Draft

Supplemental Environmental Impact Statement

In-Pit Tailings Disposal Project
Ispat Inland Mining Company
Virginia, Minnesota

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

November 1999

Draft Supplemental Environmental Impact Statement for In-Pit Tailings Disposal Ispat Inland Mining Company Virginia, Minnesota

Responsible Governmental Unit

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Abstract

This Draft Supplemental Environmental Impact Statement (SEIS) documents the analysis of potential impacts associated with depositing taconite tailings into the depleted Minorca pit taconite mine. Issues include potential surface and ground water impacts, dam safety, wetlands, and economic effects.

Certification of Responsible Governmental Unit

I hereby certify that the information contained in this document is true and complete to the best of my knowledge and that copies of the completed Draft SEIS have been made available to all persons and parties on the official EQB distribution list.

Thomas W. Balcom   12/1/99

Thomas W. Balcom, Supervisor   Date
Environmental Review Section
Office of Management & Budget Services

Executive Summary

This document supplements the Environmental Impact statements prepared in 1974 and 1990 for Ispat Inland Mining Company's taconite mining and processing facilities.

Ispat Inland proposes a change to its original mining and processing plan. When permitted in 1974, Ispat Inland (then Inland Steel Mining Company) planned to enlarge its present tailings basin as it filled to capacity. As an alternative to expanding its tailings basin, Ispat Inland proposes to deposit both fine and coarse tailings in the depleted Minorca pit, which once held taconite ore. In-pit disposal would reduce tailings basin construction costs and avoid wetland impacts associated with tailings basin expansion.

An Environmental Impact Statement is not mandatory, pursuant to Minnesota Rules Part 4410.4400 Subpart 8, for the proposed change in tailings disposal. However, reflecting concerns over potential drinking water impacts, Laws of Minnesota, 1996, Chapter 407, Section 56 authorizes the Minnesota Pollution Control Agency to permit deposition of tailings into taconite mine pits provided, "*the proposer demonstrates through an environmental impact statement and risk assessment that the deposition will not pose an unreasonable risk of pollution or degradation of groundwater*".

The potential effects of the proposed project have been studied intensively. Open pits in the project area are directly connected to groundwater; it is assumed pollutants introduced into one pit will eventually migrate to others. Of particular concern with respect to the proposed project are potentially elevated levels of the elements manganese, fluoride, and molybdenum in Ispat Inland tailings pore waters. Arsenic, although not at elevated levels, was also evaluated due to the expectation that a more stringent drinking water standard for arsenic is under consideration at the federal level.

The Minnesota departments of Natural Resources and Health, in cooperation with the Minnesota Pollution Control Agency and the University of Minnesota, extensively studied the potential for these elements to cause ground water degradation and affect public health. Studies focused on water quality in the Mesabi Mountain pit, from which the City of Virginia draws its municipal water.

The Minnesota Department of Health completed a Health Risk Assessment for the proposed project and concluded it poses negligible risk to public health. The Department of Natural Resources (DNR) conducted extensive geochemical and hydrogeologic analysis and does not expect significant ground water effects.

The Supplemental EIS includes as appendices all background studies undertaken to assess potential impacts of the proposed project, including the complete Health Risk Assessment, and studies of tailings characterization, hydrogeology, and geochemistry.

The Supplemental EIS also analyzes potential impacts to wetlands, economic costs and benefits of the No Action alternative (expanding the existing tailings basin) and Proposed alternative (in-pit tailings disposal), and dam safety (the Proposed alternative would include construction of a dike to increase Minorca pit tailings disposal capacity).

The Proposed alternative avoids wetland impacts associated with the No Action alternative, decreases costs to the project proposer, Ispat Inland, and does not pose public risk in the event of dike failure.

The Supplemental EIS suggests mitigation as warranted, particularly ground water monitoring to evaluate migration of manganese, fluoride, molybdenum, and arsenic between the Minorca and Mesabi Mountain pits, and reclamation strategies to reduce ground water flow between the pits.

Contents

Contents

Figures

Section One

1.0 Background and Overview

1.1 Summary of Proposed Project

To continue taconite processing at its Virginia facility, Ispat Inland Mining Company (Ispat Inland) must plan for future taconite tailings disposal. Ispat Inland currently disposes of fine tailings in an above-ground tailings basin, which has approximately three more years of capacity; coarse tailings are stockpiled or used in construction.

When permitted in 1974, Ispat Inland (then Inland Steel Mining Company) planned to enlarge its present tailings basin when it was filled to capacity. Tailings basin expansion is included in Ispat Inland's Permit to Mine. For the purposes of this Supplemental Environmental Impact Statement (SEIS), tailings basin expansion is the "No Action Alternative". As an alternative to expanding its tailings basin, Ispat Inland proposes to deposit both fine and coarse tailings in the depleted Minorca pit, which once held taconite ore. In-pit disposal would reduce tailings basin construction costs and avoid wetland impacts associated with tailings basin expansion. In-pit disposal of tailings is analyzed as the "Proposed Alternative".

1.2 Project Location

Ispat Inland has taconite mining-related facilities in three locations on Minnesota's Iron Range *(refer to Figures 1 to 4 for project location)*.

1) The main facility, including corporate headquarters, taconite processing plant, and the depleted Minorca pit, is in sections 32 and 33 of Township 59 North, Range 17 West, north of the City of Virginia, and Section 4 of Township 58 North, Range 17 West, which is included within the City of Virginia corporate limits. The depleted Minorca pit, where Ispat Inland proposes to deposit tailings, is approximately 2,000 feet south of the plant.

2) The existing tailings basin is north of the Laurentian Divide, approximately 3 miles

northeast of the plant, in sections 13, 14, 23, 24, and 26 of Township 59 North, Range 17 West. If the tailings basin were expanded (the No-Action alternative), the expansion would occur in sections 14, 15, 22, and 23 of Township 59 North, Range 17 West.

3) Ispat Inland's active mine, the Laurentian, is in sections 13 and 24 of Township 58 North, Range 17 West, and Section 18 of Township 58 North, Range 16 West, between the cities of Gilbert and McKinley. Ispat Inland proposes no changes in mining operations.

1.3 Environmental Setting

Located in the Virginia Horn area of the Mesabi Iron Range, the project area has been affected by iron and taconite mining for over a century. As is generally true across the Iron Range, mining occurs on the south side of the Laurentian Divide where up-thrust deposits approach the surface. The proposed project would be located within Ispat Inland's permitted mining area, filling the depleted Minorca taconite pit with tailings. The proposed project would avoid the wetland impacts associated with expanding the existing tailings basin, and would limit disturbance to a small amount of land beneath a dike proposed along the south and east edges of the Minorca pit.

South of the divide, where the proposed project would occur, surface and ground waters move south and west. North of the divide, which is a granite/quartzite aquaclude, ground and surface waters generally migrate northeasterly.

A small stream, Sauntry Creek, flows around the eastern and southern edges of the Minorca pit. The creek has been channelized and re-routed several times to accommodate mining activity. Sauntry Creek eventually flows into Virginia and Silver lakes in the City of Virginia. While Sauntry Creek was once intermittent, Ispat Inland maintains stream flow by pumping at the request of the City of Virginia.

The primary environmental issue associated with the project is whether tailings deposited in the Minorca pit may degrade water quality in the Mesabi (or Missabe) Mountain pit, which is fed by the Biwabik aquifer and is less than a mile from the Minorca pit. The City of Virginia takes its drinking water from a well adjoining the Mesabi Mountain pit *(see Figure 5)*. The DNR assumes a hydrologic connection among area pits intersecting the aquifer and that chemicals, minerals, or trace elements in the pits move among them via ground water *(see Figure 6 for a cross-section of area pits)*.

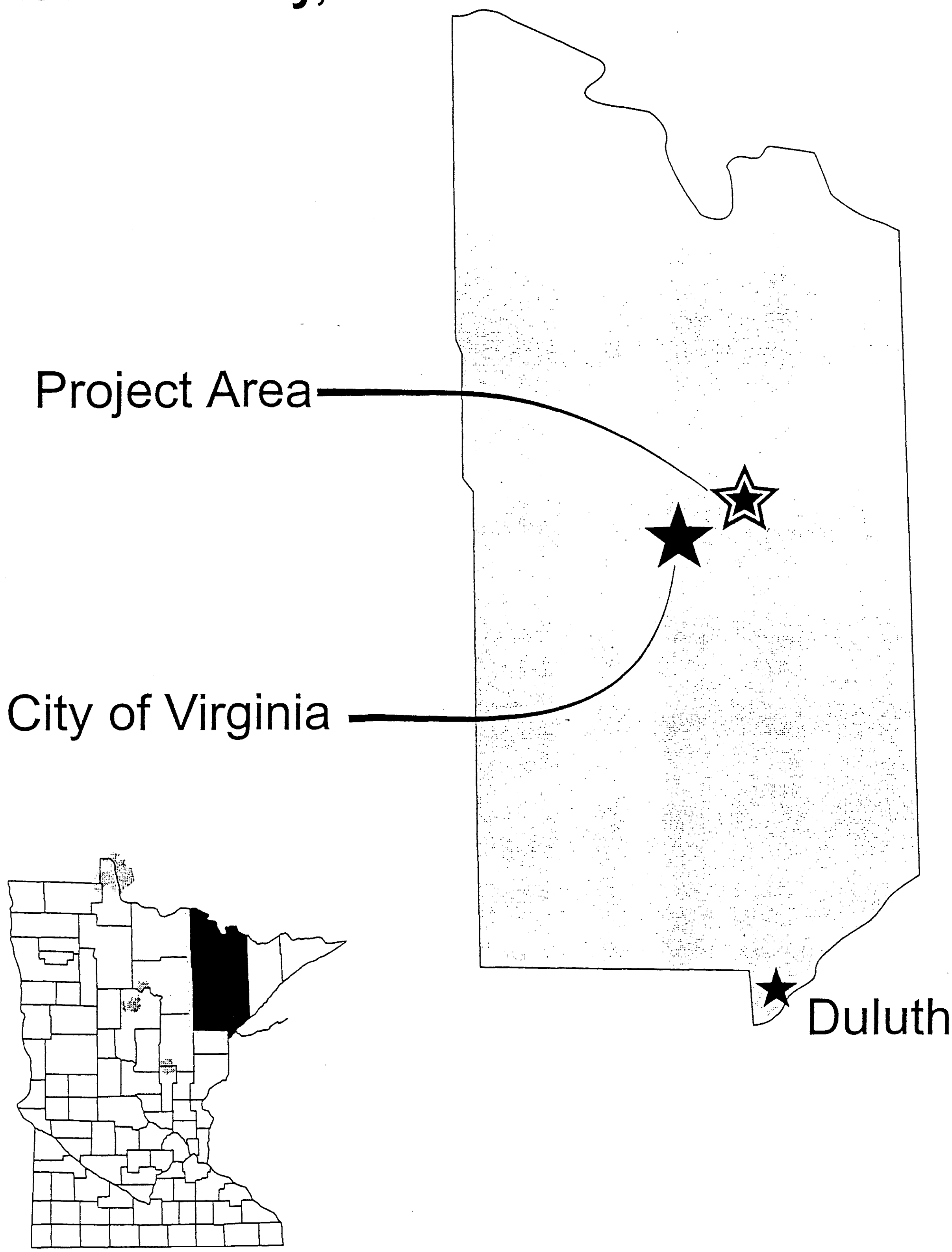
1.4 Environmental Review History

An Environmental Impact Statement is not mandatory for this project pursuant to Minnesota Rules Part 4410.4400. However, reflecting concerns over potential drinking water impacts, Laws of Minnesota, 1996, Chapter 407, Section 56 authorizes the Minnesota Pollution Control Agency to permit deposition of tailings into taconite mine pits provided, "*the proposer demonstrates through an environmental impact statement and risk assessment that the deposition will not pose an unreasonable risk of pollution or degradation of groundwater*".

The DNR previously prepared two Environmental Impact Statements for Ispat Inland's facilities; both were mandatory pursuant to Minnesota Rules Part 4410.4400, subpart 8.b. The first, completed in 1974, analyzed the potential environmental impacts of developing the Minorca mine (now depleted), ore processing facilities, and the tailings basin, which is not constructed to its fully-permitted limits. The latter, completed in 1990, analyzed the potential impacts of developing the Laurentian mine. Ore from the Laurentian is processed at Ispat Inland's existing facility, with tailings deposited in the existing tailings basin.

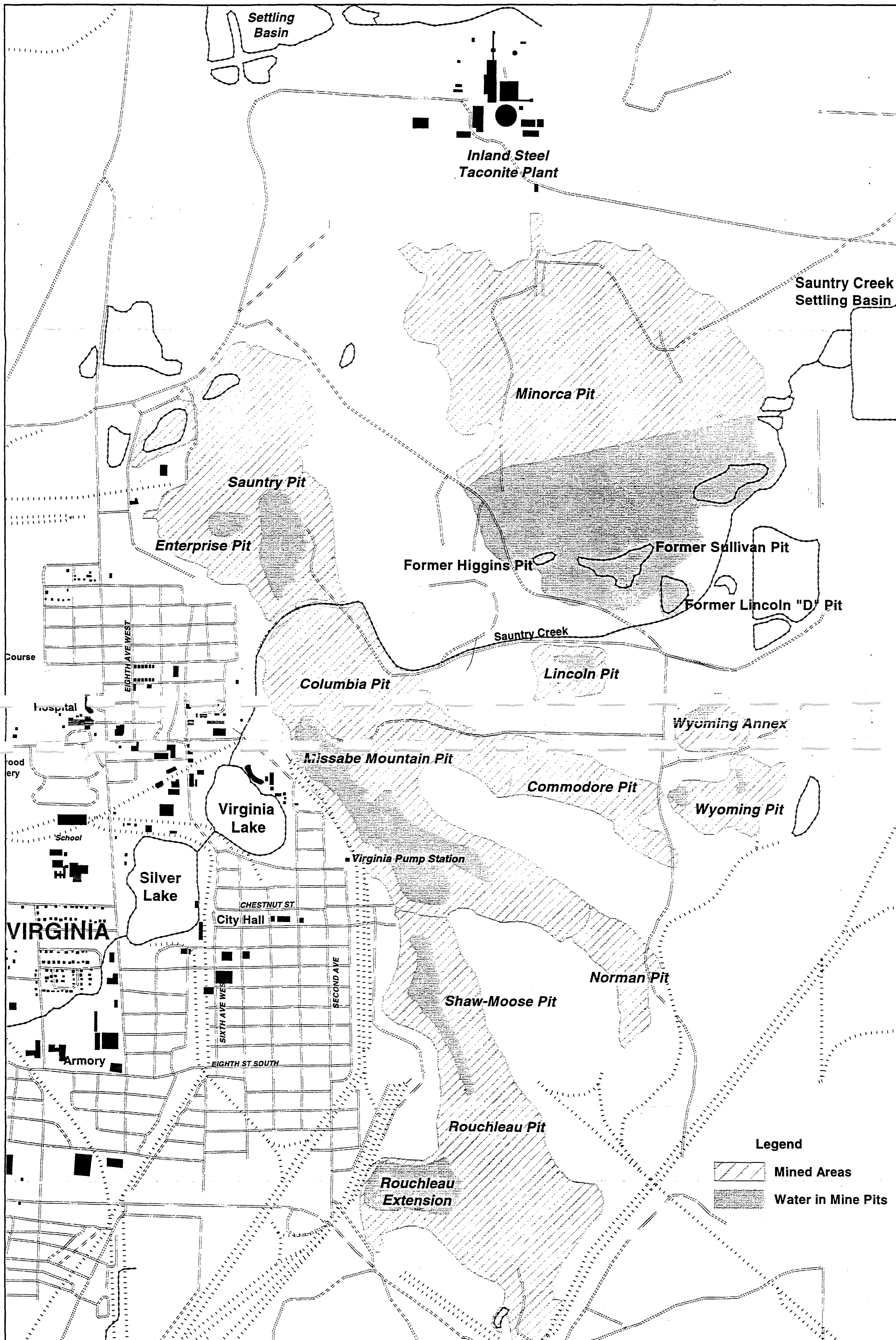
Minnesota Rules Part 4410.3000, Subpart 3.A. provide for supplementing an Environmental Impact Statement "*whenever after a final EIS has been determined adequate but before the* *project becomes exempt under part 4410.4600, subpart 2, item B or D, the RGU determines that either: (1) substantial changes have been made in the proposed project that affect the potential significant adverse environmental effects of the project; or (2) there is substantial new information or new circumstances that significantly affect the potential environmental effects from the proposed project that have not been considered in the final EIS or that significantly affect the availability of prudent and feasible alternatives with lesser environmental effects."* Pursuant to provision (1) of this subpart, the legislative requirement for EIS-level analysis is satisfied through preparation of this EIS supplement.

