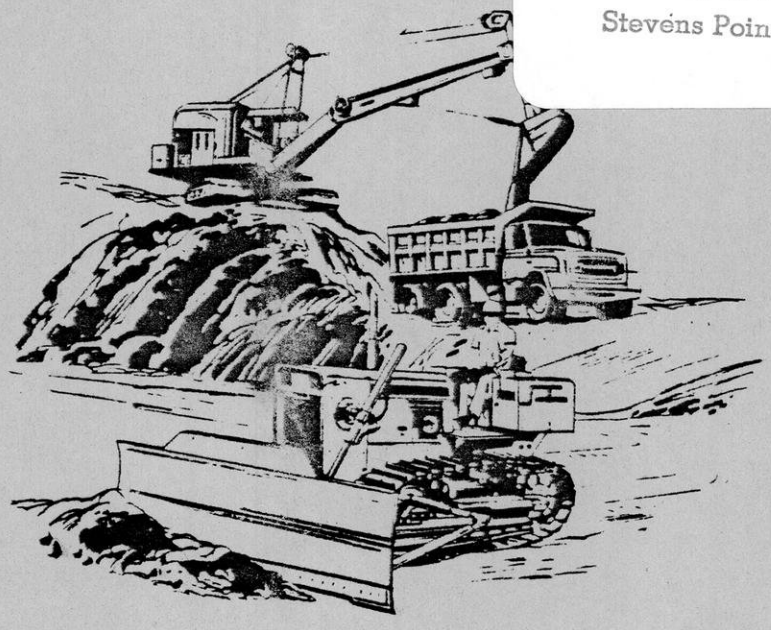
EIR chapter 1: Construction of waste disposal facilities, Crandon Project. 1982

Minneapolis, MN: INDECO, Inc., 1982

CONSTRUCTION OF WASTE DISPOSAL FACILITIES

EIR CHAPTER 1

CRANDON PRO



Prepared for

EXXON

by

indeco

EXXON MINERALS COMPANY

EIR CHAPTER 1

CONSTRUCTION OF WASTE DISPOSAL FACILITIES

CRANDON PROJECT

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September 1982

FIGURES AND TABLES

1.3.1 Schedule

Construction of the waste disposal facilities will be staged over a thirty-three year period to correspond with tailings production from the mine. The earthwork operations are divided into six phases of work over the thirty-three year period. The length of construction in each phase varies from two to four years, with periods of up to several years between phases in which no major earthwork operations are conducted. Table 1 outlines the six construction phases and activities. Figure 1 presents a continuous time line over the thirty-three year life of the facility, with the six construction phases indicated. Detailed construction activity schedules are presented in Figures 2 through 7 which describe the specific earthwork operations required for each phase of construction.

1.3.2.2.4 Waste Rock and Preproduction Ore

Waste rock generated both before and during the production of ore will be stored or disposed of in a common waste rock embankment section located between the tailings ponds (see Figure 8). During Phase 1, the bentonite liner, underdrain and filter will be constructed in the area in which this waste rock embankment will be located. The liner system will be completed before any significant waste rock production begins.

As shown in Figure 8, the subgrade for the waste rock embankment is sloped to drain to two points on the west side of the area. A toe ditch and berm will be constructed around the perimeter of the area to contain runoff and direct the drainage to the two discharge points. A temporary retention pond (GP Pond) will be constructed during Phase 1 to store the runoff from the waste rock embankment. As shown on Figure 8, this pond is located such that runoff will be gravity fed into the pond at two points. A 20 mil PVC liner will be installed on the pond bottom to prevent seepage out of the pond. The PVC liner will be covered by a 0.6m (2 ft.) layer of protective fill. This pond has a storage capacity of approximately 39,000 m^3 (50,000 yd^3), which provides storage for the equivalent of one year's net annual precipitation gain (precipitation minus pond evaporation) of approximately 178mm (7 in.) plus the 10-year, 24-hour storm which is approximately 91mm (3.6 in.)

Phase	Years	Construction Activities
1	1985-86	Construct Reclaim Pond R1 Construct Waste Rock Storage Area GP
2	1988-89	Construct Reclaim Pond R2 Construct Tailings Pond T1
3	1993-95	Construct Tailings Pond T2 Reclaim Tailings Pond T1
4	2000-02	Construct Tailings Pond T3 Place Traffic Mat on Tailings Pond T2
5	2006-09	Construct Tailings Pond T4 Reclaim Tailings Pond T3
6	2016-17	Reclaim Tailings Pond T4 Reclaim Tailings Pond T2 Final Site Reclamation

TABLE 1 - PHASES OF EARTHWORK CONSTRUCTION, WASTE DISPOSAL FACILITIES

This temporary pond will remain in place for approximately three years, until tailings pond T1 is constructed during Phase 2 construction. During this time, if the temporary pond approaches its storage capacity, the water will be pumped out of the pond and placed in reclaim pond R1. When the temporary pond is removed, the water will also be emptied into reclaim pond R1. Once pond T1 is completed, all runoff from the waste rock embankment will drain into T1.

1.3.2.4 Waste Disposal Facilities Site Preparation

Site preparation is required in the first four phases of the waste disposal facilities construction. Clearing and grubbing will be done on a phase by phase basis, such that only the area actually required for the earthwork operations in a particular phase is cleared and grubbed. The remainder of the site will be disturbed as little as possible. Figure 9 outlines the areas to be cleared and grubbed for each phase.

Marketable timber will be cut and hauled offsite. Stumps, brush and slash will be windrowed, piled and burned. The waste ash will be hauled to an area outside of the ponds and buried in a disposal pit.

Based on available site data and past experience in similar areas, once the area is cleared and grubbed it is unlikely that any topsoil will remain. However, if significant topsoil is present, it will be stockpiled for future use.

In Phase 1, additional site preparation is required to: 1) construct the waste rock haul road from the mill to the tailings ponds; 2) install a chain-link fence around the perimeter of the site; 3) construct a contractor's construction support area near the ponds; 5) install storage silos adjacent to the mill for the powdered bentonite used in the liner; 6) upgrade the haul road from the Woodlawn rail siding to the construction support area;

7) upgrade the Woodlawn rail siding. In Phases 2 through 4 required site preparation is generally limited to clearing and grubbing. In Phases 5 and 6, no significant site preparation work is required.

The waste rock haul road from the mill to the tailings ponds will be a permanent feature for the life of the mine. The haul road will be gravel surfaced, apprximately 60 ft. wide with safety berms or pipelines along the shoulder. The road will be watered on an as-needed basis to control dust. The waste rock haul road will be used as the primary access road to the ponds for all construction equipment and personnel, as well as the haul route for the off-road trucks taking waste rock from the mine to the waste rock disposal area. It is anticipated that a culvert will be needed to maintain drainage patterns in the area of Skunk Lake. Other culverts will be installed as needed during the road construction. Drainage and erosion control are discussed in more detail in Section 1.3.4.

The construction support area is also a long term feature of the waste disposal facility, and is described in detail in Section 1.3.2.13.

The haul road from the Woodlawn rail siding to the construction support area will be used only during Phase 1 to transport powdered bentonite via semi-trailer. Approximately 3 miles of the 6 mile route requires upgrading. The upgrading will be limited to surface grading and compaction as required.

The Woodlawn rail siding will also be used only during Phase 1. Surface grading is all that is required to upgrade the siding.

In all phases of construction, the earthwork operations will start as early as possible in the spring. Therefore, it is probable that some ditching and culvert installations will be required in each phase to control surface drainage.

Work schedule, types and number of construction equipment, noise and emissions for the site preparation work are discussed in later sections.

1.3.2.5 Waste Disposal Facilities Construction

Construction of the waste disposal facilities entails a major earthwork operation. Construction has been scheduled such that completion of each of the tailings ponds occurs just prior to the time at which it is required for disposal of tailings. The limited construction season in the area requires the mobilization of a relatively large equipment spread and work force to meet the schedule in each phase of the work. Equipment and manpower requirements by phase are given in the Construction Equipment Schedules and Construction Manpower Schedules, Figures 10 through 15 and Figures 16 through 21 respectively. An equipment list is given in Table 2. Major earthwork operations, some or all of which are required in each phase of construction, are described below.

Excavate to Embankment or Stockpile

Excavation will be done by scraper and hauled either directly to the embankment for placement and compaction or to a stockpile area for later use. The bottom line in Figure 1, entitled "Cumulative Till Balance", indicates the size of the stockpile required in order to balance the earthwork quantities at the end of Phase 6 without borrowing a large quantity of fill. The maximum required stockpile size by phase is summarized below:

Phase	Stockpile m^3	Stockpile yd^3
1	0	0
2	0	0
3	1,405,958	1,841,804
4	1,139,033	1,492,133
5	2,767,891	3,625,937
6	1,558,364	2,041,457

A portion of the excavated material will be stockpiled in the construction support area for use in processing liner and drain material. The remainder will be placed in a long term stockpile located east of the construction support area during Phases 3 and 4, and on top of tailings pond T2 during

TABLE 2 - EQUIPMENT LIST

Description	Model	Engine	Horsepower
Scraper	CAT 631	CAT 3408 Diesel	450
Water Wagon	CAT 631	CAT 3408 Diesel	450
Bull Dozer	CAT D9	CAT 3412 Diesel	460
Bull Dozer	CAT D8	CAT D342	300
Bull Dozer	CAT D6	CAT 3306 Diesel	140
Wheel Tractor	CAT 824	CAT 3406 Diesel	310
Front End Loader	CAT 988	CAT 3408 Diesel	375
Front End Loader	CAT 966	CAT 3306 Diesel	200
Crane 75 T	AMER 5530 TM	GM DD 4-7IN Diesel GM DD 6171N Diesel	115 Upper 238 Carrier
Crane 25 T	Grove RT 625	Cummins V504 Diesel	156
Motor Grader	CAT 16 G	CAT 3406 Diesel	250
Motor Grader	CAT 14 G	CAT 3306 Diesel	180
Excavator	CAT 235	CAT 3306 Diesel	195
Backhoe	J.D. 410	JD 4-219D Diesel	62
Compactor	DYNAPAC CA-25	CAT 3208 Diesel	125
Off Road Truck	TEREX 33-07 (40 ton)	GM DD 12V-71T Diesel	493
Belly Dump Truck and Trailer	Ford LT-9000 Tractor	240 Cummins Diesel	240
Dump Truck Tandems	Ford LT-9000	240 Cummins Diesel	240
PD Trailer and Tractor	Ford LT-9000 Tractor	240 Cummins Diesel	240
Flatbed Truck	International	185T	185
Pickup Truck	Chev 3/4 Ton	GM 305 V8 Gas JD 6 CYL Diesel	180 110 (Hydroseeder)
Hydroseeder CAT Powered Tandem Truck	-	CAT 3208 Diesel	210 (Truck)
Tractor	J.D. 4240	JD 6 CYL Diesel	110
Tractor	J.D. 2640	JD 4 CYL Diesel	65
LoBoy Trailer and Tractor 60T	GMC 6000	CAT D3406 Diesel	326
Crushing and Processing Plant	See Section 1.3.2.13		

TABLE 2 - EQUIPMENT LIST (Cont'd)

Description	Model	Engine	Horsepower
Batch Plant	See Section 1.3.2.13		
42" Conveyor	Universal	Electric	
Generator	335 KW	CAT D346 Diesel	
Generator	250 KW	CAT 3408 Diesel	385
Generator	90 KW	CAT 3304 Diesel	
Generator	30 KW	Homelite Diesel	61
15 HP Sump Pump			
Flowmaster Pump			
Power Ram Packer	Kelly 10KR7		
Power Auger			
Chain Saws	Homelite 925 24"	Homelite 5.0 Cu. In. 2 Cycle	3
Compressor 1200	CAT 1200 C.F.M.	CAT 3406 Diesel	325

Phases 5 and 6. For practical considerations the height of the stockpile will be limited to approximately 15m (50 ft.) or less. The storage area required to stockpile 1,500,000m^3 (2,000,000 yd^3) at a maximum height of 15m (50 ft.) is approximately 25 acres.

Placement of the bentonite topseal and vegetative cover on tailings pond T2 will be delayed until Phase 6 in order to allow pond T2 to be used as a stockpile location during Phases 5 and 6. When pond T2 is filled with tailings, the traffic mat will be placed. The construction support area and long term stockpile will then be relocated on top of pond T2. In Phase 6 when the stockpile is depleted, the bentonite topseal and vegetative cover will be placed, completing the reclamation of Pond T2.

The excavation operation will be conducted using two or more equipment spreads at two shifts per day each. Due to the tight schedule, portions of the excavation will be completed early in order to allow subsequent operations such as liner and drain installation to proceed simultaneously, as indicated in Figures 2 through 7.

Process Glacial Till

A processing plant will be set up in the construction support area to produce the processed materials required for the mine backfill and underdrain system. The plant will be run on a two shifts per day basis. The processing operation is described in more detail in Section 1.3.2.13.

Install Bentonite Liner and Underdrain System - Tailings Ponds

Powdered bentonite will be shipped by enclosed rail car to the Woodlawn siding during Phase 1 and to the mill site during subsequent phases. A pneumatic unloading system will be used to transfer the bentonite from the rail car to a pressurized cement tanker ("PD" or pressure differential - positive displacement trailer). This unloading system is completely contained. No significant quantities of bentonite powder will be released to the atmosphere. After Phase 1, the bentonite may also be transferred

directly into the storage silos at the mill using a similar unloading system. The PD trailers will haul the bentonite to the batching plant in the construction support area, serving as portable storage silos. As the batching operation requires, the PD trailers will pneumatically discharge bentonite into an enclosed batching hopper. The liner material (minus 3/4" glacial till), bentonite and water will be mixed in a twin shaft pug mill. The bentonite-soil mix liner will then be hauled in tandem dump trucks to the pond for placement.

On completion of the excavation in a particular area, the subgrade will be brought to grade by setting grade stakes on a 25 ft. grid pattern for survey control. A tolerance of $\pm$ ½ in. on the subgrade and bentonite liner can then be obtained using conventional survey control as would be the case on a typical highway construction job.

Once the grade stakes are set and the subgrade meets the accepted tolerances, the bentonite liner will be placed. The liner material will be hauled by tandem dump trucks, dumped, spread by dozer and grader, and compacted to 95% of Standard Proctor. Loose lifts of 9-12 in. may be required to obtain a compacted layer 6 in. thick. The grade stakes will be left in place until the compaction equipment has completed its passes. The grade stakes will then be removed and the hole where the stake penetrated the bentonite liner will be filled and compacted by hand using a portable power ram packer.

Immediately following placement of the bentonite liner, the drain and filter material will be placed in order to protect the liner from damage. Separate equipment spreads will be used for the liner, drain and filter. The drain and filter will placed by end dumping from tandem dump trucks and pushing the drain or filter material out over the bentonite liner. In this manner the construction equipment operates on the drain or filter, and not directly on the liner. Installation of the underdrain pipe system will occur during the same time frame as placement of the liner, drain and filter.

Install Hypalon Liner, Cover and Riprap - Reclaim Ponds

The bentonite liner and non-carbonate sand will be placed in the reclaim ponds in the same manner as was described for the tailings ponds. The only difference is that belly dump semi trailers will be used to haul the non-carbonate sand from an off-site source.

Installation of the hypalon liner is generally a manual operation requiring only a front end loader to handle the rolls of hypalon liner material. Once the hypalon is in place, the sand cushion and protective cover will be placed by dumping and spreading ahead of the construction equipment such that the hypalon is protected by the 0.46m (1.5 ft) thick sand cushion or protective cover. An additional 0.3m (1 ft) thick layer of transition material will be placed on the upper portions of the reclaim pond slopes where riprap is required. The riprap, which consists of preproduction mine waste rock, will also be placed by a dump and spread operation. The 0.76m (2.5 ft) thick layer of sand cushion and transition material will provide adequate protection against damage to the hypalon liner.

Place Topseal and Reclamation Cover

A working mat will be constructed over the surface of the tailings by pushing in the top of the embankments with dozers. The required thickness of the working mat depends on the strength and consistency of the tailings. It is anticipated that a minimum 0.61m (2 ft) thickness will be required to efficiently operate equipment on the working mat. Additional fill will be obtained from the long term stockpile (scraper haul) to complete the working mat and establish the desired grade. The subgrade will be brought to grade and the bentonite seal placed in the same manner as was described for the bentonite liner on the pond bottom. As the bentonite seal is completed, the 0.91m (3 ft) thick cover layer will be placed over the seal. This cover material will also come from the long term stockpile. Grass cover will then be established by hydroseeding.

Dust and Water Control

Control of dust during the earthwork operations will be accomplished by sprinkling as necessary.

Control of runoff water, particularly when significant portions of the excavation and embankments have been completed, will require temporary sumps. Excess water will be pumped out of the interior of the pond into the surrounding natural drainage system. Surface drainage and erosion control is discussed in Section 1.3.4.

1.3.2.13 Construction Support Area

During Phase 1, a construction support area will be constructed in the area where tailings pond T4 will eventually be built. This construction support area will be used as a base of operations for the earthwork contractor during construction of the waste disposal facilities. Figures 22 and 23 presents a layout of this support area.

As shown in the figures, the support area will include:

1) Crushing and Processing Plant
2) Batching and mixing plant
3) Stockpiles of processed materials
4) Fuel storage including 2 - 10,000 gallon diesel tanks, 1 - 1,000 gallon gasoline tank, 2 - 500 gallon oil tanks. The storage area will be enclosed by a perimeter dike approximately 3 ft. in height to contain any potential spill.
5) Three semi trailers for small tool and miscellaneous equipment storage
6) 40 ft x 60 ft portable shop (pole building)
7) 8 ft x 30 ft quality control trailer with field soils lab
8) 12 ft x 70 ft contractor's office trailer
9) Equipment storage area
10) Generators during Phase 1

The support area is approximately 20 acres in size and will be constructed by first clearing and grubbing the area, then constructing an earthfill pad. As shown in Figures 22 and 23, the pad will be sloped to drain, with the runoff diverted into a retention pond. An overflow weir will be used to control flow out of the retention pond. The surface of the support area will consist of natural glacial till - no gravel will be placed. Dust will be controlled by sprinkling with water as needed.

During Phase 1, generators will be required to provide power for the processing and batch plants, the construction trailers and other power requirements. In subsequent phases, power will be available in the support area via a powerline from the mill.

Water is available to the construction support area from the existing 12 in. diameter well. A 500 GPM pump will be installed in the well during Phase 1.

The construction support area will remain in place through Phase 4. Between phases when no earthwork operations are being conducted, there will probably not be any equipment stored in the support area. Some processed material stockpiles may remain between phases. The long term glacial till stockpile will be located adjacent to the construction support area as shown in Figures 22 and 23.

In Phase 5, tailings pond T4 will be constructed, requiring that the support area be relocated to the top of tailings pond T2. The long term stockpile will be reduced to zero storage after Phase 4. For Phases 5 and 6 the long term stockpile will be located on top of tailings pond T2.

Batch Plant

A batching and mixing plant will be used to mix the processed glacial till, powdered bentonite and water for the liner and topseal. The batching plant is a standard unit commonly used for concrete batching operations. One batch plant will be used to feed two rotary pug mills (reverse augers). The pug mills are standard units commonly used for asphalt mixing.

The batching and mixing plants are both run by electrical power. During Phase 1, this power will be provided by a 250 KW generator. In subsequent phases, electrical power will be available from a powerline from the mill. A CAT 988 loader will be used to feed the processed glacial till to the batching plant. The remainder of the operation, including the addition of the appropriate quantity of bentonite and water, and the mixing operation, is automatic. The batching and mixing operation will be conducted on a single shift basis at the same time that the liner or seal is being placed on the subgrade. A summary of the various elements of the batching and mixing plant is listed below.

Hagen Batching Plant Model TPM-10C:

10 cubic yard aggregate weigh batcher

36" x 43' deep troughing transfer belt conveyor with 30 hp electric motor

10 cubic yard cement weight batcher

Mounted 15 hp air compressor (75.6 CFM)

Overhead aggregate bin, 65 ton, 43.8 cubic yard, with three compartments

Mobile overhead cement silo 1000 bbl (4009 cubic feet) 11' - 7" diameter

2-Hagen continuous pug mills, 75 hp, single direction feed, 200 to 400 rated TPH rated

Rotary vane bentonite feeder, includes hopper and feed metering device for injecting bentonite into pug mill

Radial stacking conveyor

The CAT 988 loader is the only diesel engine required in the batching and mixing operation. The remainder of the process is powered by electric motors. Noise and exhaust emissions due to the batching and mixing will therefore not be significant. The plant will be kept in good repair to minimize the general plant noise as well. The processed glacial till will be sprinkled as necessary to minimize dust problems during the operation.

Crushing and Processing Plant

A crushing and processing plant will be used to process the required materials for the liner and underdrain system. Crushing and processing will be conducted on a two shift per day basis. The various elements which make up the crushing and processing plant are shown on Figure 23.

The crushing and processing plant is run by electrical power. A 335 KW generator will be used during Phase 1, with power from the mill in later phases. A CAT 988 loader will be used to feed the glacial till to the processing plant. A series of conveyors and radial stackers will distribute the finished product to the appropriate stockpile in the construction support area. The processing operation will be conducted on a two shifts per day basis.

As is similar to the batching plant, a CAT 988 loader is the only diesel engine required in the processing operation. All other power comes from electric motors. Exhaust emissions therefore will not be significant. Noise generated while processing (screening and washing) will not be excessive. However, when crushing is required the noise level could significantly increase.

As shown on Figures 22 and 23, there are several different material stockpiles in the construction support area. To control dust, these piles will be sprinkled as necessary.

1.3.2.14 Fuels and Other Energy Requirements

The approximate maximum hourly fuel consumption for each phase of construction is geven in Table 3 below:

Construction Phase	FUEL					
	Gasoline		Diesel		Lub. Oil	
	Liters	Gallons	Liters	Gallons	Liters	Gallons
1	38	10	2082	550	30	8
2	38	10	2082	550	30	8
3	38	10	1893	500	23	6
4	38	10	1893	500	23	6
5	38	10	2460	650	34	9
6	19	5	1136	300	11	3

TABLE 3 - MAXIMUM HOURLY FUEL CONSUMPTION BY PHASE

These values of hourly consumption represent the maximum fuel use during the peak of earthwork operations for each phase. The average hourly fuel consumption for any phase will be less than the values given in Table 3.

During the peak of activity, some of the earthwork operations will be conducted on a two shift per day basis. During these peak periods, daily diesel fuel consumption will be on the order of 30,000 liters (8,000 gallons).

Storage tanks will be provided for temporary storage of fuels and lubricants in the construction support area. As shown in Figure 23, a containment dike will be constructed around the storage tanks to contain any potential spillage from the tanks.

1.3.4 Summary Pollution Control, Emissions and Effluents

During each phase of construction, control of surface water runoff will be accomplished by constructing a series of ditches, dikes and retention ponds. These erosion control measures were designed to utilize the existing topography for drainage control, with ditches and dikes constructed as necessary to control discharge into the surrounding natural drainage system. Figures 24 through 29 detail the drainage patterns

and location of required control features for each phase of construction. Surface runoff with the potential for high suspended solids content will be diverted through sedimentation ponds with overflow weirs before discharging into the natural drainage system of the surrounding area. These sedimentation ponds will allow settling of the suspended solids. Bales of hay will be used as needed to provide small dikes for control of drainage in localized areas.

Contaminated surface runoff from the waste rock embankment area will be collected and stored in a lined pond as described in Section 1.3.2.2.4. During later phases of construction the waste rock embankment area will drain into tailings pond T1.

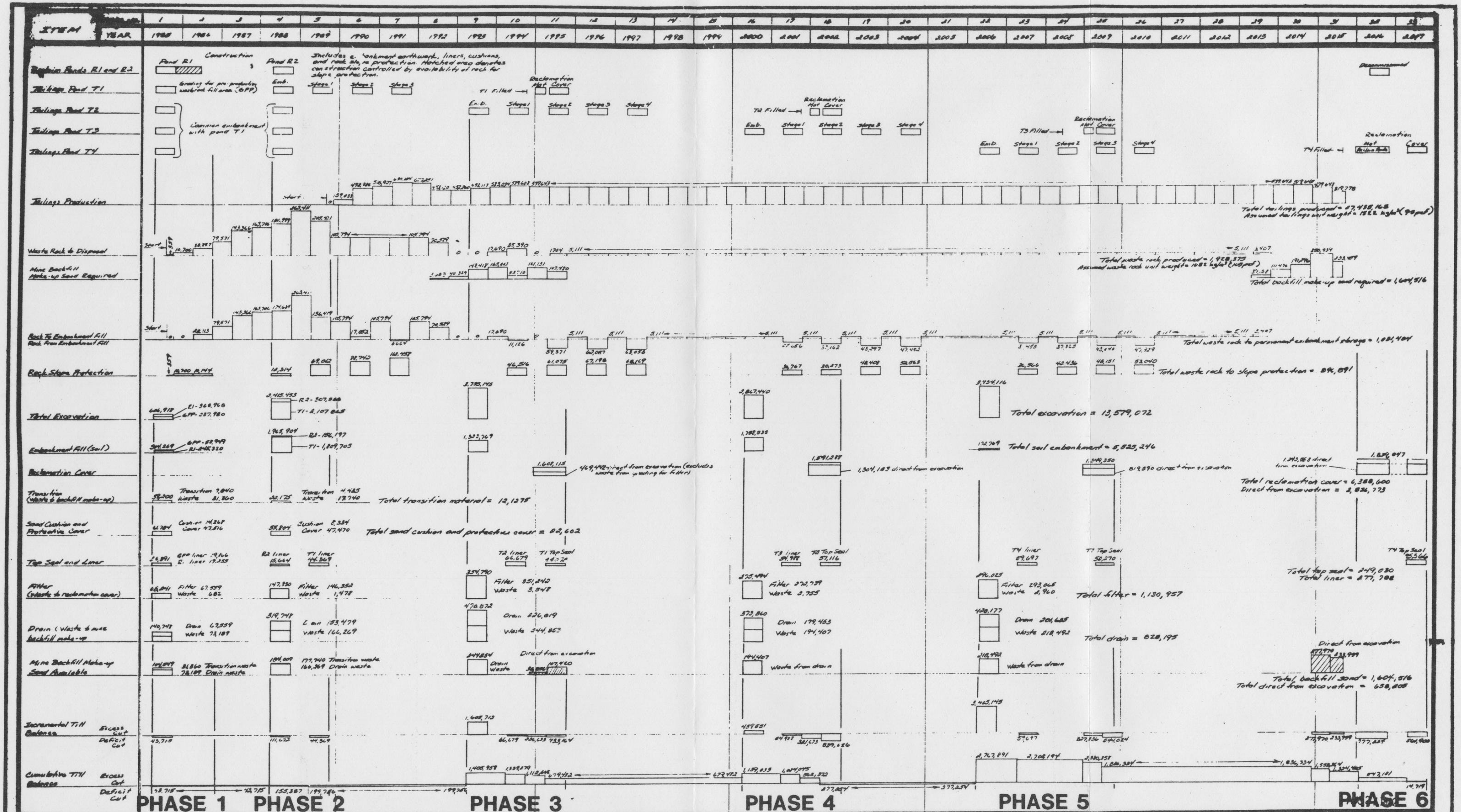
Clearing and grubbing will be done in phases as shown in Figure 9. Areas to be cleared and grubbed will be limited to only that area required in order to complete the earthwork operations in that phase.