St. Louis County, MN



INLAND STEEL MINING
MINORCA MINE

Inland Steel Mining Company Minorca Mine County Location Map	Date: 11/96 Figure: 1



INLAND STEEL MINING MINORCA MINE	Scale 1" = 1500'	HDR HDR Engineering Inc.	Inland Steel Mining Location Map

Date: 8-96

Figure: 2

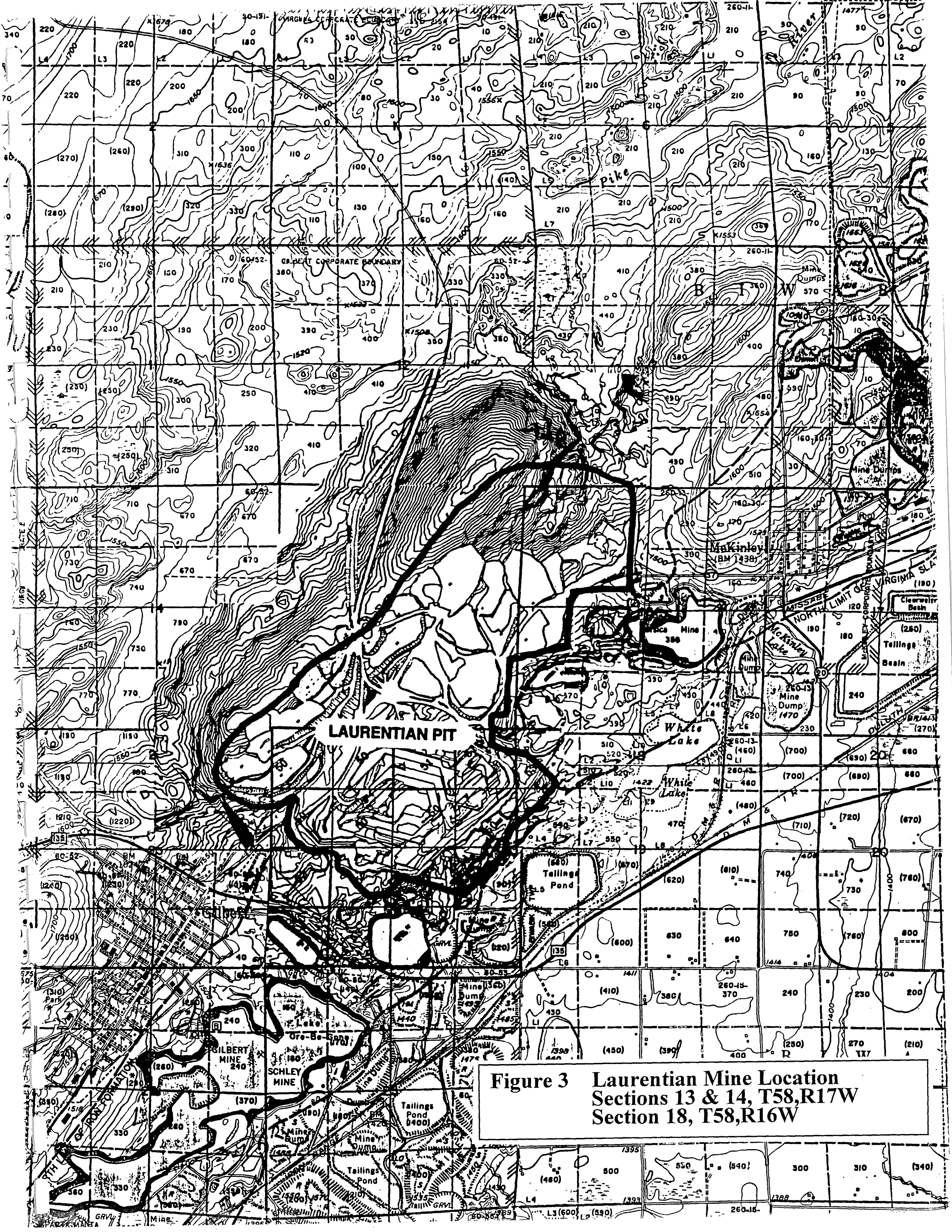
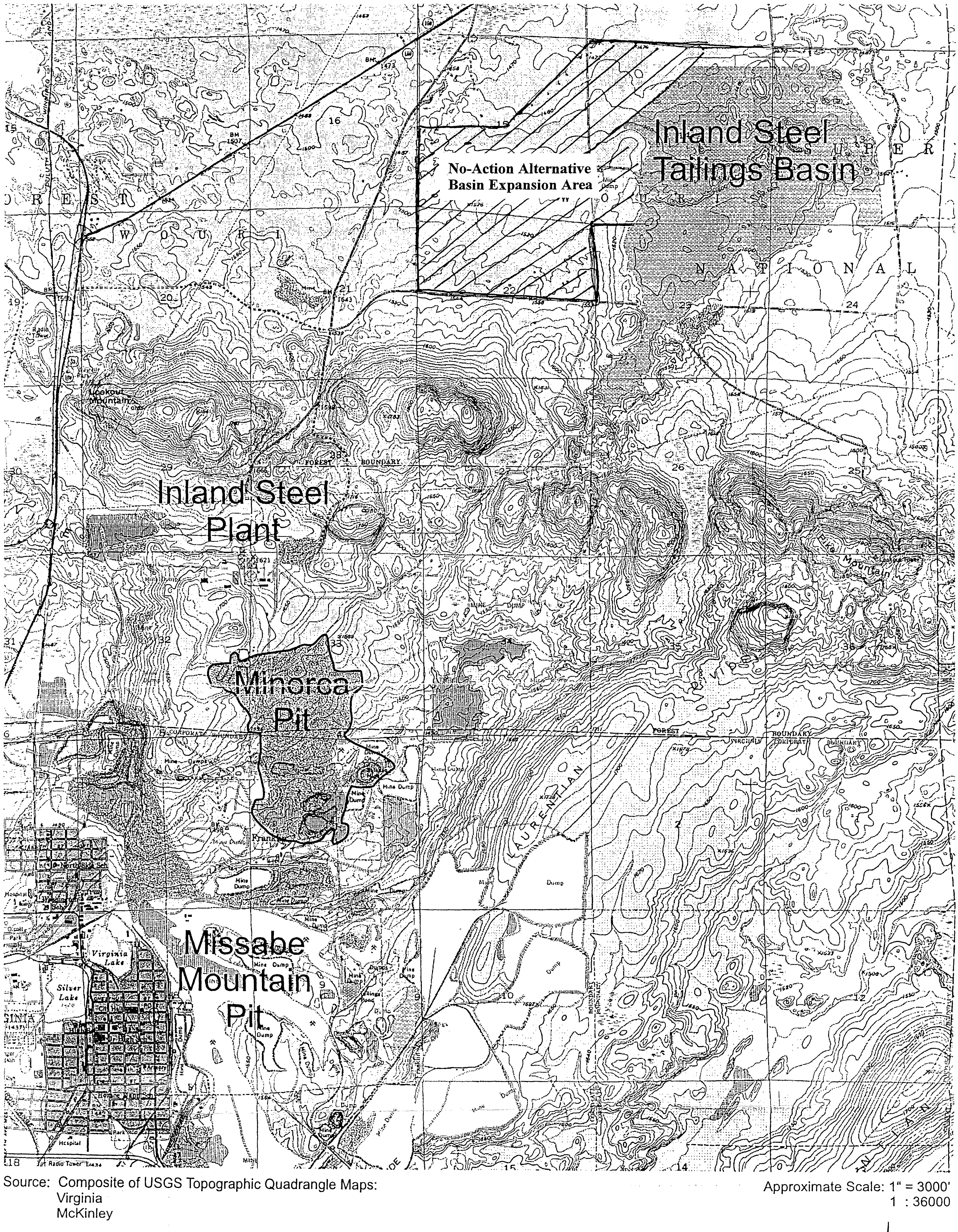


Figure 3 Laurentian Mine Location
Sections 13 & 14, T58,R17W
Section 18, T58,R16W



Source: Composite of USGS Topographic Quadrangle Maps:
Virginia
McKinley

Approximate Scale: 1" = 3000'
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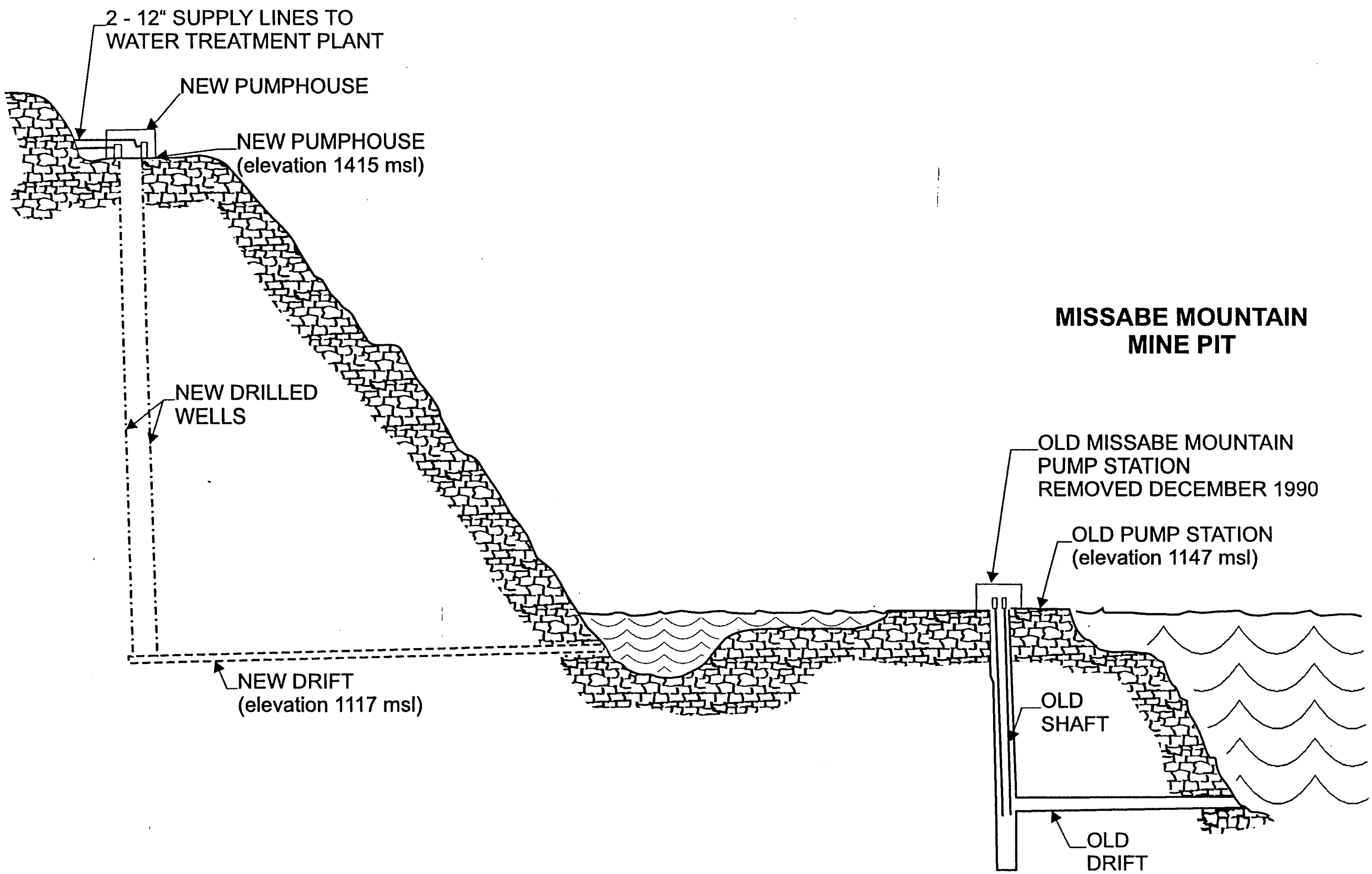
N

INLAND STEEL MINING
MINORCA MINE

Inland Steel Mining Company
Minorca Mine

Date:
11/96

Figure 4 Upland Tailings Basin (including "No Action" Expansion)



INLAND STEEL MINING
MINORCA MINE

HDR

HDR Engineering Inc.