1.3.5 Construction Personnel

Construction manpower requirements by craft for each phase of construction are given in Figures 16 through 21. Two shifts per day will be used for the excavation operations and processing glacial till. The construction activity schedules (Figures 2 through 7) indicate the extent and duration of all construction operations, including those that are double shifts.

In addition to the construction manpower requirements described above, the earthwork contractor will have a full time staff on-site to manage the construction. This field staff will consist of:

1 - Survey Chief
2 - Grading Superintendents (1 day shift, 1 night shift)
1 - Project Engineer
1 - Quality Control Technician
3 - Survey Party (including rodmen)
1 - Office Manager/Secretary
½ - Project Manager



NOTES:

1. In general, production volumes and construction volumes are shown in 6 month time blocks. The production of tailings and waste rock have been adjusted to coincide with the 6 month construction time blocks. Therefore, the time blocks at the beginning and end of the production schedules are not full 6 month periods.

   Tailings pond construction is scheduled to begin (except for waste rock embankment which coincides with waste rock production schedule) as late as possible to have the ponds in service as per tailings production. Tailings ponds assumed to be vertically staged as follows:

   Embankment: Includes all excavation. Includes soil fill to finished subgrade.

   Stage 1: Includes liner, underdrain, and rock slope protection (as applicable) over pond bottom and up to the level of the lowest bench.

   Stage 2, 3, 4: Includes liner, underdrain, and rock slope protection (as applicable) to next highest bench or crest as appropriate.

3. Embankment soil fill and pond soil cut are computed to subgrade levels which are those below liners, underdrains, rock slope protection, etc.

4. Grading for waste rock embankment and storage area is scheduled prior to pre-production waste rock generation. Grading includes liner, and underdrain placement. Shown as part of tailings pond 1 construction on schedule. This development could be done over a longer time period assuming it is sequenced with pre-production waste rock generation. This waste rock embankment forms common embankment between pond 1 and ponds 2, 3, and 4.

5. Completion of reclaim pond R1 dependent on generation of pre-production waste rock. Reclaim pond R1 includes processed material and off site borrow material for sand cushion below the synthetic liner which cannot contain carbonate minerals.

6. It is anticipated that cobbles larger than 6 inches (152mm) will have to be scalped from the till prior to embankment construction. Since it is not possible to estimate this volume, a figure of 0.1 percent has been used as an allowance. However, this allowance is not reflected in the volumes shown on this schedule.

7. Tailings production, waste rock production, and backfill sand requirements based on a 62.3 M metric ton orebody with 25% contingency (77.8 M metric tons) and approximately 43% tailings. Ore production at a nominal 9,100 metric tons per day.

FIGURE 1

INDECO · TWIN CITY DIVISION 1800 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

VOLUMES IN CUBIC METERS

REVISED	DATE	BY	DESCRIPTION
Volumes	5/7/82	RMS	Volume of Reclamation Cover For Pond T4 Changed.
Volumes	8/18/82	GHC	Reclamation Cover for Ponds T1, T2, T3 and T4 changed

EXXON MINERALS COMPANY, U.S.A.
CRANDON PROJECT

TITLE: CONSTRUCTION AND MATERIAL VOLUME SCHEDULE

SCALE: As Shown	STATE: Wisconsin	COUNTY: Forest	
DRAWN BY: GHC	DATE: 4-28-82	CHECKED BY: MTF	DATE: 4.23.82
APPROVED BY: GHC	DATE: 4-28-82	APPROVED BY:	DATE:
APPROVED BY:	DATE:		
DRAWING NO.: 050-1-81402		SHEET ___ OF ___	REVISION NO.: 2

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 1

YEAR 1	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mobilization												
Clear & Grub					———							
Construct Waste Rock Haul Road					—							
Construct Bentonite Haul Road						—						
Upgrade Rail Siding						—						
Construct Support Area Pad					—							
Construct Bentonite Storage Facilities At Mill Site						———						
Install Pump					—							
Set Up Processing Plant and Batch Plant						———						
Install Perimeter Chainlink Fence						———	———	———	———	———	———	
Excavate R1 & GP to Embankment & Stockpile						2 Shifts ———	———	———				
Finishing R1 & GP							———	———				
Subgrade Preparation R1 & GP								—				
Ditching (Drainage)						—						
Process Glacial Till						2 Shifts ———	———	———	———	———		
Batch Bentonite Liner R1 & GP								———	———	———		
Load, Haul & Place Bentonite Liner R1 & GP								———	———	———		
Load, Haul & Place Non-Carbonate Sand R1									———	———		
Install Hypalon Liner R1										———		
Load, Haul & Place Sand Cushion & Protective Cover R1											———	
Load, Haul & Place Transition Material R1												—
Load, Haul & Place Riprap R1												—

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

indeco
TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 2

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 1

YEAR 1 (Cont'd)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Load, Haul & Place Drain GP									—			
Load, Haul & Place Filter GP										—		
Excavate GP Pond to Stockpile								2 Shifts —	—			
Install PVC Liner in GP Pond										—		
Load, Haul & Place Random Fill in GP Pond										—		
Load, Haul & Place Riprap in GP Pond										—		
Ditch Excavation GP Pond									—			
Sump & Pump Runoff Water								—	—	—	—	—
Place Gravel on Perimeter Roads								—				
Erosion Control						—						
Turf Establishment Rl								—				
YEAR 2												
Load, Haul & Place Riprap Rl						—				—		

1988 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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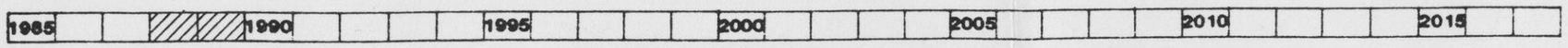
TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 2

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 2

YEAR 1	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mobilization												
Clear & Grub				———								
Set Up Processing Plant & Batch Plant				——								
Excavate R2 to Embankment & Stockpile				——	2 Shifts	——						
Excavate T1 to Embankment & Stockpile				——	2 Shifts	———	———	———	———	———		
Haul Borrow to Processing Plant						2 Shifts ——						
Finishing R2						—						
Subgrade Preparation R2						—						
Ditching (Drainage)						—						
Process Glacial Till					2 Shifts	———	———	———	———	———		
Batch Bentonite Liner R2						——	——					
Load, Haul & Place Liner R2						——	——					
Load, Haul & Place Non-Carbonate Sand R2							——					
Clean Lap Joint on Existing R1 Hypalon Liner							—					
Install Hypalon Liner R2								——				
Load, Haul & Place Sand Cushion & Protective Cover R2									——			
Load, Haul & Place Transition Material R2									—			
Load, Haul & Place Riprap R2									—			
Sump & Pump Runoff Water						——	——	——	——			
Construct Mixing Box							—					



PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1800 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 3

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 2

YEAR 2	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Process Glacial Till												
Finishing T1												
Subgrade Preparation T1												
Batch Bentonite Liner T1												
Load, Haul & Place Liner T1												
Load, Haul & Place Drain T1												
Install Underdrain Pipe T1												
Load, Haul & Place Filter T1												
Place Gravel on Perimeter Roads												
Erosion Control												
Turf Establishment R2 & T1												

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 3

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 3

YEAR 1	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mobilization												
Clear & Grub				———								
Set Up Processing Plant & Batch Plant				——								
Excavate T2 to Embankment and Stockpile				——	2 Shifts ———	———	———	———	———	———	———	
Process Glacial Till					2 Shifts ———	———	———	———	———	———		
YEAR 2												
Mobilization												
Finishing T2					———							
Subgrade Preparation T2						——						
Ditching (Drainage)						—						
Process Glacial Till					2 Shifts ———							
Batch Bentonite Liner T2						———	———	———				
Load, Haul & Place Bentonite Liner T2						———	———	———				
Load, Haul & Place Drain T2						———	———	———	———			
Install Underdrain Pipe T2							———	——				
Load, Haul & Place Filter T2						———	———	———				
Load, Haul & Place Rock Slope Protection T2								———	———	———	———	
Sump & Pump Runoff Water						———	———	———				
Place Gravel on Perimeter Roads						—						
Erosion Control						—						

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 4

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 3

YEAR 3	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mobilization												
Load, Haul & Place Rock Slope Protection T2				———								
Excavate T1 Embankment to Traffic Mat T1				———	———	———						
Excavate T1 Underdrain to Traffic Mat T1							———					
Excavate Long Term Stockpile to Traffic Mat T1							———					
Subgrade Preparation T1					———							
Batch Bentonite Seal T1						———	———	———				
Load, Haul & Place Bentonite Seal T1						———	———	———				
Excavate Long Term Stockpile to Vegetative Cover T1							———	———	———			
Turf Establishment T2									———	———		

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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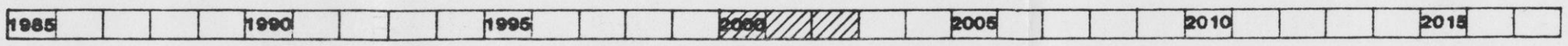
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 4

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 4

YEAR 1	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mobilization												
Clear & Grub				———								
Set Up Processing & Batch Plant				——								
Excavate T3 to Embankment and Stockpile				——	2 Shifts	———	———	———	———	———		
Process Glacial Till					2 Shifts	———	———	———	———	———	———	
YEAR 2												
Mobilization												
Finishing T3					———							
Subgrade Preparation T3					—	—						
Ditching (Drainage)					—							
Batch Bentonite Liner T3						———	———	———				
Load, Haul & Place Bentonite Liner T3						———	———	———				
Load, Haul & Place Drain T3						———	———	———	—			
Install Underdrain Pipe T3							———	—				
Load, Haul & Place Filter T3						———	———	———	—			
Load, Haul & Place Rock Slope Protection T3								———	———	———	———	
Sump & Pump Runoff Water					———	———	———	———	—			
Place Gravel on Perimeter Roads									—			
Erosion Control						—						



PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 5

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 4

YEAR 3	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mobilization												
Excavate T2 Embankment to Traffic Mat T2				—	—							
Excavate T2 Underdrain to Traffic Mat T2					—							
Excavate Long Term Stockpile to Traffic Mat T2					—	—	—	—				

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 5

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 5

YEAR 1	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mobilization												
Clear & Grub				—								
Set Up Processing Plant & Batch Plant				—								
Excavate T4 to Embankment & Stockpile				—	2 Shifts	—	—	—	—	—	—	
Process Glacial Till					2 Shifts	—	—	—	—	—		
YEAR 2												
Mobilization												
Excavate T4 to Embankment & Stockpile				—	—							
Process Glacial Till				—	—	—						
Finishing T4					—							
Subgrade Preparation T4					—							
Ditching (Drainage)					—							
Batch Bentonite Liner T4					—	—	—	—				
Load, Haul & Place Bentonite Liner T4					—	—	—	—				
Load, Haul & Place Drain T4					—	—	—	—				
Install Underdrain Pipe T4						—	—					
Load, Haul & Place Filter T4					—	—	—	—	—			
Load, Haul & Place Rock Slope Protection T4							—	—	—	—	—	
Sump & Pump Runoff Water					—	—	—	—	—			
Place Gravel on Perimeter Roads					—							
Erosion Control					—							

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

indeco TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 6

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 5

YEAR 3	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
No Earthwork Activity During Year 3												
YEAR 4												
Mobilization												
Excavate T3 Embankment to Traffic Mat T3				—								
Excavate T3 Underdrain to Traffic Mat T3				—	—							
Excavate Long Term Stockpile to Traffic Mat T3					—	—	—					
Batch Bentonite Seal T3						—	—	—				
Load, Haul & Place Bentonite Seal T3						—	—	—				
Excavate Long Term Stockpile to Vegetative Cover T3								—	—			
Turf Establishment T3									—	—		

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 6

CONSTRUCTION ACTIVITY SCHEDULE-PHASE 6

YEAR 1	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Mobilization												
Set Up Batch Plant												
Excavate R1 & R2 Underdrain to Traffic Mat T4					2 Shifts							
Excavate R1 & R2 Embankments to R1 & R2 Interior Ponds						2 Shifts						
Excavate Haul Road to Traffic Mat T4						2 Shifts						
Excavate T4 Embankment to Traffic Mat T4					2 Shifts							
Excavate Long Term Stockpile to Traffic Mat T4							2 Shifts					
Finishing T2 & T4												
Subgrade Preparation T2 & T4												
Batch Bentonite Seal T2 & T4												
Load, Haul & Place Bentonite Seal T2 & T4												
Erosion Control												
YEAR 2												
Mobilization												
Batch Bentonite Seal T2 & T4												
Load, Haul & Place Bentonite Seal T2 & T4												
Excavate Long Term Stockpile to Vegetative Cover T2 & T4						2 Shifts						
Turf Establishment T2 & T4												

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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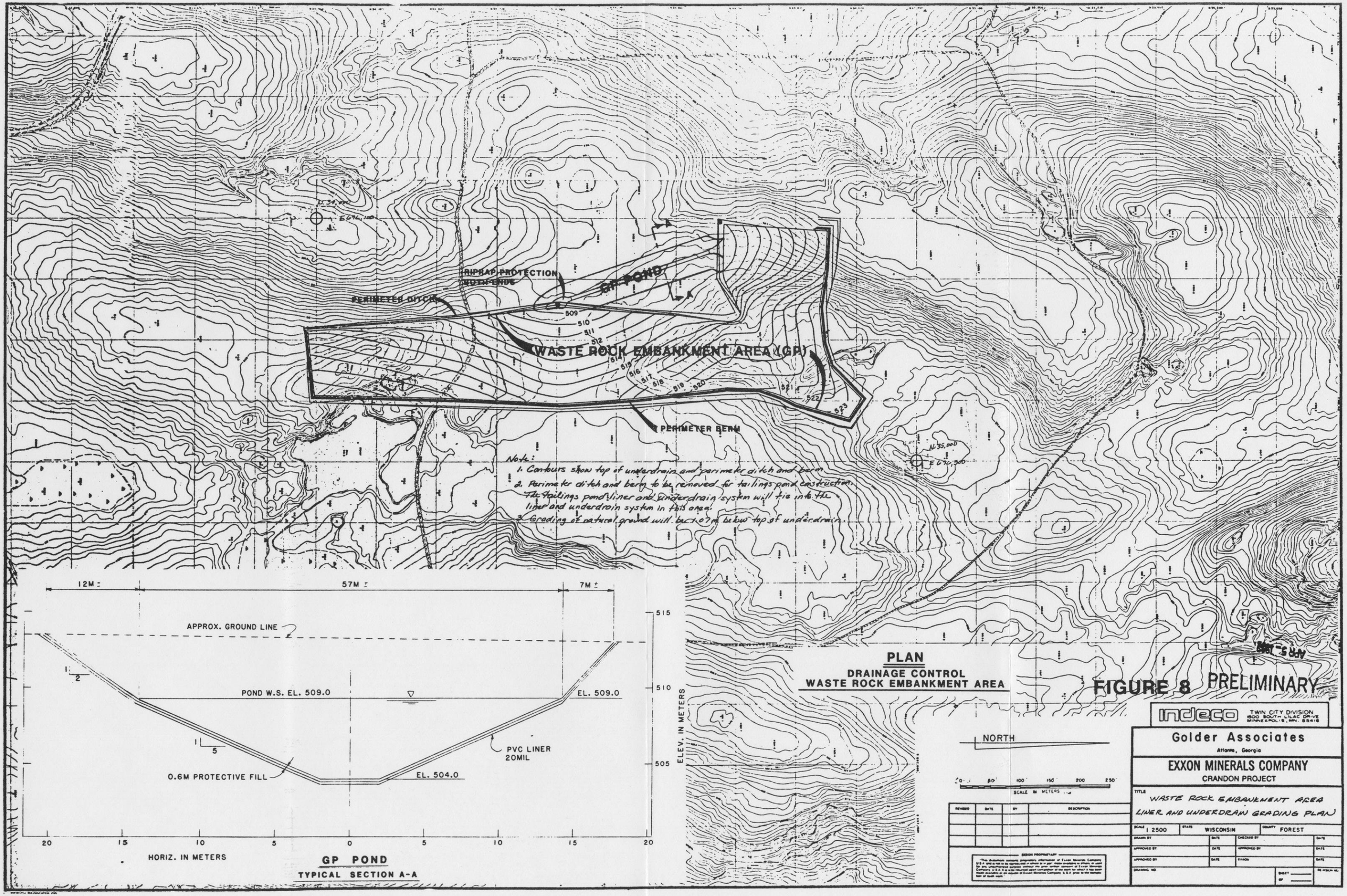
TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 7



PLAN
DRAINAGE CONTROL
WASTE ROCK EMBANKMENT AREA

GP POND
TYPICAL SECTION A-A

FIGURE 8 PRELIMINARY

indeco — TWIN CITY DIVISION, 800 SOUTH LILAC DRIVE, MINNEAPOLIS, MINN. 55416

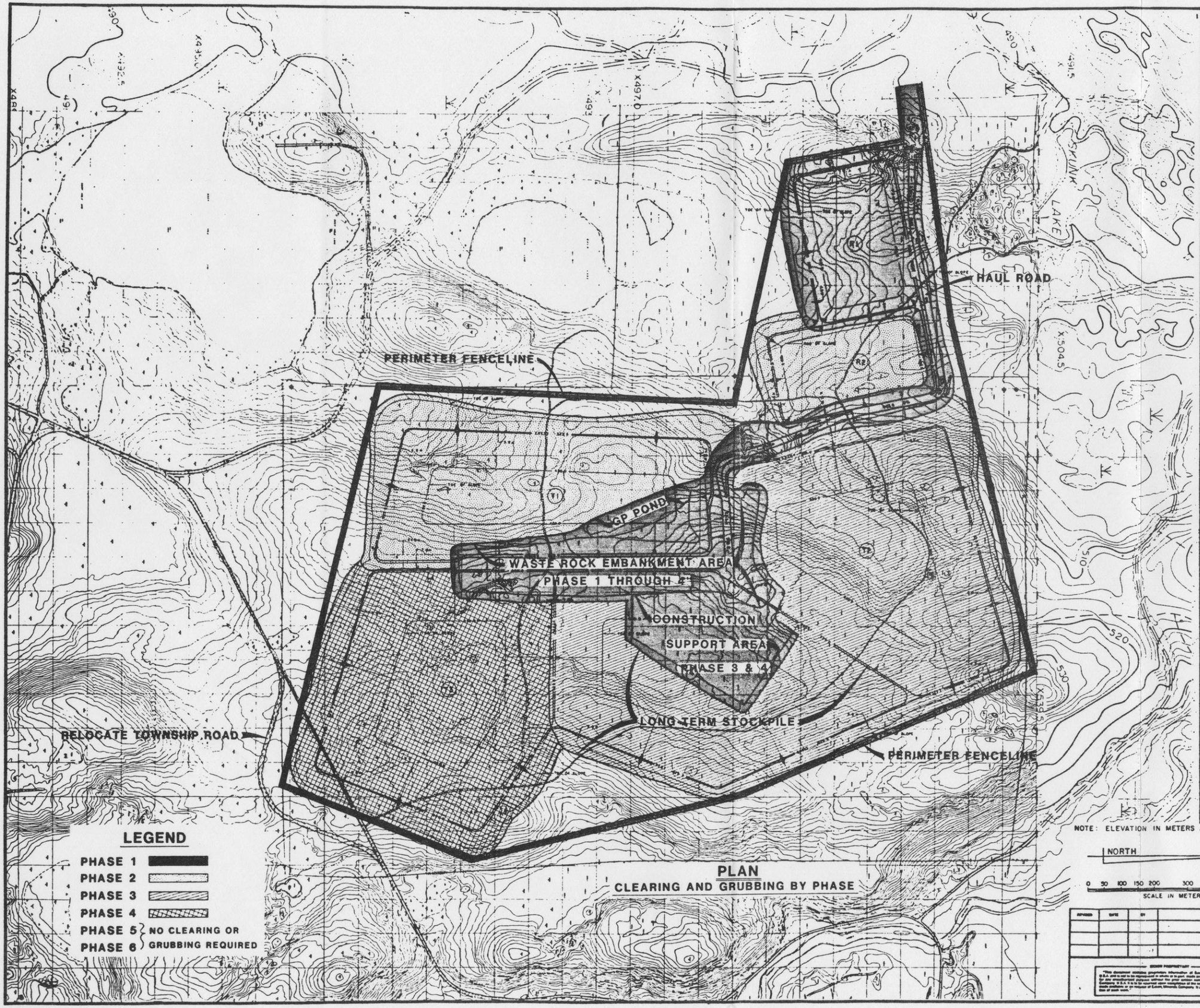
Golder Associates
Atlanta, Georgia

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE: WASTE ROCK EMBANKMENT AREA
LINER AND UNDERDRAIN GRADING PLAN

SCALE 1 2500 | STATE WISCONSIN | COUNTY FOREST

DRAWN BY | DATE | CHECKED BY | DATE
APPROVED BY | DATE | APPROVED BY | DATE
APPROVED BY | DATE | EXXON | DATE
DRAWING NO. | SHEET ___ OF ___ | REVISION NO.



PLAN
CLEARING AND GRUBBING BY PHASE

NOTE: ELEVATION IN METERS ABOVE MSL

NORTH

0 50 100 150 200 300 400 500
SCALE IN METERS

DISPOSAL SYSTEM DATA

Tailings Pond Area (ha.)	233.6	Abandonment Cover Seal Thickness(m)	0.10
Abandonment Area (ha)	202.2	Minimum Abandonment Cover Thickness (m)	1.7
Wetlands Covered (ha)	20.6	Underdrain Drain Layer Thickness (m)	0.46
Pond Excavation ($\times 10^6$ m^3)	13.579	Minimum Underdrain Filter Layer Thickness (Note 1) (m)	0.46
Till and Waste Rock Embankment Fill ($\times 10^6$ m^3)	6.566	Minimum Rock Slope Protection Thickness (Note 2) (m)	1.0
Waste Rock Embankment Fill($\times 10^6$ m^3)	1.04	Reclaim Pond Synthetic Liner Thickness (mm)	0.9
Minimum Crest Width (Note 3)(m)	4.9	Reclaim Pond Till/Bentonite Liner Thickness (m)	0.15
Processed Till For Mine Backfill Makeup ($\times 10^6$ m^3)	1.605	Sand Cushion Above Synthetic Liner Thickness (m)	0.46
Tailings Slope (%)	0.5	Sand Cushion Below Synthetic Liner Thickness (m)	0.30
Minimum Abandonment Cover Slope (%)	2.0	Protective Cushion Above Synthetic Liner Thickness (m)	0.46
Till/Bentonite Tailings Pond Liner Thickness (m)	0.15	Transition Below Reclaim Pond Rock Slope Protection Thickness (m)	0.30

INDIVIDUAL POND DATA

POND NUMBER / POND DATA	R1	R2	T1 (See Note 4)	T2	T3	T4	Σ
Period of Use (yrs)	0-30	0-30	4-9	10-16	17-23	24-30	—
Area Inside Crest (ha.)	12.70	11.65	33.08	43.86	40.29	44.30	185.88
Bottom Area (ha.)	8.14	8.13	14.11	15.32	12.92	14.10	69.72
Lined Slope Area (ha)	4.74	3.81	20.39	32.64	29.09	27.22	114.89
Maximum Interior Depth (m)	8.7	7.0	23.5	29.0	31.0	30.0	—
Maximum Exterior Fill Height (m)	13.1	13.0	29.0	32.5	21.7	13.6	—
Crest Elevation (m)	505.6	505.6	522.5	529.5	529.5	529.5	—
Lowest Bottom Elevation (m)	496.9	498.6	499.0	500.5	498.5	499.5	—
Struck Storage Volume ($\times 10^6$ m^3)	0.59	0.59	5.00	7.56	7.24	7.87	27.47
Tailings Storage Volume ($\times 10^6$ m^3)	—	—	4.04	6.26	6.26	6.15	22.71
Till Excavation ($\times 10^6$ m^3)	0.369	0.308	2.346	3.755	2.867	3.934	13.579
Till Embankment ($\times 10^6$ m^3)	0.245	0.156	1.869	1.324	1.759	0.173	5.526
Synthetic Liner Area (ha)	13.64	12.47	—	—	—	—	26.11
Till/Bentonite Liner Volume ($\times 10^6$ m^3)	0.020	0.018	0.073	0.076	0.063	0.069	0.319
Underdrain Drain Material Volume ($\times 10^6$ m^3)	—	—	0.220	0.226	0.179	0.202	0.827
Underdrain Filter Material Volume ($\times 10^6$ m^3)	—	—	0.214	0.351	0.275	0.293	1.131
Rock Slope Protection Volume ($\times 10^6$ m^3)	0.021	0.012	0.270	0.243	0.170	0.181	0.897
Abandonment Cover Volume($\times 10^6$ m^3)	—	—	0.885	1.514	1.260	1.903	5.562
Till/Bentonite Abandonment Cover Seal ($\times 10^6$ m^3)	—	—	0.051	0.066	0.060	0.110	0.287
Sand Cushion Above Synthetic Liner ($\times 10^6$ m^3)	0.014	0.008	—	—	—	—	0.022
Sand Cushion Below Synthetic Liner ($\times 10^6$ m^3)	0.039	0.035	—	—	—	—	0.074
Protective Cushion Above Synthetic Liner ($\times 10^6$ m^3)	0.048	0.047	—	—	—	—	0.095
Transition Below Reclaim Pond Rock Slope Protection ($\times 10^6$ m^3)	0.008	0.004	—	—	—	—	0.012
Underdrain Collector Pipe Length (m)	—	—	1760	1610	1580	1545	6295
Sump Discharge Pipe Length (m)	—	—	345	410	435	425	1615

DISPOSAL SYSTEM DATA AND POND DATA NOTES

1. Underdrain filter 1.0 meter thick beneath rock slope protection on tailings ponds T2, T3, and T4.
2. Rock slope protection 2.0 meters thick on tailings pond T1.
3. Crest width varies from 4.9 meters to 7.0 meters depending on number of pipelines along crest.
4. Excavation, fill, and underdrain material volume for grading below waste rock embankment and storage area included with tailings pond T1 volume.

Site area mapping is at 1.0 meter contour interval. Additional area to the north and west was added at the available 2.0 meter contour interval to provide coverage for the compliance boundary.