Inland Steel Mining Company

City of Virginia
Water Supply Pumping Station

Date: 11/96

Figure: 5

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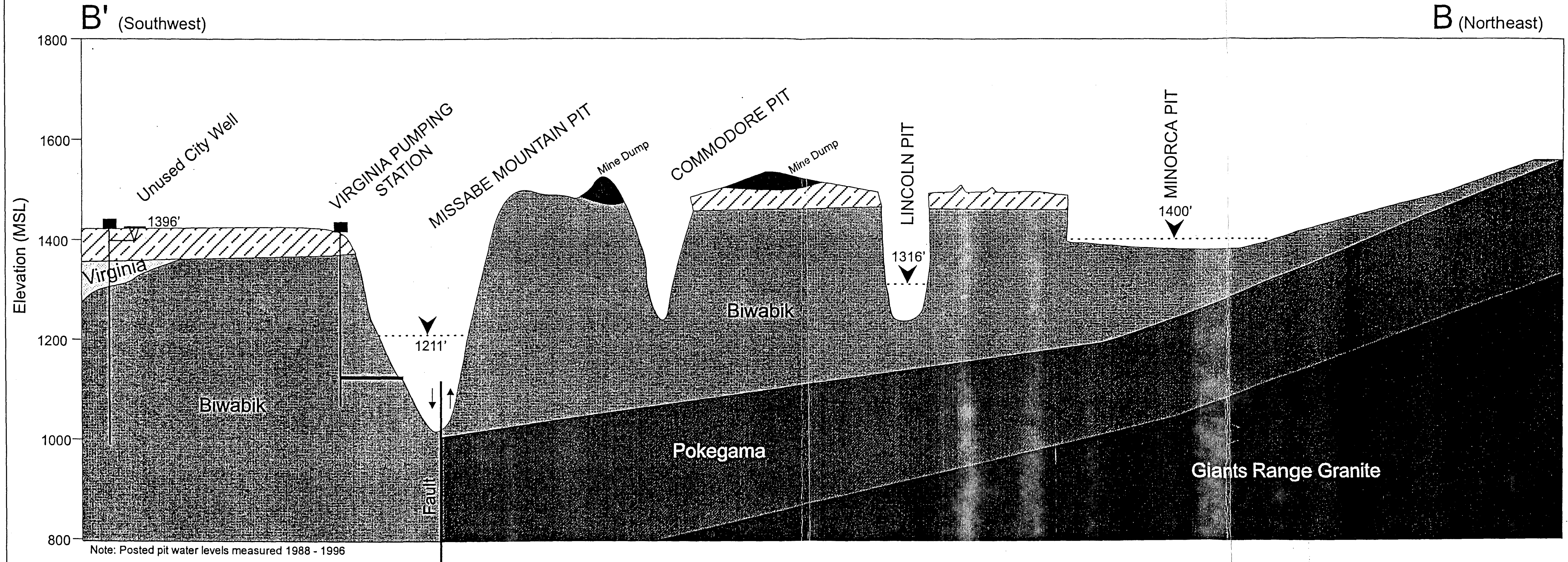
INLAND STEEL MINING

MINORCA MINE



Legend

- Water elevation
- Drift
- Virginia Argillite
- Biwabik Iron Formation
- Pokegama Quartzite
- Giants Range Granite

Vertical Scale 1" = 200'

Horizontal Scale 1" = 1000'

HDR

HDR Engineering Inc.

Inland Steel Mining Company B' - B (Southwest-Northeast) Generalized Cross Section	Date: 11/96 Figure: 6

Section Two

2.0 Taconite Processing and Tailings Generation

2.1 Taconite Processing

The basic material inputs to fluxed taconite pellet production are coarse ore, fluxstone (limestone and dolomite), water, and bentonite (clay). The production end products are fluxed oxide pellets, coarse tailings (beach sand-grain size), fine tailings (powder texture), and water. Ispat Inland's current tailings discharge is a slurry of fine tailings and water. Due to tailings basin capacity limitations and pumping costs, Ispat Inland separates its coarse tailings for truck haulage, disposing of them on land. If the proposed project proceeds, Ispat Inland will pump both coarse and fine tailings into the Minorca pit.

Iron beneficiation at the Ispat Inland facility consists of crushing, grinding, separation, and agglomeration (pelletizing). The process is diagrammed in Figure 7. Ore is hauled from the mine to a series of crushers where it is reduced to nominal 0.5-inch material then wet-ground in rod mills to 10-mesh size (0.08 inch). The wet material is sent to magnetic separators, which separate material with iron content from the waste, or "tails", materials. The tails are sent to classifiers that separate and dewater the coarse fraction. The coarse tails are hauled by truck for on-land disposal. Fines (fine tails) from the classifier are sent to the tailings thickener, where fine tailings from throughout the process are collected, dewatered to 50 percent solids, and discharged to the tailings basin.

The ore slurry undergoes further grinding, screening, and magnetic concentration. Silica is removed with the aid of flotation reagents (amines) and frother. The fluxstone is crushed, wet-ground, and pumped to a holding tank from which it is pumped and mixed with the ore slurry. The fluxed slurry is dewatered, caked, mixed with bentonite and balled into "green" pellets ranging from 3/8 to 5/8 inches in diameter. The pellets are fed to an indurator (oven) which dries and fires the pellets. Finished pellets are stockpiled and eventually loaded onto rail cars for final shipment.

2.2 Water and Tailings Cycle

The taconite processing water cycle is substantially closed. A simplified depiction of water routing for the Ispat Inland facility is provided in Figure 8, a more detailed diagram in Figure 9. Water is recovered from the tailings basin and used repeatedly in processing. Losses due to evaporation are replaced with make-up water from the nearby Sauntry and Enterprise pits (*see Figure 2*). Water also enters the cycle via precipitation, either into the tailings basin or onto impervious surfaces in the plant and parking areas. Plant site runoff is collected in a settling basin, which also receives discharge from the plant sanitary waste water treatment system. Water from the plant site settling basin is returned to the plant and re-enters the processing cycle. The plant site settling basin is located just west of the plant. It was originally constructed for disposal of Enterprise mine tailings, but was never used for that purpose.

Ispat Inland's tailings basin is located about 3 miles northeast of the plant, north of the Laurentian divide. The main basin was created by constructing a conventional earth dam containing part of the watershed of Wuori Creek. The tailings discharged into the main basin was a slurry of water and solid tailings from Minorca pit ore. The tailings stream was discharged into the upper reaches of the basin. The solids settled out, leaving a clear water pool adjacent the dam.

When the main cell of the basin filled to capacity and flood storage diminished, an interior dike, constructed of primarily coarse tailings, was built to provide storage capacity for tailings from Ispat Inland's Laurentian mine (permitted in 1991), creating a new cell (Cell IIA). A decant structure was installed to allow decanted water stored behind the Cell IIA dike to flow into the clear water pool of the main cell.

In addition to water in the tailings slurry, other sources of water in the basin include direct precipitation and surface water runoff.

The majority of the water from the clear water pool is pumped to the plant for reuse. Water also leaves the tailings basin through seepage and through a siphon discharge to Wuori Creek, as necessary, to manage basin water levels.

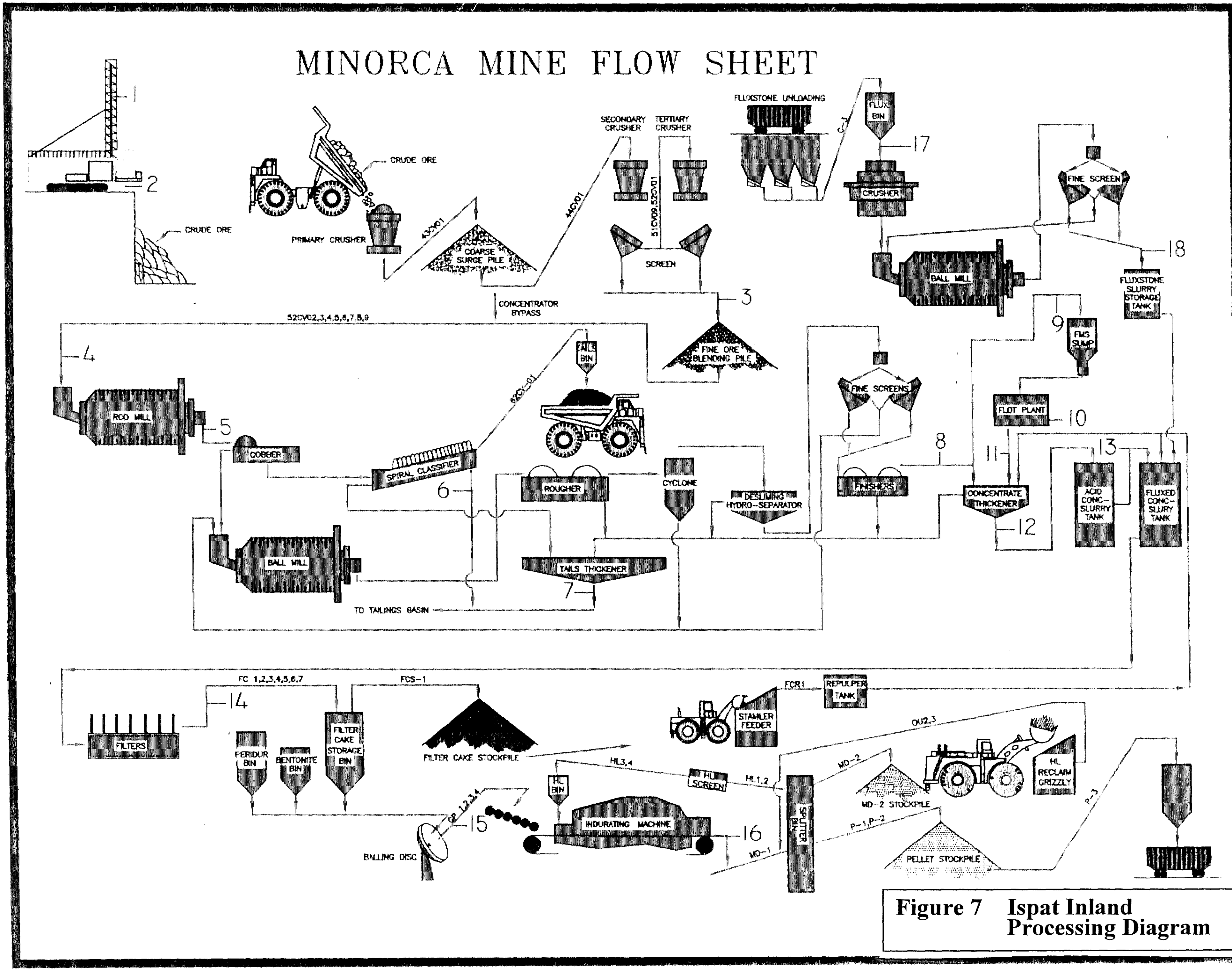


Figure 7 Ispat Inland Processing Diagram

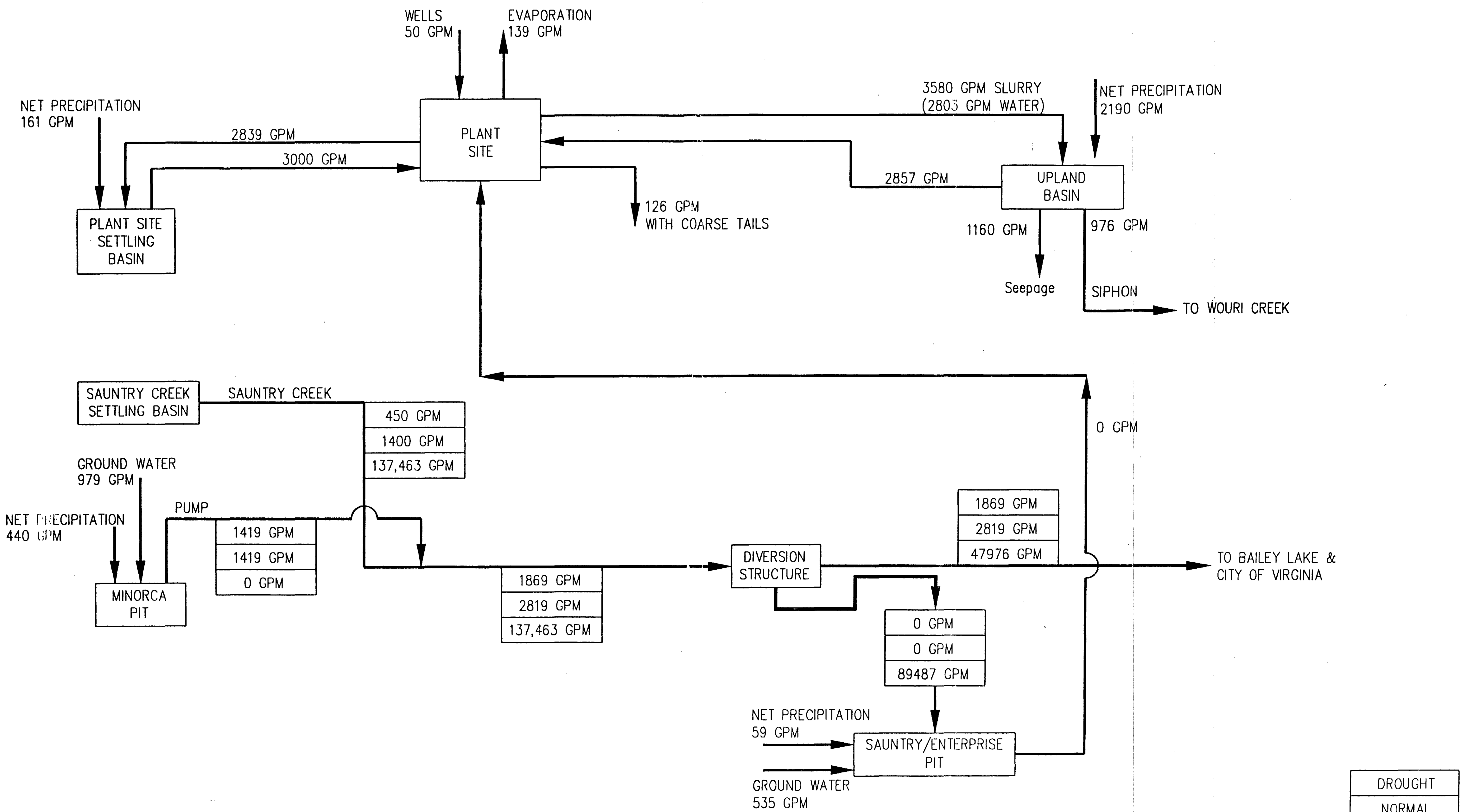


Figure 8 Simplified Water Balance No Action Alternative

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NORAMCO engineering corporation
HIBBING, MINNESOTA