FIGURE 9

indeco TWIN CITY DIVISION 1500 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

Golder Associates
Atlanta, Georgia

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE: WASTE DISPOSAL SYSTEM
SITE 41-114 B

SCALE	STATE	COUNTY
AS SHOWN	WISCONSIN	FOREST

DRAWN BY SKB — DATE 5-24-82 — CHECKED BY — DATE
APPROVED BY — DATE — APPROVED BY — DATE
APPROVED BY — DATE — APPROVED BY — DATE

050-1-80594

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 1

	YEAR 1 - 1985												YEAR 2 - 1986																																			
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
CAT 631 Scraper					8	11	10	10	10	7	5	5																																						
CAT 631 Water Wagon					2	3	2	6		1																																							
CAT D9 Dozer					2	3	2	2	2	1																																							
CAT D8 Dozer					9	3	4	5	4	4	2	4						2				2																												
CAT D6 Dozer							1	5	2																																									
Rake (D8)					5																																											
Disc (D8)								1																																								
CAT 988 Loader						2		1	2	2		1						1				1																											
CAT 966 Loader					3					2	1																																						
CAT 235 Excavator					2	1			1	1	1																																					
CAT 16G Motor Grader							1	1																																								
CAT 14G Motor Grader					2	3	3	9	6	6	2	2																																						
CA 25 Compactor					2	3	2	6	2	2																																							
Tandem Dump Truck					3			9	9	9		4						4				4																											
Flatbed Truck					1	3	1	1	1	1	1																																						
Pick-up Truck					5	5	5	8	6	7	3	2						1				1																												
PD Trailer and Tractor								2	2	2																																							
Batch Plant and Pug Mill								1	1	1																																							
Processing Plant						1	1	1	1	1																																								
Bentonite Unloading System								1	1	1																																							
LoBoy Trailer and Tractor					34	11	2	24	1																																							

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 10

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 1

	YEAR 1 - 1985												YEAR 2 - 1986																																			
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Generator 335 KW						1	1	1	1	1	1																																							
Generator 250 KW								1	1	1	1																																							
Generator 90 KW					1	1	1	1	1	1	1	1																																						
Generator 30 KW								1	1	1	1	1																																						
42" Belt Conveyor								1	1	1	1	1																																					
Pump 15 HP								1	1	1	1	1																																					
Truck Crane 25 ton					1	1		1																																									
J D Hydroseeder								1																																								
J D Tractor with Disc								1																																								
J D Diesel Mulcher								1																																								
Flowmaster Pump					1	1	1	1		1																																							
Chainsaw					2																																											
Power Ram Packer								2	2	2																																						
Belly Dump Trailer and Tractor									13	13																																						
CAT 824 Wheel Tractor									1	1																																						
J D 410 Backhoe					1	1																																									
Truck Crane 75 ton					1	1																																									
Power Auger					1	1	1	1	1	1	1																																						

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 10

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 2

	YEAR 1 - 1988												YEAR 2 - 1989																							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
CAT 631 Scraper				12	12	14	9	12	12	8							10	8	8	8																														
CAT 631 Water Wagon				3	3	4	3	2	2	2							1																																
CAT D9 Dozer				3	3	3	2	2	2	2																																						
CAT D8 Dozer				9	3	5	3	4	6	2							6	4	4	4																												
CAT D6 Dozer						3	3										2	2	2																													
Rake (D8)				5																																											
Disc (D8)						1											1																														
CAT 988 Loader					2	3	4	2	3	2							2	1	1																												
CAT 966 Loader				2			1	1																																						
CAT 235 Excavator				1		1	1	1																																						
CAT 16G Motor Grader						1											1																														
CAT 14G Motor Grader				3	3	6	6	4	4	2							6	6	6	4																												
CA 25 Compactor				3	3	6	4	2	2	2							2	2	2																												
Tandem Dump Truck				3		8	8		4								8	8	8																												
Flatbed Truck							1										2																														
Pick-up Truck				6	4	7	9	4	4	2							6	4	4	3																												
PD Trailer and Tractor						2	2										2	2	2																												
Batch Plant and Pug Mill						1	1										1	1	1																												
Processing Plant					1	1	1	1	1	1							1																														
Bentonite Unloading System						1	1										1	1	1																												
LoBoy Trailer and Tractor				39	5	17	3	1												3																												

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN 55416

FIGURE 11

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 2

	YEAR 1 - 1988												YEAR 2 - 1989																							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW						3	3	3	3																											
42" Belt Conveyor								1	1								2	2	2	2																
Pump 15 HP						7	7	7	7																											
Truck Crane 25 ton						1																														
J D Hydroseeder																				1																
J D Tractor with Disc																				1																
J D Diesel Mulcher																				1																
Flowmaster Pump				1	1	1	1	1	1	1							1																			
Chainsaw				2																																
Power Ram Packer						2	2										2	2	2																	
Belly Dump Trailer and Tractor							13																													
CAT 824 Wheel Tractor							1																													
Compressor 1200 CFM							1																													
JD 410 Backhoe							1																													

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN 55416

FIGURE 11

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 3

	YEAR 1 - 1993												YEAR 2 - 1994												YEAR 3 - 1995																							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
CAT 631 Scraper				12	12	12	12	12	12	12	12						4	16	12	12	12										10	5	5																	
CAT 631 Water Wagon				3	3	3	3	3	3	3	3						1	1												1	2	1																	
CAT D9 Dozer				3	3	3	3	3	3	3	3																				2	1	1															
CAT D8 Dozer				9	3	3	3	3	3	3	3						4	9	6	8	8	2	2						10	8	9	10	2	1															
CAT D6 Dozer																	1	2	2	2	2									2	2	2																	
Rake (D8)				5																																												
Disc (D8)																	1	1												1	1	1																	
CAT 988 Loader					2	2	2	2	2	2							2	1	1	2	2	1	1					1		1	1	1																
CAT 966 Loader				2															1	1																													
CAT 235 Excavator				1													1		1	1																													
CAT 16G Motor Grader																	1																																
CAT 14G Motor Grader				3	3	3	3	3	3	3	3						2	8	8	9	9	1	1					1		4	5	3	1															
CA 25 Compactor				3	3	3	3	3	3	3	3						1	2	2	2	2									4	4	2																
Terex 33-07 Off Road Truck																				3	3	3	3					3																				
Tandem Dump Truck				3														6	6	6	6									6	6	6																
Flatbed Truck																		2																														
Pick-up Truck				5	3	3	3	3	3	3	3						4	6	6	7	6	1	1					3	2	5	7	6	3															
PD Trailer and Tractor																		2	2	2	2									2	2	2																
Batch Plant and Pug Mill																		1	1	1	1									1	1	1																
Processing Plant					1	1	1	1	1	1	1						1																														
Bentonite Unloading System																		1	1	1	1									1	1	1																
LoBoy Trailer and Tractor				39	4												2	14		1								1																				

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1900 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 12

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 3

	YEAR 1 - 1993											
	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
J D Hydroseeder												
J D Tractor with Disc												
J D Diesel Mulcher												
Flowmaster Pump				1	1	1	1	1	1	1	1	
Chainsaw				2								
Power Ram Packer												

	YEAR 2 - 1994											
	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW						3	3	3	3			
42" Belt Conveyor						4	4	4	4			
Pump 15 HP						7	7	7	7			
Truck Crane 25 ton						1						
J D Hydroseeder												
J D Tractor with Disc												
J D Diesel Mulcher												
Flowmaster Pump					1	1						
Chainsaw												
Power Ram Packer						2	2	2	2			

	YEAR 3 - 1995											
	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
J D Hydroseeder									1	1		
J D Tractor with Disc									1	1		
J D Diesel Mulcher									1	1		
Flowmaster Pump							1	1	1			
Chainsaw												
Power Ram Packer						2	2	2				

	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
J D Hydroseeder												
J D Tractor with Disc												
J D Diesel Mulcher												
Flowmaster Pump												
Chainsaw												
Power Ram Packer												

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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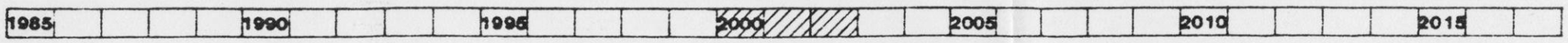
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN 55416

FIGURE 12

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 4

	YEAR 1 - 2000												YEAR 2 - 2001												YEAR 3 - 2002																							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
CAT 631 Scraper				12	12	12	12	12	12	12							6	12	16	12									12	12	12	12																		
CAT 631 Water Wagon				3	3	3	3	3	3	3							1	1											3	3	3	3																		
CAT D9 Dozer				3	3	3	3	3	3	3																			3	3	3	3																		
CAT D8 Dozer				9	3	3	3	3	3	3							3	7	8	8	2	2	2						8	11	3	3	3																		
CAT D6 Dozer																	1	2	2	2																														
Rake (D8)				5																																													
Disc (D8)																	1	1																																
CAT 988 Loader					2	2	2	2	2									1	1	2	1	1	1																												
CAT 966 Loader				2															1																																
CAT 235 Excavator				1													1		1																																
CAT 16G Motor Grader																	1																																		
CAT 14G Motor Grader				3	3	3	3	3	3	3							3	11	10	9	1	1	1																												
CA 25 Compactor				3	3	3	3	3	3	3							2	2	2	2																														
Terex 33-07 Off Road Truck																				3	3	3	3																											
Tandem Dump Truck				3														8	8	8																														
Flatbed Truck																		2																																
Pick-up Truck				5	3	3	3	3	3	3							3	5	7	6	1	1	1						2	5	3	3	3	2	2														
PD Trailer and Tractor																		2	2	2																														
Batch Plant and Pug Mill																		1	1	1																														
Processing Plant					1	1	1	1	1	1																																								
Bentonite Unloading System																		1	1	1																														
LoBoy Trailer and Tractor				40	4												2	16	5										2																				



PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 13

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 4

	YEAR 1 - 2000											
	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
Flowmaster Pump				1	1	1	1	1	1	1		
Chainsaw				2								
Power Ram Packer												

	YEAR 2 - 2001											
	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW					3	3	3	3				
42" Belt Conveyor						3	4	3				
Pump 15 HP					7	7	7	7				
Truck Crane 25 ton					1							
Flowmaster Pump					1	1						
Chainsaw												
Power Ram Packer						2	2	2				

	YEAR 3 - 2002											
	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
Flowmaster Pump					1	1	1	1				
Chainsaw												
Power Ram Packer												

	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
Flowmaster Pump												
Chainsaw												
Power Ram Packer												

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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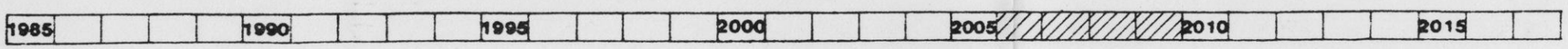
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 13

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 5

	YEAR 1 - 2006												YEAR 2 - 2007												YEAR 3 - 2008												YEAR 4 - 2009											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
CAT 631 Scraper				12	12	12	12	12	12	12	12					12	16	16	16	12	4																					6	6	6	6	6			
CAT 631 Water Wagon				3	3	3	3	3	3	3	3					3	3	1																						2	2	2						
CAT D9 Dozer				3	3	3	3	3	3	3	3					3	3																								2	2	2	2	2			
CAT D8 Dozer				6	3	3	3	3	3	3	3					3	9	8	8	7	3	1	1																		12	14	14	2	2	2			
CAT D6 Dozer																	3	3	3	3																						2	2	2					
Rake (D8)				5																																												
Disc (D8)																	1																																
CAT 988 Loader					2	2	2	2	2	2						2	3	3	1	2	1	1	1																				1	1	1					
CAT 966 Loader				2														1	1																														
CAT 235 Excavator				1													1	1	1																														
CAT 16G Motor Grader																	1																																
CAT 14G Motor Grader				3	3	3	3	3	3	3	3					3	12	10	10	9	3	1	1																				2	2	4	2				
CA 25 Compactor				3	3	3	3	3	3	3	3					3	5	2	2	2																							2	2	2					
Terex 33-07 Off Road Truck																				4	4	4	4																										
Tandem Dump Truck				3													6	6	6	6																							6	6	6					
Flatbed Truck																	2																																
Pick-up Truck				4	3	3	3	3	3	3	3					3	11	7	7	6	2	1	1																			3	5	7	4	4	3	1	
PD Trailer and Tractor																	2	2	2	2																							2	2	2					
Batch Plant and Pug Mill																	1	1	1	1																							1	1	1					
Processing Plant					1	1	1	1	1	1						1	1	1																															
Bentonite Unloading System																	1	1	1	1																							1	1	1					
LoBoy Trailer and Tractor				37	3												30	1																								3	2						



PHASE LOCATION SCHEDULE

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1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 14

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 5

YEAR 1 - 2006

Equipment	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
J D Hydroseeder												
J D Tractor with Disc												
J D Diesel Mulcher												
Flowmaster Pump				1	1	1	1	1	1	1	1	
Chainsaw				2								
Power Ram Packer												

YEAR 2 - 2007

Equipment	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW					3	3	3	3	3			
42" Belt Conveyor					4	4	4	3	1			
Pump 15 HP					7	7	7	7	7			
Truck Crane 25 ton					1							
J D Hydroseeder												
J D Tractor with Disc												
J D Diesel Mulcher												
Flowmaster Pump				1	1	1						
Chainsaw												
Power Ram Packer					2	2	2	2				

YEAR 3 - 2008

Equipment	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
J D Hydroseeder												
J D Tractor with Disc												
J D Diesel Mulcher												
Flowmaster Pump												
Chainsaw												
Power Ram Packer												

YEAR 4 - 2009

Equipment	J	F	M	A	M	J	J	A	S	O	N	D
Generator 30 KW												
42" Belt Conveyor												
Pump 15 HP												
Truck Crane 25 ton												
J D Hydroseeder									1	1		
J D Tractor with Disc									1	1		
J D Diesel Mulcher									1	1		
Flowmaster Pump					1	1	1					
Chainsaw												
Power Ram Packer						2	2	2				

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 14

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 6

	YEAR 1 - 2016												YEAR 2 - 2017																							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
CAT 631 Scraper					8	9	9	8	2									12	12	16																												
CAT 631 Water Wagon					2	3	3	2	1																																						
CAT D9 Dozer					2	3	3	2										5	5	5																										
CAT D8 Dozer					6	6	3	3	2									5	5	5																										
CAT D6 Dozer								1	5	4							2	2	2																												
Disc (D8)									1	1																																				
CAT 988 Loader									1	1																																				
CAT 16G Motor Grader								2	2																																					
CAT 14G Motor Grader								2	7	4							2	7	7	5																										
CA 25 Compactor									6	6							2	2	2																												
Tandem Dump Truck									12	12							12	12	12																												
Flatbed Truck					2															2	2																										
Pick-up Truck					3	3	3	4	6	4							2	9	9	5	1	1																								
PD Trailer and Tractor									2	2							2	2	2																												
Batch Plant and Pug Mill									1	1							1	1	1																												
Bentonite Unloading System									1	1							1	1	1																												

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN 55416

FIGURE 15

CONSTRUCTION EQUIPMENT SCHEDULE-PHASE 6

	YEAR 1 - 2016												YEAR 2 - 2017																																			
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
J D Hydroseeder																				1	1	1																										
J D Tractor with Disc																				1	1	1																										
J D Diesel Mulcher																				1	1	1																										
Flowmaster Pump					1	1	1	1	1																																							
Power Ram Packer									4	4							4	4	4																													

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 15

CONSTRUCTION MANPOWER SCHEDULE-PHASE 1

	YEAR 1 - 1985												YEAR 2 - 1986											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Operating Engineers					68	67	58	85	67	51	20	19						4				4		
Laborers					17	16	9	25	17	41	24	2						2				2		
Teamsters					3	4		13	26	26		4						4				4		
Iron Workers					3																			
Cement Masons					4																			
Carpenters					4																			

	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

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SOUTH LILAC DRIVE
MINNEAPOLIS, MN

FIGURE 1

CONSTRUCTION MANPOWER SCHEDULE-PHASE 2

	YEAR 1 - 1988												YEAR 2 - 1989																																			
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Operating Engineers				81	75	103	79	67	69	52							52	36	36	28																														
Laborers				5		7	21	17	4								11	4	4	5																														
Teamsters				3		10	11		4								12	10	10																														
Carpenters							2																																										

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1800 SOUTH LILAC DRIVE
MINNEAPOLIS, MN 55416

FIGURE 17

CONSTRUCTION MANPOWER SCHEDULE-PHASE 3

	YEAR 1 - 1993												YEAR 2 - 1994												YEAR 3 - 1995																							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Operating Engineers				78	75	75	75	75	75	75							39	67	63	68	57	7	7					18	12	28	49	25	10																
Laborers				5													1	17	16	18	18								5	5	10	5																
Teamsters				3														10	8	11	11	3	3					3		8	8	8																

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN 55416

FIGURE 18

CONSTRUCTION MANPOWER SCHEDULE-PHASE 4

	YEAR 1 - 2000												YEAR 2 - 2001												YEAR 3 - 2002																							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Operating Engineers				79	75	75	75	75	75	75							24	59	65	55	9	7	7					12	39	28	32	32																	
Laborers				5													3	14	8	6										4	4																	
Teamsters				3														12	10	13	3	3	3																									

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

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TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

FIGURE 19

CONSTRUCTION MANPOWER SCHEDULE-PHASE 5

	YEAR 1 - 2006												YEAR 2 - 2007												YEAR 3 - 2008												YEAR 4 - 2009											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Operating Engineers				71	72	72	72	72	72	72	62					15	80	74	64	55	20	7	7																			17	33	46	30	30	21	4		
Laborers				5													14	8	8	6	2																						4	4	4	5	5		
Teamsters																	10	8	8	12	4	4	4																				8	8	8				

1985 1990 1995 2000 2005 2010 2015

PHASE LOCATION SCHEDULE

indeco TWIN CITY DIVISION 1500 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

FIGURE 20

CONSTRUCTION MANPOWER SCHEDULE-PHASE 6

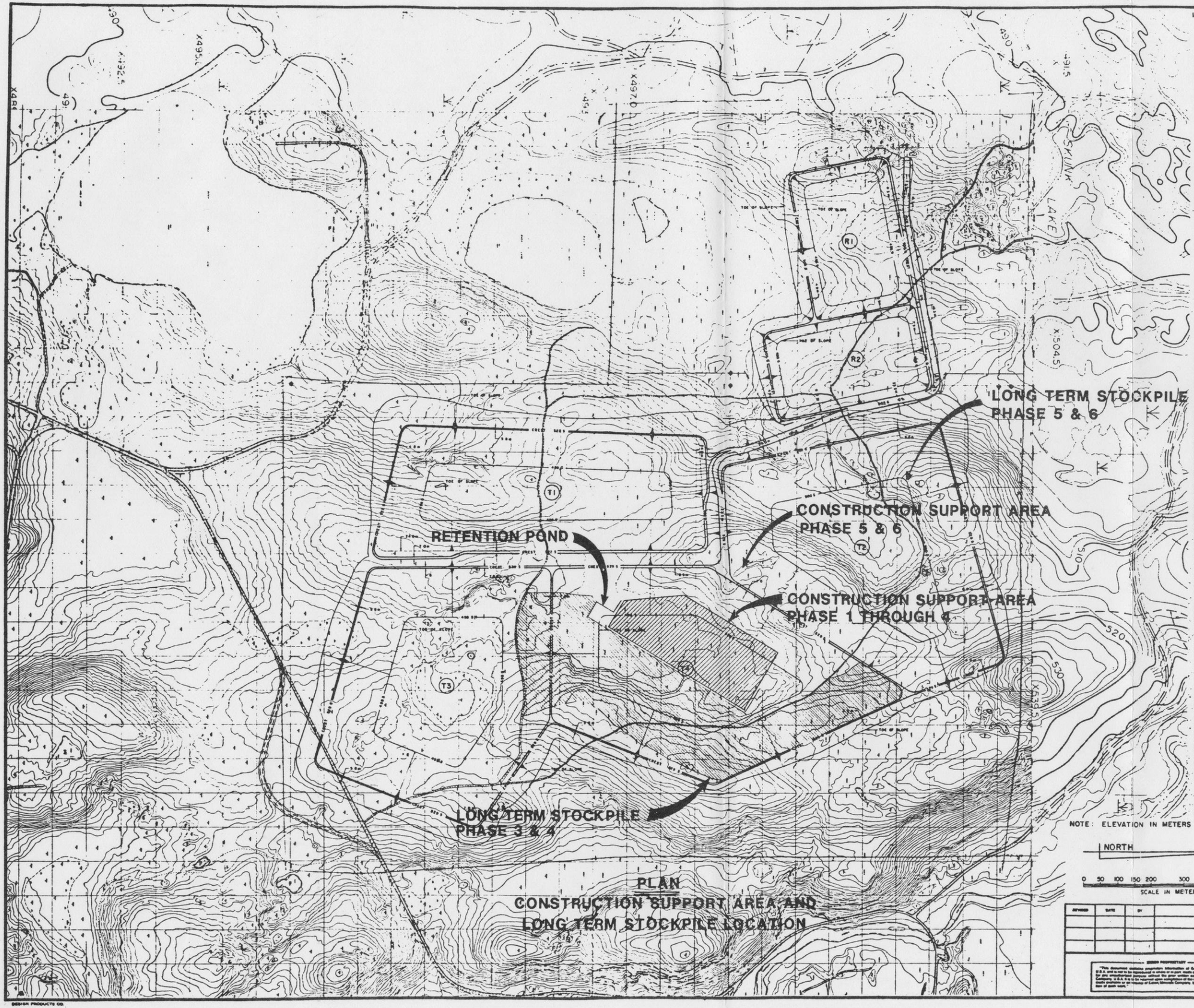
	YEAR 1 - 2016												YEAR 2 - 2017																							
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Operating Engineers					44	52	44	39	47	30							22	52	52	71	32	8															
Laborers					7				8	9							8	8	8	10	10	10															
Teamsters					2				16	16							16	16	16																		

1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015

PHASE LOCATION SCHEDULE

indeco TWIN CITY DIVISION
1500 SOUTH LILAC DRIVE
MINNEAPOLIS, MN 55416

FIGURE 21



PLAN
CONSTRUCTION SUPPORT AREA AND LONG TERM STOCKPILE LOCATION

NOTE: ELEVATION IN METERS ABOVE MSL

NORTH

0 50 100 150 200 300 400 500
SCALE IN METERS

DISPOSAL SYSTEM DATA			
Tailings Pond Area (ha.)	233.6	Abandonment Cover Seal Thickness(m)	0.15
Abandonment Area (ha)	202.2	Minimum Abandonment Cover Thickness (m)	1.7
Wetlands Covered (ha)	20.6	Underdrain Drain Layer Thickness (m)	0.46
Pond Excavation ($\times 10^6$ m^3)	13.579	Minimum Underdrain Filter Layer Thickness (Note 1) (m)	0.46
Till and Waste Rock Embankment Fill ($\times 10^6$ m^3)	6.566	Minimum Rock Slope Protection Thickness (Note 2) (m)	1.0
Waste Rock Embankment Fill($\times 10^6$ m^3)	1.04	Reclaim Pond Synthetic Liner Thickness (mm)	0.81
Minimum Crest Width (Note 3) (m)	4.9	Reclaim Pond Till/Bentonite Liner Thickness (m)	0.15
Processed Till For Mine Backfill Makeup ($\times 10^6$ m^3)	1.605	Sand Cushion Above Synthetic Liner Thickness (m)	0.46
Tailings Slope (%)	0.5	Sand Cushion Below Synthetic Liner Thickness (m)	0.30
Minimum Abandonment Cover Slope (%)	2.0	Protective Cushion Above Synthetic Liner Thickness (m)	0.46
Till/Bentonite Tailings Pond Liner Thickness (m)	0.15	Transition Below Reclaim Pond Rock Slope Protection Thickness (m)	0.30

INDIVIDUAL POND DATA

POND NUMBER / POND DATA	R1	R2	T1 (See Note 4)	T2	T3	T4	Σ
Period of Use (yrs)	0-30	0-30	4-9	10-16	17-23	24-30	—
Area Inside Crest (ha)	12.70	11.65	33.08	43.86	40.29	44.30	185.88
Bottom Area (ha:)	8.14	8.13	11.11	15.32	12.92	14.10	69.72
Lined Slope Area (ha)	4.74	3.81	20.39	32.64	28.09	27.22	14.89
Maximum Interior Depth (m)	8.7	7.0	23.5	29.0	31.0	30.0	—
Maximum Exterior Fill Height (m)	13.1	13.0	29.0	32.5	21.7	13.6	—
Crest Elevation (m)	505.6	505.6	522.5	529.5	529.5	529.5	—
Lowest Bottom Elevation (m)	496.9	498.6	499.0	500.5	498.5	499.5	—
Struck Storage Volume ($\times 10^6$ m^3)	0.59	0.59	5.00	7.59	7.24	7.67	27.47
Tailings Storage Volume ($\times 10^6$ m^3)	—	—	4.04	6.26	6.26	6.15	22.71
Till Excavation ($\times 10^6$ m^3)	0.369	0.308	2.346	3.755	2.867	3.934	13.579
Till Embankment ($\times 10^6$ m^3)	0.245	0.156	1.869	1.324	1.759	0.173	5.926
Synthetic Liner Area (ha)	13.64	12.47	—	—	—	—	26.11
Till/Bentonite Liner Volume ($\times 10^6$ m^3)	0.020	0.018	0.073	0.076	0.063	0.069	0.319
Underdrain Drain Material Volume ($\times 10^6$ m^3)	—	—	0.220	0.226	0.179	0.202	0.827
Underdrain Filter Material Volume ($\times 10^6$ m^3)	—	—	0.214	0.351	0.273	0.295	1.131
Rock Slope Protection Volume ($\times 10^6$ m^3)	0.021	0.012	0.270	0.243	0.170	0.181	0.897
Abandonment Cover Volume ($\times 10^6$ m^3)	—	—	0.885	1.514	1.260	1.903	5.562
Till/Bentonite Abandonment Cover Seal ($\times 10^6$ m^3)	—	—	0.051	0.066	0.060	0.110	0.287
Sand Cushion Above Synthetic Liner ($\times 10^6$ m^3)	0.014	0.008	—	—	—	—	0.022
Sand Cushion Below Synthetic Liner ($\times 10^6$ m^3)	0.039	0.035	—	—	—	—	0.074
Protective Cushion Above Synthetic Liner ($\times 10^6$ m^3)	0.048	0.047	—	—	—	—	0.095
Transition Below Reclaim Pond Rock Slope Protection ($\times 10^6$ m^3)	0.008	0.004	—	—	—	—	0.012
Underdrain Collector Pipe Length (m)	—	—	1760	1610	1380	1345	6295
Sump Discharge Pipe Length (m)	—	—	345	410	435	425	1615

DISPOSAL SYSTEM DATA AND POND DATA NOTES

1. Underdrain filter 1.0 meter thick beneath rock slope protection on tailings ponds T2, T3, and T4.
2. Rock slope protection 2.0 meters thick on tailings pond T1.
3. Crest width varies from 4.9 meters to 7.0 meters depending on number of pipelines along crest.
4. Excavation, fill, and underdrain material volume for grading below waste rock embankment and storage area included with tailings pond T1 volume.