TITLE
INLAND STEEL MINING CO.
SIMPLIFIED WATER BALANCE, EXISTING
SEPT 1997

DWG. NO 97754-FS-005
CLIENT NO ———
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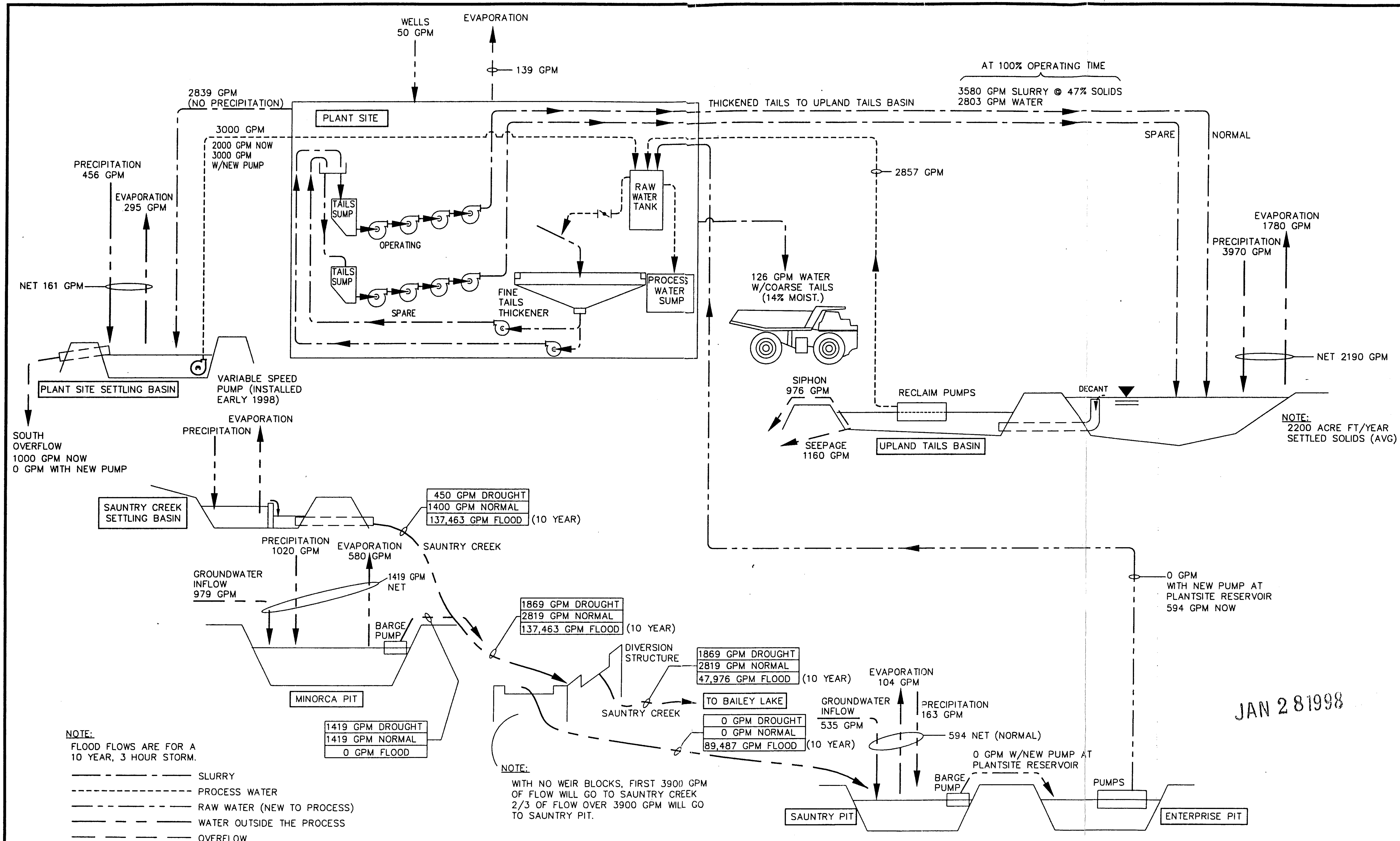

CLIENT
INLAND STEEL MINING CO.
VIRGINIA, MN
N PIT TAILINGS DISPOSAL STUDY

NORAMCO engineering corporation
HIBBING, MINNESOTA

TITLE
PLANT SITE WATER BALANCE
EXISTING UPLAND TAILS BASIN
AVERAGE FLOWS, SEPT. 1997

97754-FS-001

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Figure 9 Detailed Water Balance No Action Alternative

REVISIONS

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	ISSUED WITH REPORT	VAN				
	RE-ISSUED FOR APPROVAL	VAN		BEK		12/31/97
	RE-ISSUED FOR APPROVAL	VAN		BEK		10/28/97
	ISSUED FOR APPROVAL	VAN		BEK		10/1/97
	PRELIMINARY ISSUE	LEV		BEK		9/10/97

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Section Three

3.0 Tailings Disposal

3.1 Expanded Tailings Basin (No Action Alternative)

Ispat Inland's tailings basin has approximately three years of capacity remaining. If the proposed project is not implemented, Ispat Inland will expand its existing basin to its originally-permitted limits. The fully-constructed tailings basin was included in the EIS completed in 1974 when the mine and processing facilities were originally proposed. The basin expansion would cover approximately 800 acres of valley side and bottom, to the west of the existing tailings basin, and would be similar to the existing tailings basin in appearance and operation. Figure 10 provides a timetable for construction and operation of the No Action alternative.

To construct the basin expansion, a dike would be built along the east, north, and west sides of the expanded basin area *(see Figure 11)*. The southern (non-diked) side of the basin would be up against existing hills. The dike would be constructed of mine rock and coarse tails, with geotextile between the rock and the coarse tails on the downstream side and a liner on the upstream side to minimize seepage through the dike *(see Figure 12)*. Although dike construction would occur over nine years, tailings deposition could begin after three. Prior to filling the dike, marketable timber would be removed; the remaining vegetation would be left in place for dust control.

Overflow from the basin would be decanted to the clear water pond in the existing basin then pumped to the plant for reuse. Excess water in the clear water pond would continue to be discharged into Wuori Creek. Due to the high cost of pumping, only fine tailings would be deposited in the basin expansion. Coarse tails would continue to be trucked for use in dike construction or stockpiled.

Tailings would be deposited into the basin from the south (uphill) side, settling out as they flowed north. The decant structure would be located at the northeast corner of the basin. The height of the decant could be adjusted, allowing the water in the settling pool to rise as the basin filled up and the basin dike was completed. The pipeline could be extended into the basin for more efficient filling.

The basin would be full after 10 years of tailings disposal, consisting of a delta of fine material sloping at approximately 0.5% to the north towards the settling pool.

After the basin was full, a permanent spillway would be constructed to maintain the pool level and the basin would be reclaimed with vegetation.

3.2 In-Pit Tailings Disposal (Proposed Alternative)

Ispat Inland proposes to start construction of the proposed project in the spring of 2000. A project construction and operations timetable is depicted in Figure 13.

If the proposed project proceeds, coarse tailings would be combined with fine tailings for in-pit disposal. A summary of the tailings and water components of the proposed tailings discharge is:

	Solids	Water	Total
Coarse Discharge (gpm)	500	390	890
Fine Discharge (gpm)	650	3080	3730
Total (gpm)	1150	3470	4620

(gpm = gallons per minute)

The proposed project would result in minor changes to the water cycle: tailings water would be recovered from the Minorca pit instead of the existing tailings basin; relatively minor amounts of water would be discharged to the existing tailings basin for fugitive dust control, and discharges to Wuori Creek from the existing tailings basin would continue in order to maintain flood storage capacity. Ispat Inland would continue to pump water from the Minorca pit complex to augment flows in Sauntry Creek. Figure 14 provides a simplified diagram of the proposed water cycle. A more detailed diagram is provided in Figure 15.

Generally, the proposed project would involve construction of a tailings discharge pipe from the processing plant to a movable location in the Minorca pit, and construction of a water intake pump station and pipeline to carry water from the pit back to the plant where it would be re-used. All construction would occur on Ispat Inland property, on lands previously affected by mining. Ispat Inland expects project construction to take approximately one year.

A return water barge, pumps, and pipeline will be installed in the Lincoln 'D' pit (connected to the Minorca pit), which will be used as a clarifying basin during the early years of project operation. The return water pipes would run along the floor of the pit, and would eventually be covered with tailings.

Modifications would be made in the plant to divert coarse tailings to the fine tailings pumps where they would be combined with the fine tails and pumped to the basin.

Tailings could be deposited in the basin after the first year of project construction. Ispat Inland initially plans to use a single pipe, discharging tailings from the north edge of the pit. Additional pipes would be added if warranted. The tailings would form a delta to the south, varying in slope from 1.5% to 0.5% on the bottom of the pit. Coarse material would settle out almost immediately and fine material would travel to the pool at the southern end of the pit. The pipeline could be extended further into the basin for more efficient filling.

An additional pump would be installed next to the return water pumps to pump excess water from the Minorca pit complex into Sauntry Creek. This would be necessary to maintain pool elevation in the initial operation of the basin and to maintain flows in Sauntry Creek, as requested by the City of Virginia.

To maintain the existing basin during in-pit disposal, Ispat Inland would seed, mulch, and fertilize the basin beach area to minimize dust lift-off from the basin in accordance with State of Minnesota Mineland Reclamation Rules. The barge and pumps would be kept operational and the clear water pool would remain a source of make-up water for processing. The pool water level would be monitored and maintained.

The Minorca pit can store approximately 5 years of tailings without dike construction. The rim of the pit varies from elevation 1527 feet mean sea level (msl) at the northern rim to elevation 1460 feet msl along the southern rim. At the end of the fifth year of tailings deposition, Ispat Inland estimates the level of the pool in the basin would approach the low point in the pit wall. To create additional capacity in the pit, Ispat Inland proposes to construct a 6,000 foot-long dike along the eastern and southern edges of the pit *(see Figure 16)*. The dike would be approximately 30 feet high, constructed to a crest elevation of 1492 feet msl on the south rim of the pit, and would increase total pit life to approximately 10 years.

The dike would be constructed of mine rock and coarse tails, with a liner on the upstream surface of the dike to reduce seepage *(see Figure 17)*. The dike would include a spillway set at an elevation of approximately 1483 to prevent overtopping during flood events. The spillway would be located at the west end of the dike and would empty into Sauntry Creek. Dike construction would require relocation of approximately 5000 feet of Sauntry Creek along the southern reach of the dike.

At current production rates, the pit would fill after ten years of tailings disposal. There would be a delta of coarse material above the water sloping from the north towards the water, with the fines settling near or under the settling pool. Ispat Inland will construct a channel between the Minorca and Lincoln 'D' pits to permit tailings flow and settling in the Lincoln 'D' pit. Eventually this entire area of the pit would be filled with tailings.

To reclaim the pit, the pool in the basin would be pumped down to elevation 1460 feet msl (pit rim elevation in the spillway area). A permanent spillway would be constructed at that elevation, discharging to Sauntry Creek. At this elevation, the pool is expected to be very small. The tailings surface of the basin would be reclaimed with vegetation and the return water pumps and exposed pipelines would be removed.

Inland Steel Mining Company, In Pit Disposal Project
Sequence of Key Events
Cell IIA for 5 Years, West Cell for 10 Years, (Plan through 2013)

NORAMCO Project No. 97754
BEK, 6/25/98

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Task	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Deposit Tails in Cell IIA	■	■	■	■	■												
Move Tails Discharge Pipe Location, Cell IIA	■																
Raise Cell IIA Dike with Coarse Tails	■	■															
Construction on West Cell			■	■	■	■	■	■	■	■	■						
Deposit Tails in West Cell						■	■	■	■	■	■	■	■	■	■		
Reclaim Cell IIA						■	■										
Deposit Excess Coarse Tails on a Dump											■	■	■	■	■		
Reclaim West Basin																■	■

Figure 10 **Development Timetable No Action Alternative**

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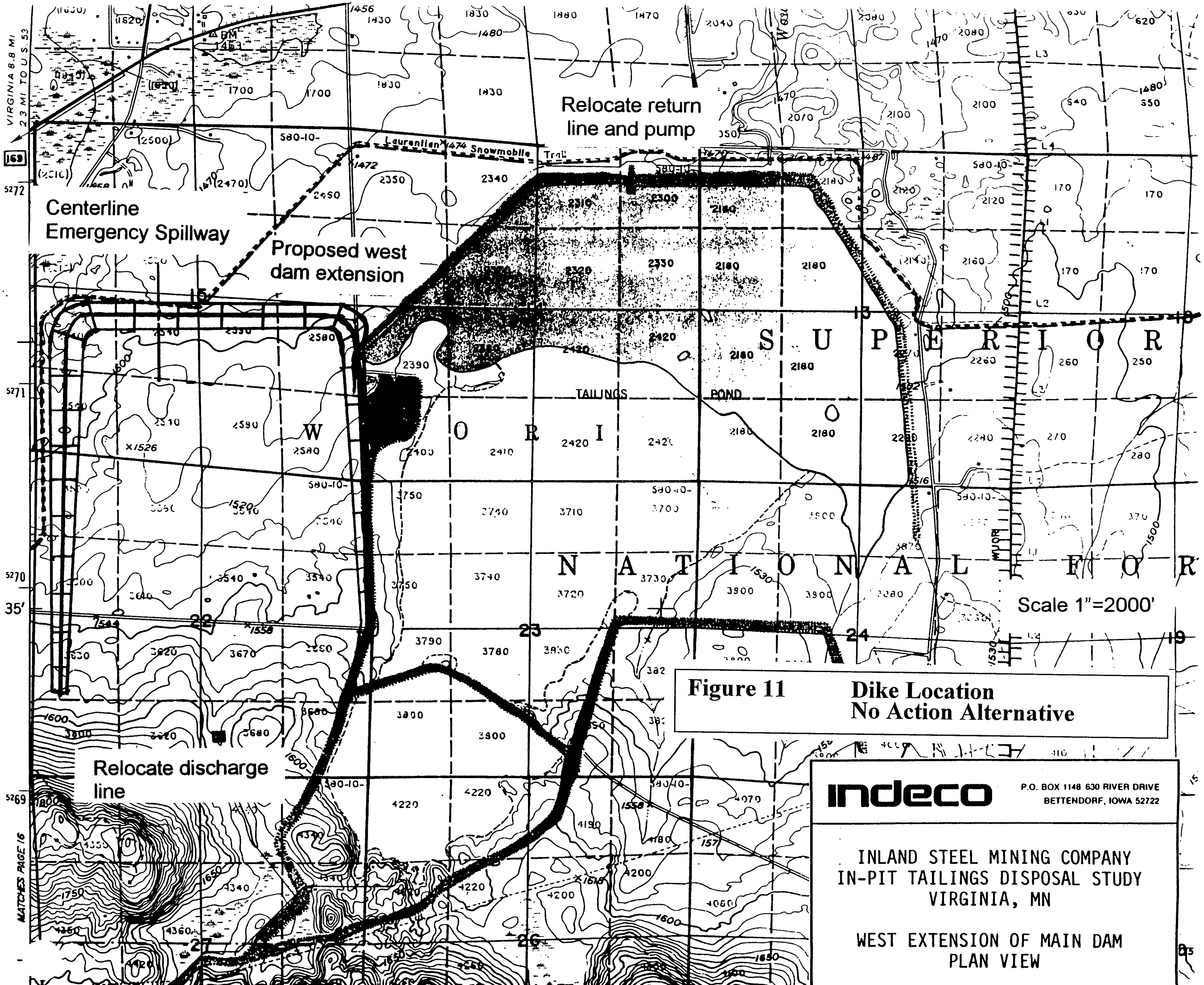

Figure 11 Dike Location No Action Alternative

indeco P.O. BOX 1148 630 RIVER DRIVE BETTENDORF, IOWA 52722

INLAND STEEL MINING COMPANY
IN-PIT TAILINGS DISPOSAL STUDY
VIRGINIA, MN

WEST EXTENSION OF MAIN DAM
PLAN VIEW

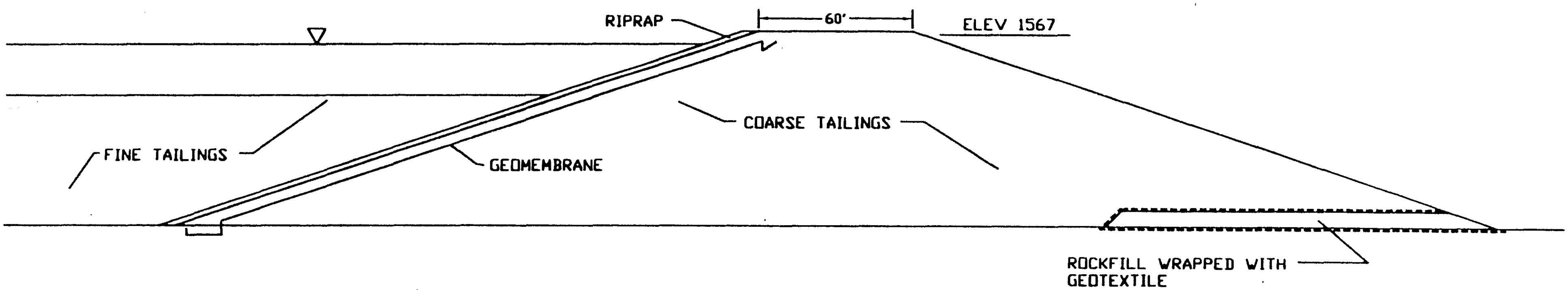

Figure 12 **Dike Cross-Section**
No Action Alternative

indeco
P.O. BOX 1148 630 RIVER DRIVE
BETTENDORF, IOWA 52722

INLAND STEEL MINING COMPANY
IN-PIT TAILINGS DISPOSAL STUDY
VIRGINIA, MN

WEST EXTENSION OF MAIN DAM
TYPICAL SECTION

Inland Steel Mining Company, In Pit Disposal Project
Sequence of Key Events
In Pit 10 Years, / Cell IIA Tailings 5 Years Disposal (Plan through 2013)

NORAMCO Project No. 97754
BEK, 6/25/98

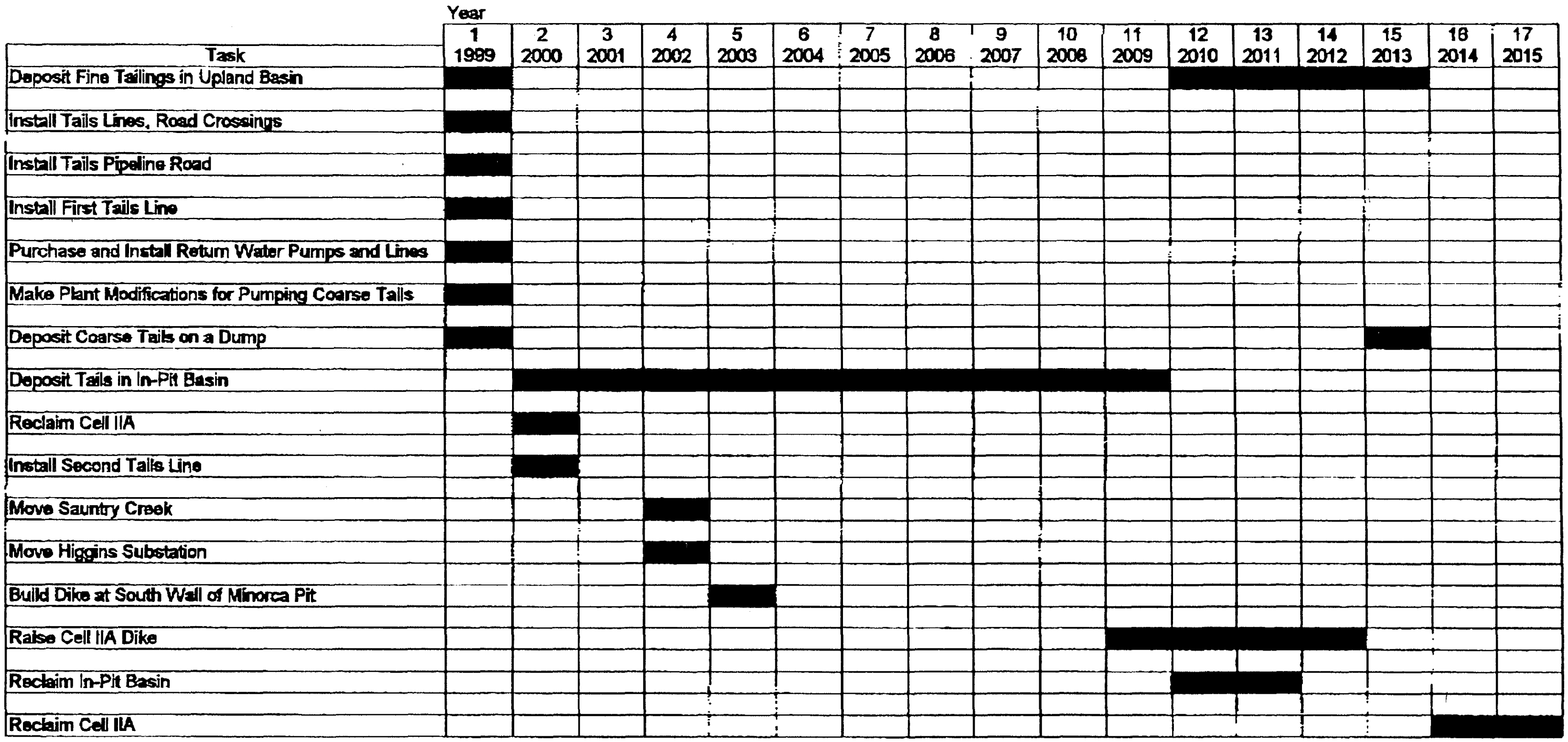

Figure 13 **Development Timetable Proposed Alternative**

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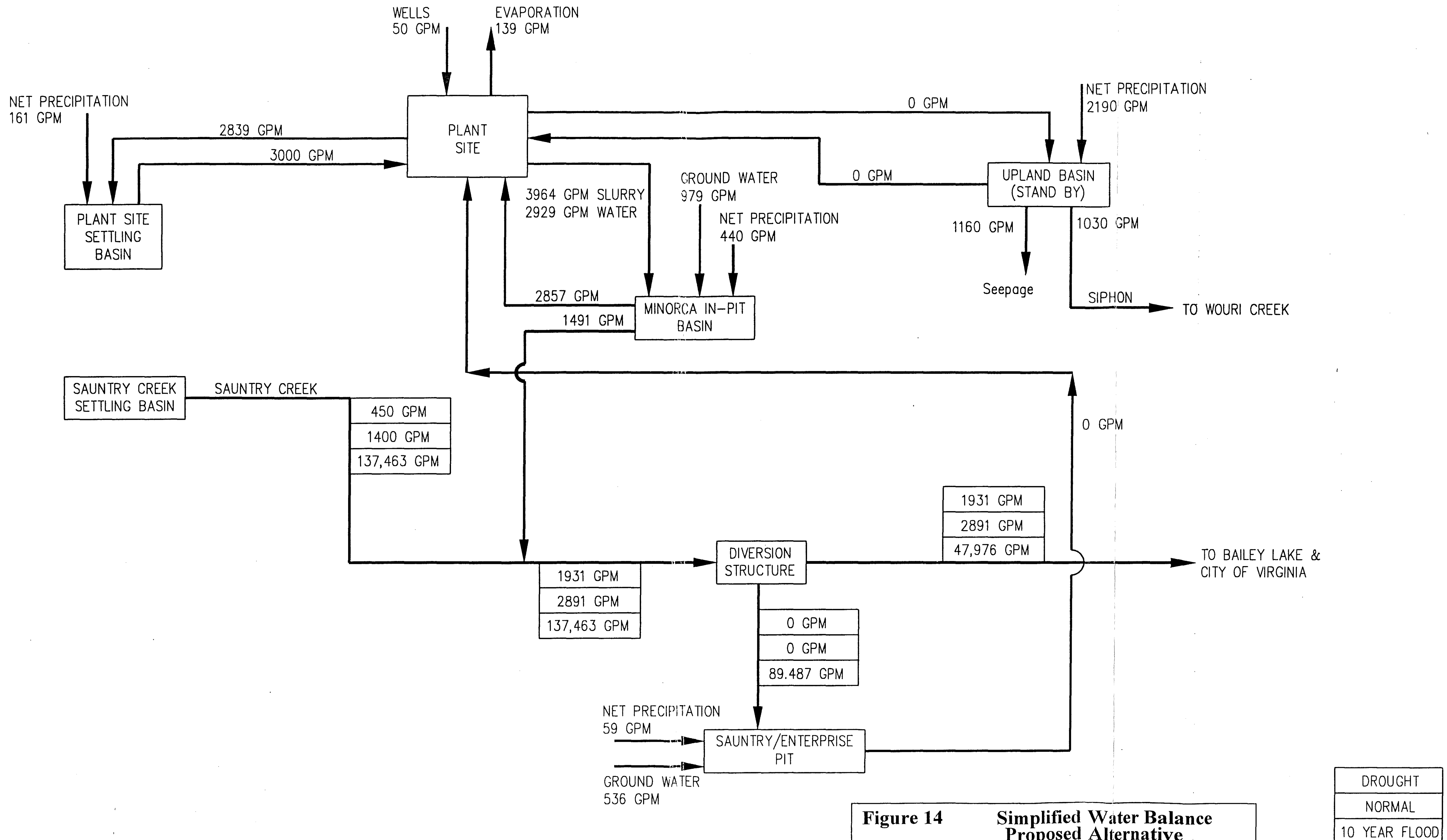

Figure 14 Simplified Water Balance Proposed Alternative

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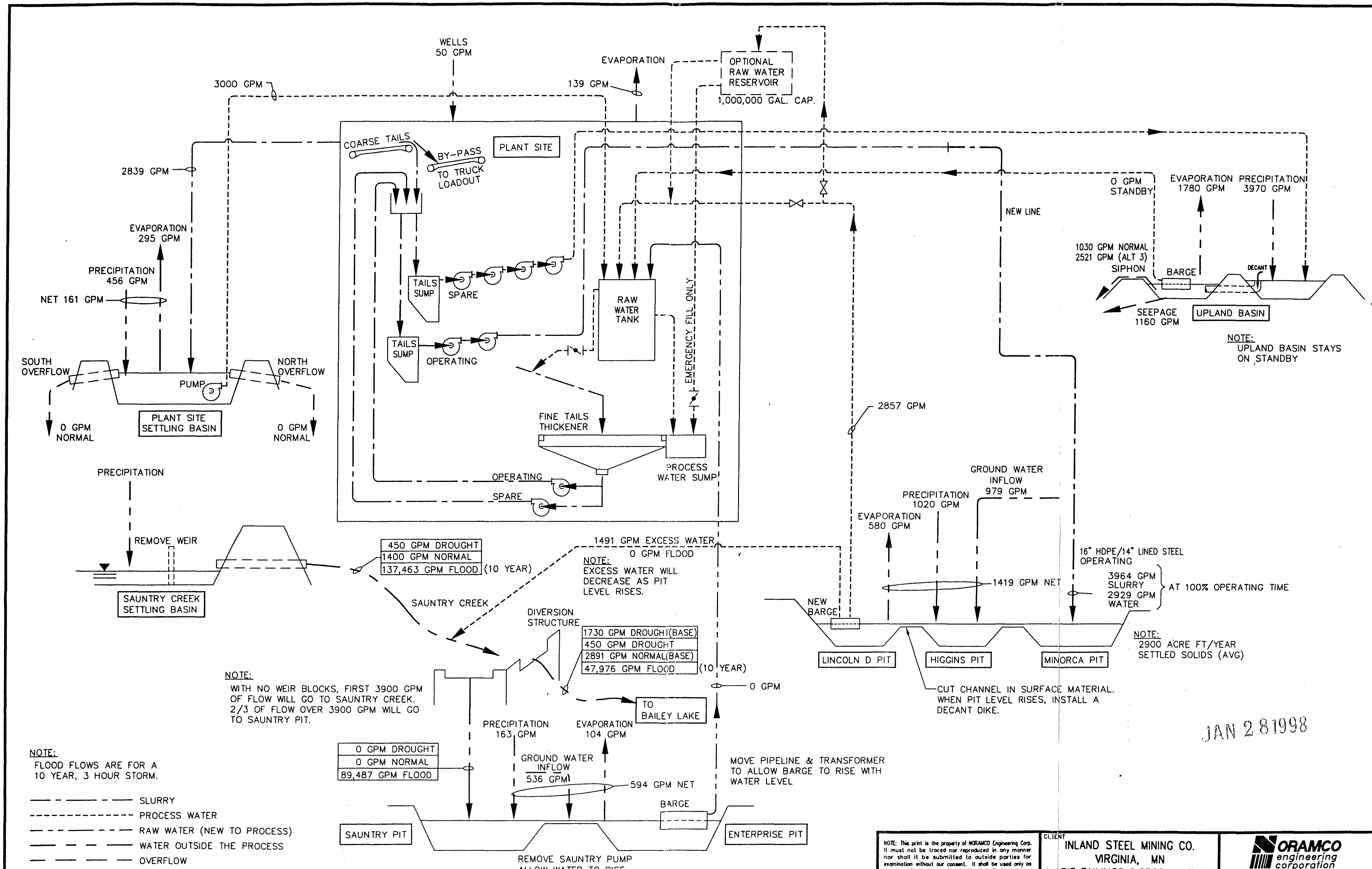
					SCALE	NONE	