Site area mapping is at 1.0 meter contour interval. Additional area to the north and west was added at the available 2.0 meter contour interval to provide coverage for the compliance boundary.

FIGURE 22

indeco TWIN CITY DIVISION 800 SOUTH LILAC DRIVE MINNEAPOLIS, MN 55416

Golder Associates
Atlanta, Georgia

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE: WASTE DISPOSAL SYSTEM SITE 41-114 B

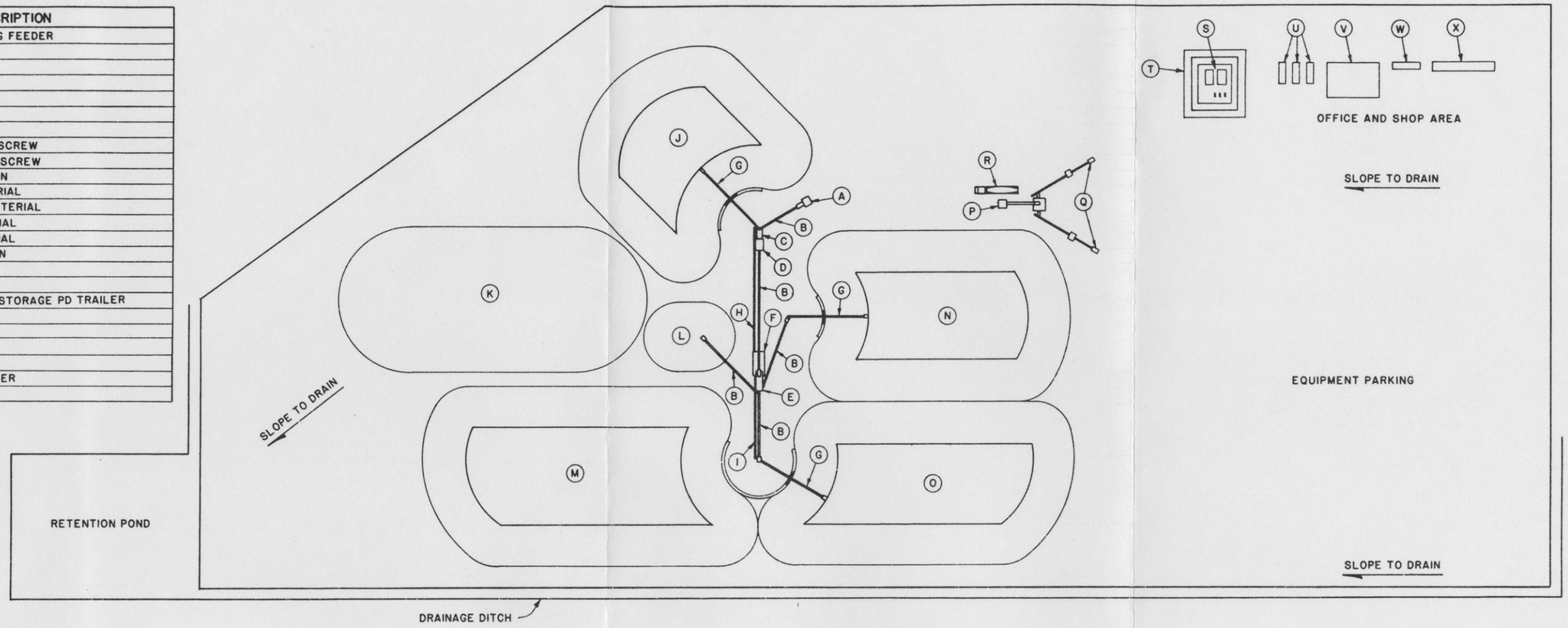
SCALE	STATE	COUNTY
AS SHOWN	WISCONSIN	FOREST

DRAWN BY	DATE	CHECKED BY	DATE
SKB	5-24-82		
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO. 050-1-80594		SHEET OF	REVISION NO.

DESIGN PRODUCTS CO.

ITEM		DESCRIPTION
A		HOPPER WITH VIBRATING FEEDER
B		CONVEYOR
C		SCALPING SCREEN
D		CRUSHING PLANT
E		DECK SCREEN
F		CLASSIFYING TANK
G		RADIAL STACKER
H		SINGLE FINE MATERIAL SCREW
I		DOUBLE FINE MATERIAL SCREW
J		20,000cm SAND CUSHION
K		67,000cm FILTER MATERIAL
L		7,800cm TRANSITION MATERIAL
M		67,000cm DRAIN MATERIAL
N		37,000cm LINER MATERIAL
O		42,000cm SAND CUSHION
P		BATCHER
Q		PUG MILL
R		TEMPORARY BENTONITE STORAGE PD TRAILER
S		FUEL STORAGE
T		CONTAINMENT DIKE
U		STORAGE TRAILERS
V		PORTABLE SHOP
W		QUALITY CONTROL TRAILER
X		CONTRACTOR'S TRAILER

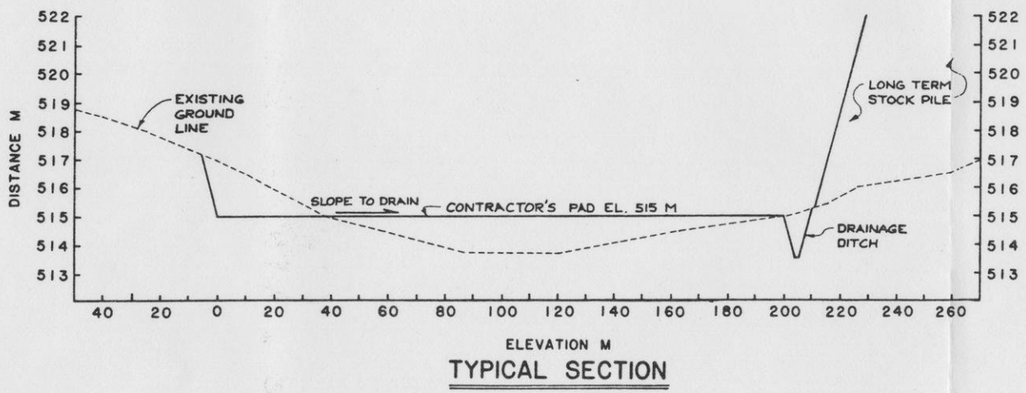
NOTE: PROCESSED MATERIAL STOCKPILES SHOWN REPRESENT PHASE I QUANTITIES, STOCKPILES FOR OTHER PHASES ARE OF SIMILAR SIZE.



CONSTRUCTION SUPPORT AREA

30 0 30

SCALE IN METERS



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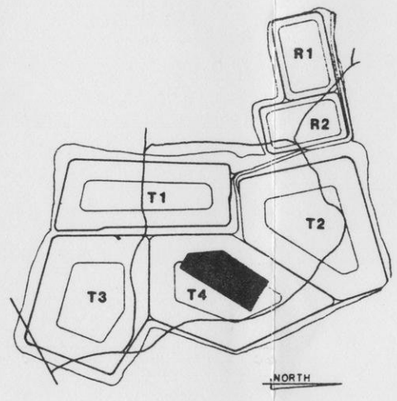


PROJECT LOCATION

FIGURE 23

indeco TWIN CITY DIVISION
800 SOUTH LILAC DRIVE
MINNEAPOLIS, MN. 55416

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
CONSTRUCTION SUPPORT AREA
PLAN & ELEVATION

REVISED	DATE	BY	DESCRIPTION

SCALE	STATE	COUNTY	
DRAWN BY	DATE	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO		SHEET ___ OF ___	REVISION NO

EROSION CONTROL SCHEDULE

1	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
2	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
3	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
4	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 500
5	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
6	PONDS TO DISCHARGE ELEV. 503.4 AND THEN DISCHARGES INTO DRAINAGE BASIN 7
7	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 496
8	PONDS TO DISCHARGE ELEV. 507 AND THEN DISCHARGES THRU DITCH TO DRAINAGE BASIN 4
9	DITCH CHECK DISCHAPGING INTO EXISTING DRAINAGE THRU CULVERT

LEGEND

- DIKE
- DITCH WITH DIRECTION OF FLOW SHOWN
- DRAINAGE BASIN
- →2 DRAINAGE BASIN DISCHARGE POINT WITH I.D. NUMBER
- POND

PHASE 1

CONSTRUCT RECLAIM POND R1

CONSTRUCT WASTE ROCK STORAGE AREA GP

FIGURE 24

BASE SHEET DEVELOPED BY GOLDER ASSOCIATES

NOTE : ELEVATION IN METERS ABOVE MSL

NORTH

0 50 100 150 200 300 400 500

SCALE IN METERS

REVISED	DATE	BY	DESCRIPTION

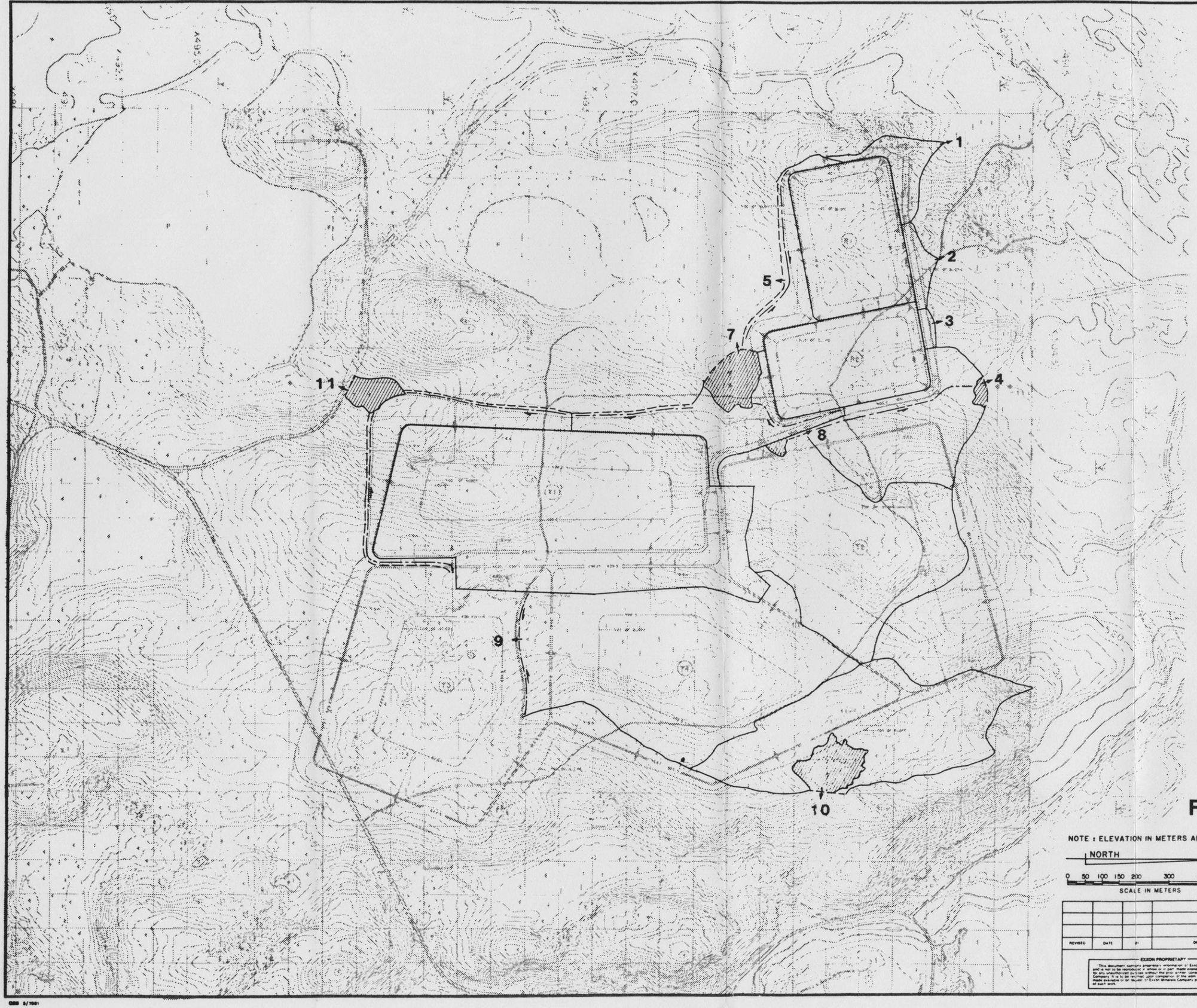
indeco TWIN CITY DIVISION 800 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
WASTE DISPOSAL SYSTEM
SITE 41-114B
EROSION CONTROL - PHASE 1

SCALE AS SHOWN	STATE		COUNTY
DRAWN BY WHP	DATE	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO.		SHEET OF	REVISION NO.

GBB 5/1981



EROSION CONTROL SCHEDULE

1	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
2	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
3	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
4	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 500.
5	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
7	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 496
8	PONDS TO DISCHARGE ELEV. 507 AND THEN DISCHARGES THRU DITCH TO DRAINAGE BASIN 4
9	DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE THRU CULVERT
10	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 517
11	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV 494

LEGEND

- DIKE
- DITCH WITH DIRECTION OF FLOW SHOWN
- DRAINAGE BASIN
- →2 DRAINAGE BASIN DISCHARGE POINT WITH I.D. NUMBER
- POND

PHASE 2

CONSTRUCT RECLAIM POND R2

CONSTRUCT TAILINGS POND T1

FIGURE 25

BASE SHEET DEVELOPED BY GOLDER ASSOCIATES

NOTE : ELEVATION IN METERS ABOVE MSL

NORTH

0 50 100 150 200 300 400 500

SCALE IN METERS

REVISED	DATE	BY	DESCRIPTION

indeco TWIN CITY DIVISION 1500 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
WASTE DISPOSAL SYSTEM
SITE 41-114B
EROSION CONTROL - PHASE 2

SCALE AS SHOWN	STATE		COUNTY
DRAWN BY WHP	DATE	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO.		SHEET ___ OF ___	REVISION NO.