NORAMCO engineering corporation
HIBBING, MINNESOTA

TITLE
INLAND STEEL MINING CO.
SIMPLIFIED WATER BALANCE, IN-PIT TAILS DEPOSITION

DWG. NO 97754-FS-006
CLIENT NO ---
REV A
Tue, Mar 03, 1998 8:42am

ACAD DWG.# G:/97754/754G021



CLIENT
INLAND STEEL MINING CO.
VIRGINIA, MN
IN PIT TAILINGS DISPOSAL STUDY

NORAMCO engineering corporation
HIBBING, MINNESOTA

REVISIONS

NO.	DESCRIPTION	BY	CH.	APPROVED	DATE
	ISSUED WITH REPORT	VAN			12/31/97
	RE-ISSUED FOR APPROVAL	VAN		BEK	10/28/97
	RE-ISSUED FOR APPROVAL	VAN		BEK	10/28/97
	ISSUED FOR APPROVAL	VAN		BEK	10/1/97
	PRELIMINARY ISSUE	LEV		BEK	9/10/97

Figure 15 Detailed Water Balance Proposed Alternative

TITLE
PLANT SITE WATER BALANCE
PROPOSED MINORCA PIT TAILS BASIN
FLOWS, FIRST YEAR OF OPERATION

97754-FS-002
ACAD DWG.# G:\97754\754G002
Tue, Jan 27, 1998 11:28am
REVISION 0

indeco, INC.
PRELIMINARY
DATE JAN 27 1998 BY

NOTES:
1. CONTOURS IN 10 FOOT INTERVALS

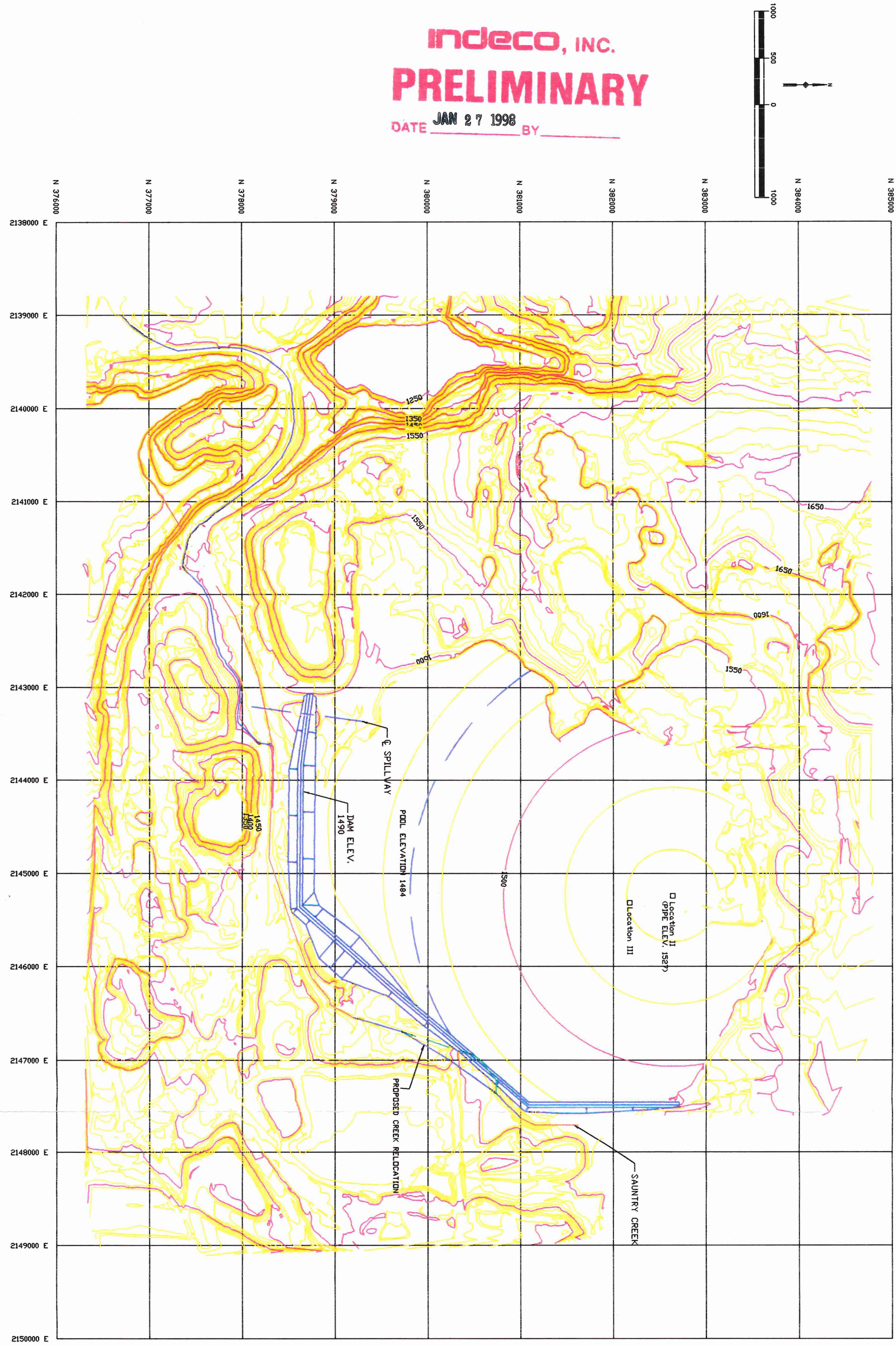


Figure 16 **Dike Location Proposed Alternative**

DRAWING NO. 121	PROJECT NO. 88-20-2020.00	INLAND STEEL MINING COMPANY IN PIT TAILINGS DISPOSAL STUDY VIRGINIA, MINNESOTA TITLE PLAN VIEW - PIT AREA 10 YEAR DEPOSITION - RELOCATED SAUNTRY CREEK	indeco P.O. BOX 1148 • 630 RIVER DRIVE BETTENDORF, IOWA 52722(319)359-5451 A SUBSIDIARY OF JOHNSON BROS. CORPORATION	DRAWN GTB CHECKED WDM APPROVED ---

SCALE	DATE
AS SHOWN	01/23/98

NO.	DESCRIPTION	DATE	WDM APPROVED

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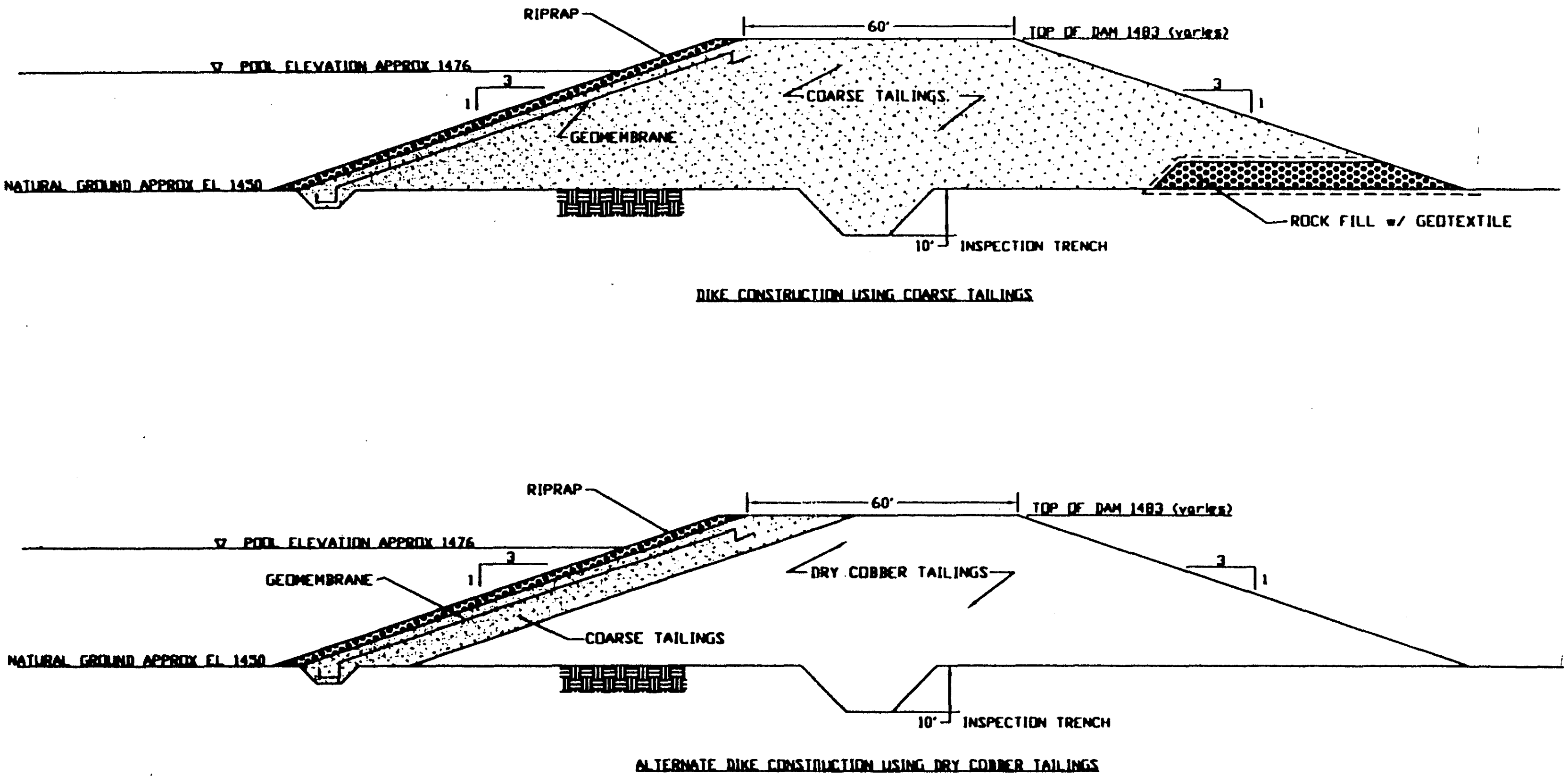

Figure 17 **Dike Cross-Section Proposed Alternative**

INLAND STEEL MINING COMPANY
IN-PIT DISPOSAL STUDY
VIRGINIA, MINNESOTA

TITLE IN-PIT STORAGE 10 YEAR DEPOSITION
TYPICAL SECTION - SOUTH SIDE OF PIT

indeco
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A SUBSIDIARY OF JOHNSON BROS. CORPORATION

Section Four

4.0 Potential Impacts and Mitigation

4.1 Introduction

The potential impacts of expanding the existing tailings basin (No-Action alternative) were analyzed in the 1974 Environmental Impact Statement the DNR prepared for Ispat Inland's existing operation. As described in the Supplemental EIS Preparation Notice (September, 1997) this document focuses on the potential impacts of depositing tailings in the depleted Minorca pit (Proposed alternative).

4.2 Surface Water

The proposed project is not expected to result in significant impacts to surface waters. The sole surface water affected by the proposed project is Sauntry Creek, which flows through Ispat Inland's permitted mining area, eventually reaching Virginia and Silver lakes in the City of Virginia.

Sauntry Creek flows from northeast to southwest circumventing the southern edge of the Minorca pit. Historically, the creek originated in a wetland area near the top of the Laurentian Divide. Natural ore and taconite mining have eliminated the stream's original channel. It now stems from Ispat Inland's Sauntry Creek settling basin, which collects runoff from Ispat Inland's stockpiles, and acts as a settling basin before discharge to the creek.

In the project area, the creek flows in a constructed channel, around the southern edge of the Minorca pit, then between the Minorca and Lincoln pits. Further to the west, the creek flows between the Sauntry pit to the north, and the Columbia and Mesabi pits to the South, eventually entering Virginia Lake.

Sauntry Creek is the primary source of fresh water for Virginia and Silver lakes in the City of Virginia. The stream was historically intermittent, but now flows year-round, augmented by pumping. Ispat Inland initially augmented stream flows by discharging excess water from the Sauntry Creek settling basin, but now uses excess water from the gradually-filling Minorca pit. Ispat Inland has maintained the pumping at the City's request in order to improve water quality in the two lakes.

If the proposed project proceeds, 5000 feet of Sauntry Creek would require additional re-routing. Ispat Inland proposes to construct a containment dike along the southeast perimeter of the Minorca pit approximately five years after in-pit tailings deposition begins. To accommodate dike construction Ispat Inland would relocate this section of the creek further southward and eastward. On Ispat Inland property, the Sauntry Creek bed is entirely constructed. The new stream channel would be constructed to existing dimensions and would not affect stream capacity.

During project operation, Ispat Inland would continue augmenting Sauntry Creek flows, using the Minorca pit complex as a water source. Ispat Inland's water appropriation permit requires maintenance of a 3.5 cubic feet per second flow in Sauntry Creek during the months of July through October. Pumps for returning water from the Minorca pit to the plant, for reuse in processing, would be installed in the Lincoln 'D' pit, which adjoins the Minorca. An additional pump would be installed next to the return water pumps to pump excess water from the southern portion of the pit complex into Sauntry Creek.

After project completion, the filled and reclaimed in-pit basin will replace some of the original watershed for Sauntry Creek, contributing to stream flows. Sauntry Creek flows also will be augmented with water released from the Sauntry Creek settling basin.

Quality of water discharged to Sauntry Creek will be regulated by the Minnesota Pollution Control Agency NPDES permit and will be subject to routine monitoring.

4.3 Ground Water

4.3.1 Background

The proposed project is not expected to affect the suitability of Mesabi Mountain pit water for drinking and other domestic uses. The City of Virginia draws its municipal water from the Mesabi Mountain pit. The pit is supplied by ground water, and the DNR assumes a direct ground water connection between the Minorca and Mesabi Mountain pits. The primary issues surrounding the proposed project have been: 1) whether the tailings contain potentially harmful elements or compounds (elements of concern or ECs), and 2) whether the ECs present in tailings pore water would migrate to the Mesabi Mountain pit in sufficient concentrations to negatively affect water quality.

Staff from the DNR, the Department of Health, the Pollution Control Agency, the University of Minnesota, the Minnesota Geologic Survey, and Ispat Inland and its consultants have independently and cooperatively studied the issues of tailings composition, hydrogeology, ground water quality, and health risk associated with the project. Tailings geochemistry, hydrogeology, health risk, and ground water quality reports are attached as appendices to the SEIS.

4.3.2 Tailings Characterization

The DNR and the University of Minnesota have studied tailings basin water quality in order to predict potential water quality in open pits if taconite tailings were deposited in them. The study included tailings basins at several taconite companies, including Ispat Inland. Samples collected from tailings basins, and from wells and seeps around the tailings basins, were tested for 82 inorganic chemical parameters and up to 180 organic parameters (*see Appendix A*). The studies concluded that four elements were present in Ispat Inland tailings pore water in concentrations warranting further analysis: manganese, arsenic, fluoride, and molybdenum. All four elements occur naturally, and are released from taconite ore when it is processed. Additional fluoride enters the tailings stream from plant stack scrubbers and small amounts of molybdenum result from wear of metal parts and grinding media.

4.3.3 Hydrogeology

The DNR performed a hydrologic analysis to estimate the maximum probable, and average annual, flow rates for water that could pass through tailings deposited in the Minorca pit and ultimately reach the Mesabi Mountain pit. The flow rates are used to predict the potential migration of tailings-contained elements and to estimate maximum concentrations of these elements in the Mesabi Mountain pit. The analysis is attached as Appendix B to this SEIS, and is summarized below.

The Minorca pit has been filling with ground water since cessation of mining and pit dewatering in 1992. The DNR expects filling would continue until pit water levels reached equilibrium (equilibrium elevation is estimated at approximately 1450 feet msl). At equilibrium, water losses from the pit (outflow to ground water or evaporation) would equal water entering the pit (from precipitation, surface runoff, and upgradient ground water).

For purposes of estimating potential "worst case" impacts to Mesabi Mountain pit water quality, the DNR assumed all water leaving the Minorca pit through below-grade fractures would eventually enter the Mesabi Mountain pit.

The DNR estimated flow rates to the Mesabi Mountain pit at two stages in project development: 1) "full development" condition, after approximately 5 years of tailings deposition, and 2) "reclamation" condition. These two stages were selected because only after "full development" is reached will there be ground water flow from the Minorca pit, which presently acts as a ground water sink. This condition would persist during the early years of tailings deposition when all excess water in the pit would be discharged to Sauntry Creek for stream flow maintenance.

Full development assumes a 35-plus foot high containment dike along the south and east sides of the Minorca pit, allowing tailings deposition to elevation 1527 feet (mean sea level) near the north end of the pit. The "full development" rates would prevail toward the end of the expected 10-year project life. The "reclamation" condition would exist after tailings deposition ceased and the project area was reclaimed.

Before the tailings reach the present runout elevation of the pit, Ispat Inland proposes to construct a containment dike along the south and east sides of the Minorca pit. This would allow tailings to be deposited in a mound some 40 feet above their contact with adjacent topography to the northwest, north, and northeast of the pit. The tailings would be spigotted in a circular pattern and would slope down in all directions from the proposed highest elevation of 1527 feet msl near the north end of the pit.

It is expected that ground water would continue to enter the pit (with relatively little outflow) until the tailings surface rose above the south rim of the pit. At this point the ground water mound formed within the tailings should begin to eliminate ground water inflow into the tailings from outside the basin. When spigotting ceases, the ground water mound within the tailings should drop to a lower elevation. However, the DNR anticipates that the highest level of the mound would remain above the level at which tailings contact adjacent topography, effectively precluding significant ground water inflow. Consequently, the DNR anticipates that virtually all post-reclamation inflow to the pit would be precipitation-derived, i.e., rainfall onto the filled pit surface or runoff from the pit's surface watershed.

During the "full development" stage of the project, the DNR assumes all net precipitation-derived inflow would infiltrate the tailings and be lost as ground water outflow. Also contributing to ground water outflows would be 100 gallons per minute of "net slurry water", i.e., water that is discharged from the plant with the tailings material but not recycled for reuse.

To maintain stream flows, Ispat Inland presently discharges water from the Minorca pit to Sauntry Creek. Although this pumping would continue during the first several years of in-pit disposal, for the purposes of the "worst case" hydrologic analysis, it was assumed that no water would be discharged from the Minorca pit to Sauntry Creek by the time the basin reaches "full development". Under this assumption, net precipitation inflow, plus the 100 gpm net slurry water must leave the basin as ground water outflow. The estimated, temporary maximum range of annual net ground water outflow for full development condition is 701 to 839 gpm.

HDR Engineering, consulting to Ispat Inland, completed a water balance for the Mesabi Mountain pit. HDR estimated an average annual net inflow to the pit of about 2135 gpm. If the Minorca pit were filled with tailings, all ground water outflow from the pit could eventually reach the Mesabi Mountain pit. The DNR estimates the maximum estimated annual net ground water outflow from the Minorca pit at "full development", 701 to 839 gpm, could theoretically increase temporary total inflow to the Mesabi Mountain pit by 33% to 39%. This estimate is intentionally calculated to reflect temporary, "worst case", conditions, including:

1) maximizing watershed area for precipitation-derived inflow;
2) assuming no surface water discharge from the tailings pond at "full development";
3) unvegetated tailings and pit rock surfaces, and
4) minimal estimates for evapotranspiration losses.

If the "worst case" conditions occurred, the predicted maximum ground water outflow would occur for only a few years. Ground water outflow is not expected to begin until the tailings pond reaches at least elevation 1407 feet msl, and may not begin until the pond approaches the predicted static water level of approximately 1450 feet msl. As tailings were stacked higher, ground water outflow would gradually increase until it peaked, temporarily, at "full development".

After reclamation, at least two factors would work to significantly reduce long-term average annual ground water outflow. First, vegetating tailings and pit rock surfaces with grasses would increase evapotranspiration loss by at least 3 inches per year, reducing ground water outflow by at least 104 gpm. Second, any surface water outflow from the tailings pond would further reduce ground water outflow. Noramco Engineering, a consultant to Ispat Inland, estimated that post-mining surface outflow from the tailings pond would average 440 gpm (9 inches). Using a more conservative estimate of 4 inches (an estimate supported by research conducted at National Steel's tailings basin in Keewatin), the DNR expects constructing an outflow channel near the top of the deposited tailings would reduce ground water outflow by an estimated 194 gpm. In addition, the 100 gpm of "net slurry water" would not be discharged to the pit, further reducing ground water outflow.

Consequently, vegetating bare surfaces with grasses, and achieving minimal surface water outflow of 4 inches per year from the Minorca pit, would reduce the estimated maximum long-term ground water outflow by 298 gpm, to 301 to 439 gpm, for an increase of 14% to 21% in the Mesabi Mountain pit's total inflow. With optimum achievable reclamation, e.g., establishing forest vegetation (preferably conifer) on bare areas and achieving an average surface water outflow of 6 inches per year, the estimated long-term, average ground water outflow from the Minorca would drop to 136 to 274 gpm, for an increase of 6% to 13% in the Mesabi Mountain pit's total inflow.

4.3.4 Health Risk Assessment

The City of Virginia obtains its potable water from the Mesabi Mountain pit, approximately one mile from the Minorca pit. The primary concern associated with the proposed project is possible degradation of the city's municipal water supply. To evaluate potential risk to the drinking water, the Minnesota Department of Health conducted a Health Risk Assessment for the proposed project. The completed report is attached as Appendix C.

The risk assessment entailed three major steps: 1) identifying any tailings-related elements or compounds that are present at above-background levels; 2) determining whether the hydrogeology of the area would permit migration of these elements or compounds to the Mesabi Mountain pit, and 3) determining whether concentrations of these elements or compounds would pose a risk to public health. The Health Department employed a public assessment process, including public scoping, public meetings, and opportunities for public review and comment of documents.

After an extensive screening process, the Department of Health identified elements and compounds of concern (ECs) for further analysis. These included: arsenic, fluoride, manganese, molybdenum, and organic processing chemicals. Using "worst case" scenarios of chemical concentrations and ground water flows, the Department determined that arsenic and organic process chemicals (which are biodegradable) would reach levels in the Mesabi Mountain pit equal to or below naturally-occurring levels (background). Using a five-fold dilution factor in the Mesabi Mountain pit, predicted levels of all ECs were below drinking water limits. Using a 2.5-fold, "worst case" scenario, predicted levels for arsenic, fluoride, molybdenum, and organic process chemicals fell below the drinking water standard, but manganese (at 2.4 mg/l) exceeded the 1.3 mg/l site-specific health based value. However, the Health Department anticipates that the geochemical, physical, and biological processes that naturally limit the levels of dissolved manganese in surface waters (such as oxidation and biological uptake) would keep manganese concentrations low in the oxygenated portion of the Mesabi Mountain pit from which drinking water is drawn.

The Health Department concluded that implementation of the proposed project would pose negligible risk to the population of the City of Virginia.

To protect the long-term water quality of the Mesabi Mountain pit, the Department recommended a water quality monitoring and protection program including five project-specific strategies to monitor potential project effects and one strategy to be implemented by the City of Virginia independently of the proposed project.

The Health Department recommendations (including Ispat Inland responses) follow:

1. *Install monitoring wells and/or monitoring sites between the Minorca Pit and the Mesabi Mountain Pit to determine changes in water quality over time.* Ispat Inland, in consultation with staff from the Minnesota Pollution Control Agency and the Department of Natural Resources installed a ground water monitoring well between the Minorca and Mesabi Mountain pits (*see Figure 18*). Ispat Inland will establish additional monitoring sites in two nearby pits: the Lincoln pit, south of the Minorca pit, and the Wyoming pit, which is southeast of the Lincoln pit *(see figures 18, and 2, respectively)*. Ispat Inland began background monitoring at the new well and the Lincoln pit in the spring of 1999, and will begin monitoring at the Wyoming pit shortly.

2. *Continue quarterly monitoring of natural water sites, including the adjacent pits, and available process water sites for ECCs and changes in water geochemistry.* Ispat Inland proposes to perform the recommended monitoring (*see recommendation 1*).

3. *Conduct periodic limnologic profiles of the Mesabi Mountain Pit for its entire depth to ascertain the level of anoxia, if any, and the degree of mixing that occurs in the pit.* The Health Department recommends limnologic profiling because dissolved oxygen levels

affect manganese precipitation. The DNR concurs this profiling should be performed. Even though manganese levels in the Mesabi Mountain pit are not expected to be problematic, anoxia could affect drinking water quality. Ispat Inland has entered discussions with the City of Virginia regarding how to accomplish the profiling.

4. *Monitor quality and levels of ECCs in the recycled water. Determine if there is a significant buildup in concentrations of ECCs in the recycled water that may subsequently lead to more enriched waters entering the Biwabik Iron Formation from the Minorca Pit.* Ispat Inland Steel will be required to perform this monitoring as a condition of its NPDES permit from the Minnesota Pollution Control Agency.

5. *Prevent disposal of organic compounds or other material that may change the geochemistry within the tailings. The reclamation plan should not include swamp- or wetland-type vegetation unless it is proven such environments will not cause development of greater reducing conditions within and adjacent to the tailings.* The Department of Natural Resources will require the tailings-filled pit to be reclaimed with upland vegetation. A permanent spillway, installed at elevation 1460 feet msl will direct surface water off the reclaimed pit surface, discouraging establishment of wetland-type vegetation.

In addition to the project-specific recommendations, the Department of Health recommends the City of Virginia develop a Source Water Protection Program for the Mesabi Mountain pit to protect it from the effects of multiple development in the area.

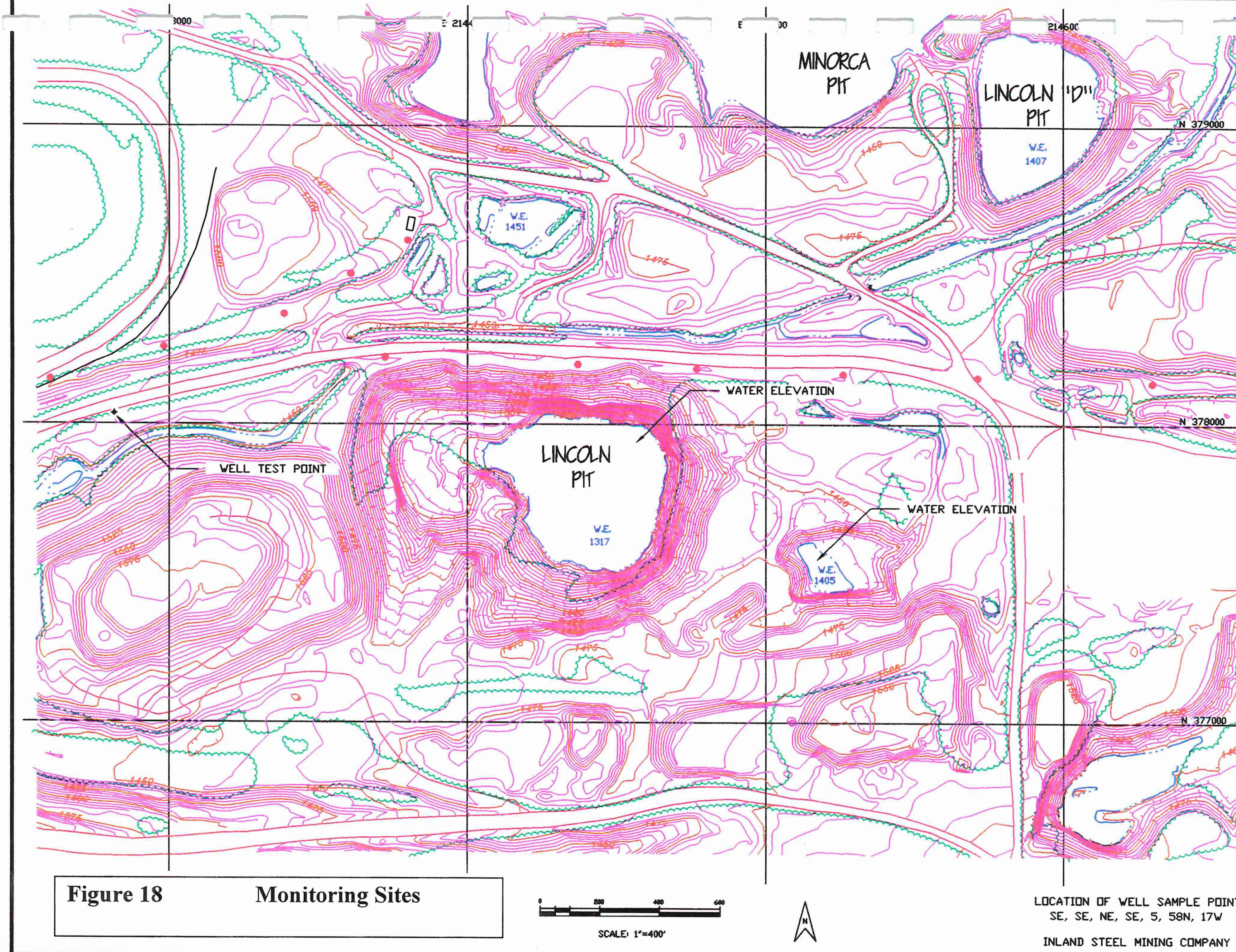


Figure 18 Monitoring Sites

4.3.5 Geochemistry and Ground Water Quality

4.3.5.1 Introduction

Supplementing the tailings geochemistry study described in Section 4.3.2, DNR reclamation staff intensively evaluated the potential levels of manganese, fluoride, molybdenum, and arsenic in the Mesabi Mountain pit that could be expected to result from the proposed project. Their study results are attached as Appendix D and are summarized below.