GBB 8/1981

EROSION CONTROL SCHEDULE	
1	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
2	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
3	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
4	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 500
5	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
7	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 496
9	DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE THRU CULVERT
10	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV 517
11	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV 494
12	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV 516

LEGEND

- DIKE
- DITCH WITH DIRECTION OF FLOW SHOWN
- DRAINAGE BASIN
- →2 DRAINAGE BASIN DISCHARGE POINT WITH I.D. NUMBER
- POND

PHASE 3

CONSTRUCT TAILINGS POND T2

RECLAIM TAILINGS POND T1

NOTE : ELEVATION IN METERS ABOVE MSL

NORTH

0 50 100 150 200 300 400 500

SCALE IN METERS

FIGURE 26

BASE SHEET DEVELOPED BY GOLDER ASSOCIATES

REVISED	DATE	BY	DESCRIPTION

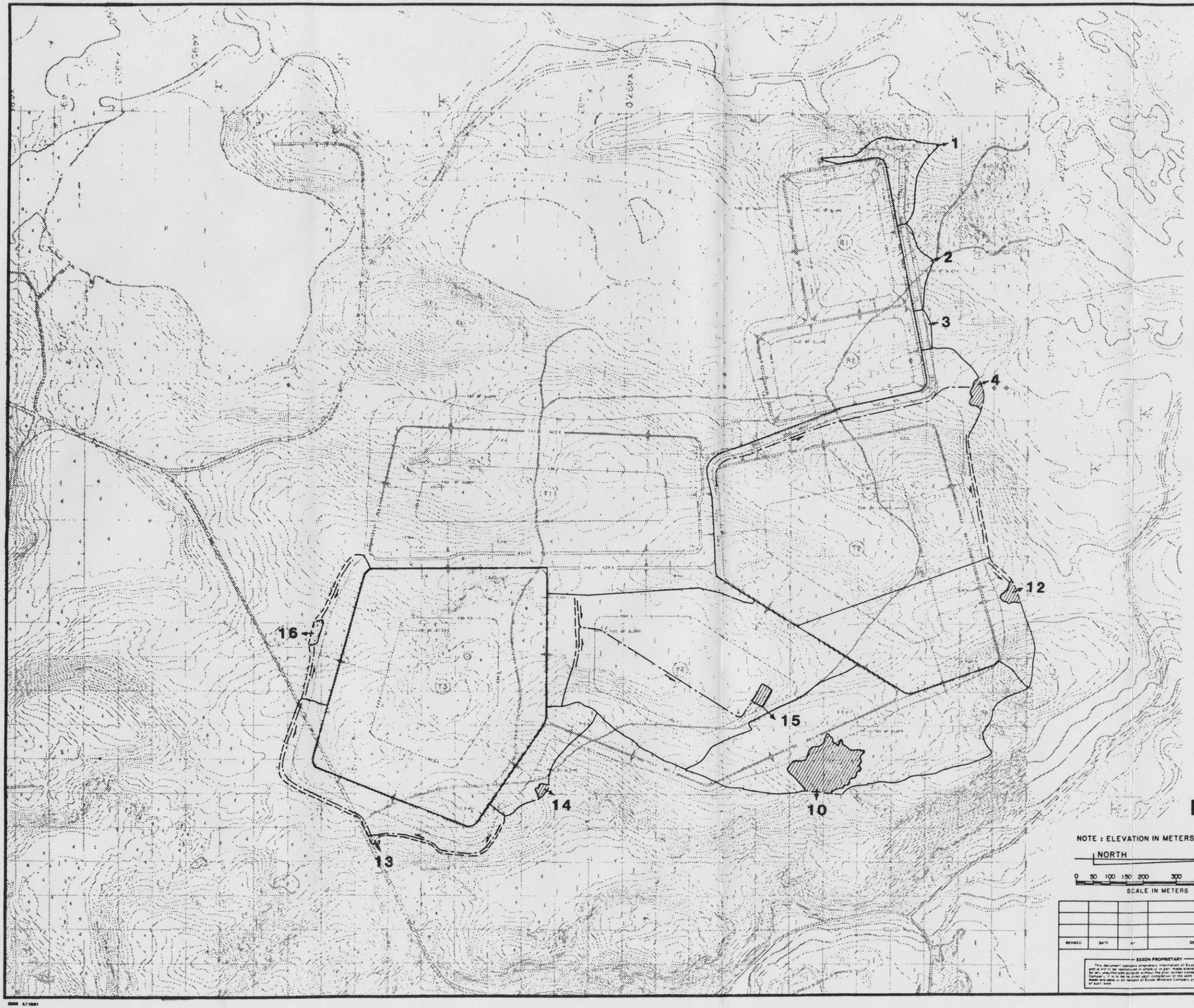
indeco TWIN CITY DIVISION 600 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
WASTE DISPOSAL SYSTEM
SITE 41-114B
EROSION CONTROL - PHASE 3

SCALE AS SHOWN	STATE		COUNTY
DRAWN BY WHP	DATE	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO		SHEET OF	REVISION NO

GSS 5/1991



EROSION CONTROL SCHEDULE

1	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
2	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
3	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
4	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 500
10	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 517
12	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 516
13	BALED HAY OR STRAW DITCH CHECKS AND SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 508
14	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV 510
15	SEDIMENT POND WITH PUMPED OVERFLOW TO BASIN 10 DISCHARGE ELEV 514
16	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 503

LEGEND

- DIKE
- DITCH WITH DIRECTION OF FLOW SHOWN
- DRAINAGE BASIN
- →2 DRAINAGE BASIN DISCHARGE POINT WITH I.D. NUMBER
- POND

PHASE 4

CONSTRUCT TAILINGS POND T3

PLACE TRAFFIC MAT ON TAILINGS POND T2

FIGURE 27

BASE SHEET DEVELOPED BY GOLDER ASSOCIATES

NOTE : ELEVATION IN METERS ABOVE MSL

NORTH

0 50 100 150 200 300 400 500

SCALE IN METERS

REVISED	DATE	BY	DESCRIPTION

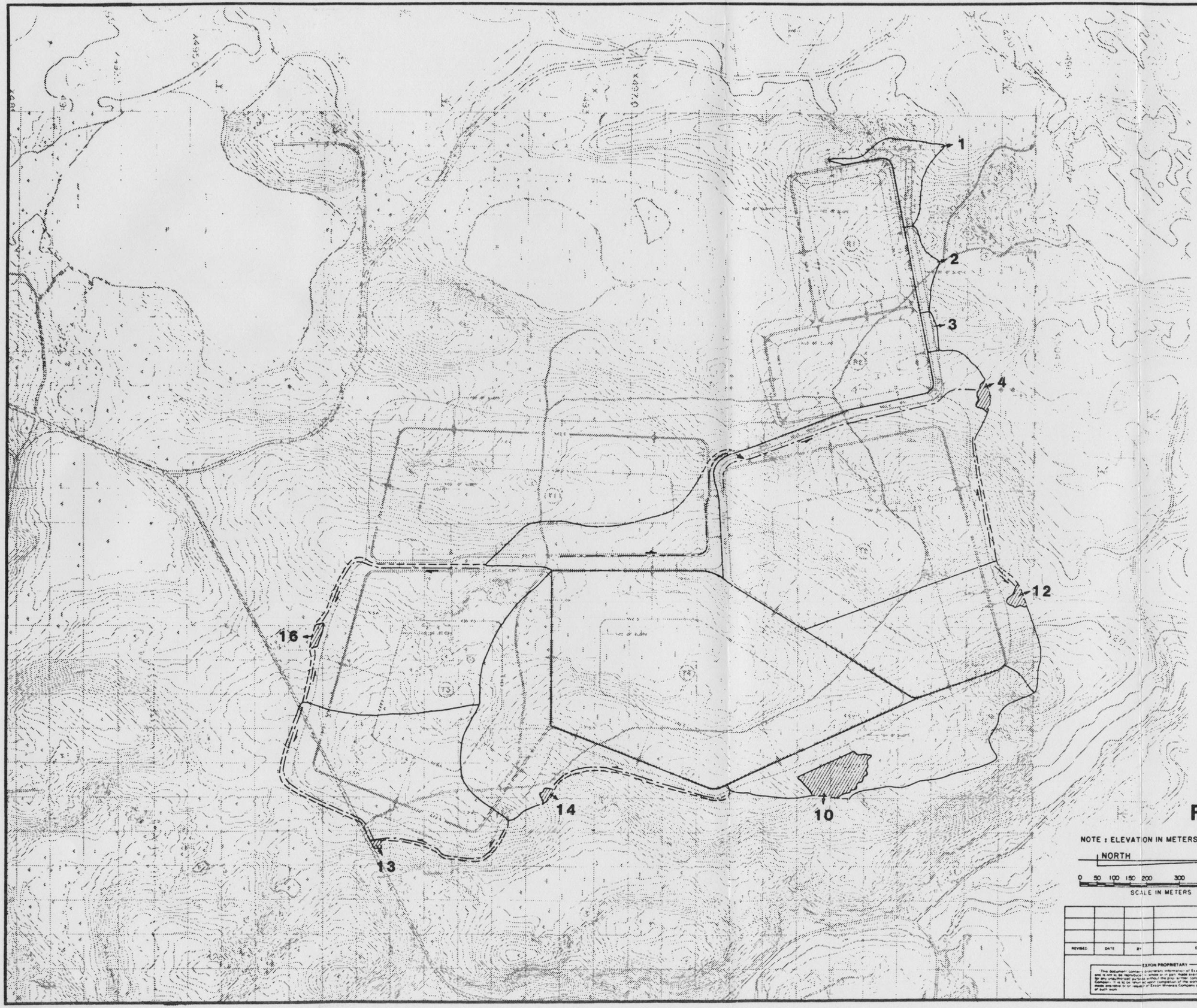
indeco TWIN CITY DIVISION 1500 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
WASTE DISPOSAL SYSTEM
SITE 41-114B
EROSION CONTROL - PHASE 4

SCALE AS SHOWN	STATE		COUNTY
DRAWN BY WHP	DATE	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO.		SHEET OF	REVISION NO.

GBR 5/1981



EROSION CONTROL SCHEDULE

1	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
2	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
3	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
4	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 500
10	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 517
12	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 516
13	BALED HAY OR STRAW DITCH CHECKS AND SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 508
14	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 510
16	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 503

LEGEND

- DIKE
- DITCH WITH DIRECTION OF FLOW SHOWN
- DRAINAGE BASIN
- →2 DRAINAGE BASIN DISCHARGE POINT WITH I.D. NUMBER
- POND

PHASE 5

CONSTRUCT TAILINGS POND T4

RECLAIM TAILINGS POND T3

FIGURE 28

BASE SHEET DEVELOPED BY GOLDER ASSOCIATES

NOTE : ELEVATION IN METERS ABOVE MSL

NORTH

0 50 100 150 200 300 400 500

SCALE IN METERS

REVISED	DATE	BY	DESCRIPTION

indeco TWIN CITY DIVISION 1500 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

EXXON MINERALS COMPANY

CRANDON PROJECT

TITLE

WASTE DISPOSAL SYSTEM
SITE 41-114B
EROSION CONTROL - PHASE 5

SCALE AS SHOWN	STATE		COUNTY
DRAWN BY WHP	DATE	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO.		SHEET OF	REVISION NO.

GBB 5/1981

EROSION CONTROL SCHEDULE

1	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
2	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
3	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
4	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 500
5	BALED HAY OR STRAW DITCH CHECK DISCHARGING INTO EXISTING DRAINAGE
7	SEDIMENT POND WITH OVERFLOW PIPE. DISCHARGE ELEV. 496
10	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 517
12	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 516
14	SEDIMENT POND WITH OVERFLOW PIPE DISCHARGE ELEV. 510

LEGEND

- DIKE
- DITCH WITH DIRECTION OF FLOW SHOWN
- DRAINAGE BASIN
- →2 DRAINAGE BASIN DISCHARGE POINT WITH I.D. NUMBER
- POND

PHASE 6

RECLAIM TAILINGS POND T4

RECLAIM TAILINGS POND T2 (BENTONITE LINER AND VEGETATIVE COVER)

FINAL SITE RECLAMATION

FIGURE 29

BASE SHEET DEVELOPED BY GOLDER ASSOCIATES

NOTE : ELEVATION IN METERS ABOVE MSL

NORTH

0 50 100 150 200 300 400 500

SCALE IN METERS

REVISED	DATE	BY	DESCRIPTION

indeco TWIN CITY DIVISION 1800 SOUTH LILAC DRIVE MINNEAPOLIS, MN. 55416

EXXON MINERALS COMPANY
CRANDON PROJECT

TITLE
WASTE DISPOSAL SYSTEM
SITE 41-114B
EROSION CONTROL - PHASE 6

SCALE AS SHOWN	STATE		COUNTY
DRAWN BY WHP	DATE	CHECKED BY	DATE
APPROVED BY	DATE	APPROVED BY	DATE
APPROVED BY	DATE	EXXON	DATE
DRAWING NO		SHEET — OF —	REVISION NO

GBS 5/1991