The Minnesota Department of Natural Resources and the University of Minnesota have been studying the potential water quality implications of depositing taconite tailings in existing mine pits across the Mesabi Iron Range. Results from this study on tailings pore water chemistry were used by the Minnesota Department of Health to conduct a health risk assessment for Ispat Inland's proposal. The risk assessment focused on potential risks to human health, and did not consider secondary drinking water quality standards.

This additional analysis focused on impacts of output from the Minorca pit clear water pool and tailings pore water on water quality in the Mesabi Mountain pit with respect to primary and secondary drinking water quality standards. It also identified chemical reactions that may reduce the levels of potential contaminants in local ground waters.

Although several taconite operations across the Mesabi Iron Range participated in the tailings basin geochemistry study, the SEIS focuses primarily on operational measurements and controlled experiments using tailings and process waters from Ispat Inland. Data from other operations were used, in conjunction with those from Ispat Inland, to describe environmentally-relevant chemical reactions associated with taconite tailings and the water they contact.

The following SEIS sections discuss levels of manganese, fluoride, molybdenum, and arsenic that could evolve in the Mesabi Mountain pit as a result of taconite tailings disposal in the

Minorca pit. Each element is discussed individually with regard to:

1) short and long-term levels expected in flow leaving the Minorca pit (source terms);
2) transport through the Biwabik aquifer (transport term);
3) dilution of inputs to the Mesabi Mountain pit, and
4) chemical reactions within the Mesabi Mountain pit.

For each of the above terms, a range of expected concentrations was determined. In order to provide the most conservative estimates, the upper end of this range, or "worst case scenario," is reported. For certain elements, evaluation of these geochemical processes provided a means to refine the source and transport terms, as well as chemical reactions within the Mesabi Mountain pit. These refined terms were judged to represent conditions that are more likely to occur than the worst case scenario.

The projected source terms are largely based on chemical analyses of process waters discharged from Ispat Inland's taconite processing plant. Data from laboratory and field experiments conducted on Ispat Inland's process waters and tailings were also considered. Geochemical modeling was used to describe environmentally relevant chemical reactions associated with taconite tailings and the water they contact.

4.3.5.2 Manganese

Manganese concentrations at the Virginia water supply intake are expected to meet the health-based water quality standard determined for this project (1.3 mg/l; MDH, 1998) as well as primary (0.1 mg/l) and secondary (0.05 mg/l) drinking water quality standards. This conclusion was reached using the following assumptions:

1) the maximum anticipated source term of 7 mg/l;

2) no removal in the Biwabik aquifer;
3) dilution to a concentration not exceeding 1.7 mg/l, and
4) removal due to chemical reactions (i.e. oxidation) within the Mesabi Mountain pit.

Removal by chemical reactions is supported by empirical data from Ispat Inland's tailings basin, field and laboratory experiments designed to assess this site, abandoned open pits, and geochemical equilibrium calculations which indicate that manganese levels are unlikely to exceed 0.01 mg/l in the Mesabi Mountain pit. Thus, manganese concentrations in the Mesabi Mountain pit will decrease below drinking water quality standards as a result of manganese oxidation.

4.3.5.3 Fluoride

Projected fluoride concentrations in the Mesabi Mountain pit are expected to meet both the primary (4 mg/l) and secondary (2 mg/l) drinking water quality standards. This conclusion was reached using the following assumptions:

1) the maximum anticipated source term of 6 mg/l;,
2) no removal in the Biwabik aquifer;
3) dilution to a concentration not exceeding 1.6 mg/l, and
4) no removal due to chemical reactions within the Mesabi Mountain pit.

Empirical data used to evaluate fluoride source terms were collected from surface and tailings pore waters around Ispat Inland's tailings basin, as well as field and laboratory experiments using process water and tailings from Ispat Inland. The worst case scenario assumes no chemical reactions will influence fluoride concentrations along the flow path. Fluoride concentrations in the Mesabi Mountain pit will decrease below drinking water quality standards as a result of dilution.

4.3.5.4 Molybdenum

Maximum anticipated molybdenum levels in the Mesabi Mountain pit will meet the drinking water quality standard of 30 ug/l. This conclusion was reached using the following assumptions:

1) short-term source term of 130 ug/l, decreasing to 45 ug/l approximately eight years after tailings deposition begins,
2) no removal in the Biwabik aquifer,
3) dilution to a concentration not exceeding 25 ug/l, and
4) no removal due to chemical reactions within the Mesabi Mountain pit.

The worst case scenario for molybdenum assumed a source term of 130 ug/l during the period when the Minorca pit clear water pool dominates ground water outflow chemistry. Elevated molybdenum concentrations in discharges from Ispat Inland's plant and an estimation of the amount of dilution available within the Minorca pit clear water pool were used to calculate this short-term, operational source term. A subsequent source term of 45 ug/lL represented long-term, tailings pore water-dominated outflow chemistry. This value was based on measurements of tailings pore water chemistry at Ispat Inland's tailings basin and field and laboratory experiments designed to evaluate this site. Since taconite processing results in molybdenum release, the long-term source of molybdenum will be eliminated when operations cease.

4.3.5.5 Arsenic

Even at maximum ground water input from the Minorca Pit, arsenic levels in the Mesabi Mountain pit will be considerably lower than the current primary drinking water standard of 50 ug/l. This conclusion was reached using the following assumptions:

1) the maximum anticipated source term of 7 ug/l;
2) no removal in the Biwabik aquifer;
3) dilution to a concentration not exceeding 2.1 ug/l, and
4) no removal due to chemical reactions within the Mesabi Mountain Pit.

The U.S. Environmental Protection Agency (EPA) is expected to lower the arsenic standard by the year 2001, although the new standard has not yet been announced. Arsenic levels in the Mesabi Mountain pit are anticipated to meet the future drinking water quality standard if it is reduced to the range of 5 to 10 ug/l. Therefore, no arsenic treatment issues at the Virginia Public Utility are expected to arise.

4.4 Dam Safety

Without modification, the Minorca pit has capacity for approximately 5 years of tailings deposition. To add another 5 years of storage capacity, Ispat Inland proposes to construct a dike along the southern and eastern rim of the pit. The dike would require a Dam Safety permit from the DNR. In issuing a Dam Safety permit, the DNR reviews construction and engineering specifications and analyzes the potential impacts of breach or failure. The Dam Safety permit also requires periodic inspection to ensure compliance and safety.

4.4.1 Dike Design and Construction

The dike would be designed in accordance with U.S. Army Corps of Engineers criteria (USACE). The USACE criteria equal or exceed the minimum criteria for design of small dams as required by the Minnesota Department of Natural Resources Dam Safety Program.

The final dike section will be determined during permitting. A typical dike cross-section is depicted in Figure 17. Ispat Inland anticipates the dike would be constructed of coarse tailings or dry cobbing material (somewhat coarser than coarse tailings). The dike would be lined with a geomembrane to limit seepage. Through-seepage and under-seepage would be controlled through the use of a filter or other suitable measures (seepage berm, etc.) and an inspection trench would be included.

The southern pit rim is at elevation 1460 feet msl. The crest of the dike, on the south side of the pit, would be at 1492 feet msl, with the toe at approximately 1450 feet msl. An emergency spillway, discharging to Sauntry Creek, would be constructed at approximately 1483 feet msl. At project completion, Ispat Inland projects tailings within the basin will reach approximately 1470 feet msl.

In addition to tailings, the dike must contain a minimum pool of water to provide retention time for sedimentation. Flood events also must be controlled to prevent overtopping of the dike. The minimum pool would provide approximately 2000 acre-feet of storage. During project operation, Ispat Inland would maintain the pool elevation at approximately 1476 feet msl.

After in-pit tailings deposition ceases, the spillway will be permanently lowered to maintain a pool elevation of approximately 1460 feet msl.

4.4.2 Flood and Breach Analysis

Noramco Engineering, consulting to Ispat Inland, evaluated the proposed dike for flood and breach potential. The dike would include an earth spillway at 1483 feet msl to pass major flood events. The design criteria contain the 100-year 6-hour storm without discharge and pass the 24-hour probable maximum flood with adequate freeboard. This criterion would eliminate overtopping failure due to hydrologic conditions.

Using computer modeling, the 100-year storm was routed through the pool. This hypothetical storm has peak inflow of about 460 cfs (cubic feet per second) and a volume of approximately 170 acre-feet. In modeling, the pool elevation rose to 1478 feet msl and the flood was contained.

The 24-hour Probable Maximum Flood was also analyzed. This storm would have a peak inflow of 2200 csf and a volume of approximately 1200 acre-feet. Routing this storm through the pool resulted in a peak elevation of 1486 feet msl, discharging water through the emergency spillway, but providing sufficient dike freeboard to prevent overtopping.

Although overtopping should not occur, a potential dike breach must be considered and a breach analysis is required for dam safety permitting. Indeco, Inc. performed a study of potential sediment release during a hypothetical dam breach event. Indeco's summary of the analysis is included below.

[*Indeco Summary*]

General. As part of any major dam study, an analysis of potential breaching and subsequent consequences is performed even though a breach is highly unlikely. The exact duration and size of a dam breach cannot be predicted so conservative guidelines are used to estimate the breach flood. Preliminary analyses were performed to determine the hydraulic characteristics of this event. For a range of parameters regarding the time and size of breach, the peak discharge ranges from 10,000 to 39,000 cfs and the duration of the breach flood ranges from 16 hours to 2 hours, respectively. The total flood volume in all cases is approximately 2300 acre-feet. Despite the large differences in the breach floods, the resulting flood downstream has limited variation due to the restricted flow in Sauntry Creek. Initial studies show that the flow in the creek is restricted to less than 900 cfs and the flood volume in the creek is less than 600 acre-feet with the remaining volume being lost in the pits adjacent to the creek (specifically, Lincoln and Sauntry pits).

Breach Configuration. As previously noted, the breach configuration is based on conservative assumptions. In this case, the overall height of the dam is relatively low (approximately 33 feet as a maximum). This low height produces a relatively small breach. For this study, Indeco used the full dam height (33 feet) and an assumed breach width of four times the height (130 feet). For these values, the volume of the dam material (coarse tailings) lost in the breach is approximately 25,000 cubic yards.

Release of Fine Tailings. The tailings stored behind the dam will consist of fine and coarse tailings. Due to the distance from the source, the material near the dam would be largely fine tailings. Some of the tailings stored behind the dam could be released during a breach. The amount, however, is limited due to the short length of the dam breach and the relatively low height of the tailings at the dam. For the proposed 10-year project design, the elevation of the tailings at the dam is about 1466 msl. Considering the worst case, the height of the tailings which could be released is about 16 feet. Unlike the water storage, which would be totally depleted in a maximum breach event, the tailings have some shear strength and will reach equilibrium at some slope. In order to determine this slope, Indeco analyzed three cases: 1) stability analysis under sudden drawdown conditions using consolidated-undrained strengths; 2) sudden drawdown using consolidated-drained strengths, and 3) liquefaction (loss of shear strength under rapid loading conditions due to excess pore pressures).

For the stability analyses, the critical slopes were 3 (horizontal) to 1 (vertical) and 4.5 (horizontal) to 1 (vertical) for consolidated-undrained and consolidated-drained strengths, respectively. The fine tailings, because of the grain size and saturated conditions, are susceptible to liquefaction. A search of the scientific literature shows that the final slope after liquefaction could range from 6 (horizontal) to 1 (vertical) to 12 (horizontal) to 1 (vertical). Tests of various fine sands under liquefaction indicate that the minimum stable slope is about 8 (horizontal) to 1 (vertical). For this analysis, Indeco used the 8 (horizontal) to 1 (vertical) slope to determine the volume of tailings released. This volume is approximately 12,000 cubic yards.

Conclusions. Figure 19 depicts a breach typical. The size of the breach related to the overall dike length can be seen easily. Considering a full height breach with the likely maximum width and the most conservative slope for the fine tailings, the resulting release is approximately 25,000 cubic yards of coarse tailings and 12,000 cubic yards of fine tailings. With these conservative assumptions, the tailings release totals 23 acre-feet, which is about 1 percent of the water volume released. Based on the stable slope, Indeco estimates that the initial deposit would average about 5 feet deep and extend about 80 feet perpendicular to the axis of the dam. From this estimate, the approximate length of the initial deposit would be 2500 feet. This estimate is affected by the local topography and the location of the breach, but this estimate likely represents a worst case. Because of the large fraction of coarse tailings, much of the tailings will settle out in the near vicinity of the dam. Some of the sediment will be carried downstream due to the initial flow and subsequent erosion by flow in the creek but the effect would be short term and limited by the small sediment volume.

[End of Indeco summary]

The primary environmental concern regarding a potential breach is whether fine tailings would reach the northern end of the Mesabi Mountain pit. As indicated by Indeco's analysis, coarse tailings would likely settle out quickly in the vicinity of the breach. Some fine tailings could enter the Lincoln pit, south of the Minorca pit, the remainder would be carried as sediment by Sauntry Creek.

Sauntry Creek has fairly limited capacity (approximately 900 cfs). Floodwaters in the creek, should a breach occur, would overtop the creek at the western edge of Ispat Inland's operation (*see Figure 2*) where the creek bed follows a saddle between the Sauntry pit (to the north) and the Columbia pit (to the south). The right creek bank is lower in this reach; floodwaters would flow over the bank, then follow the steep Sauntry pit haul road north into the Sauntry pit.

Further downstream, just before the creek turns south toward Virginia, a diversion structure was installed in the creek bed. The structure was designed to divert excess creek water into the Sauntry pit (through a culvert) for use as process make-up water. Historically, however, creek flows are so low that passive diversion rarely occurs. In a breach situation, however, the structure would divert flood-level waters from the creek into the Sauntry pit, further minimizing the potential for fine tailings to enter the Mesabi Mountain pit.

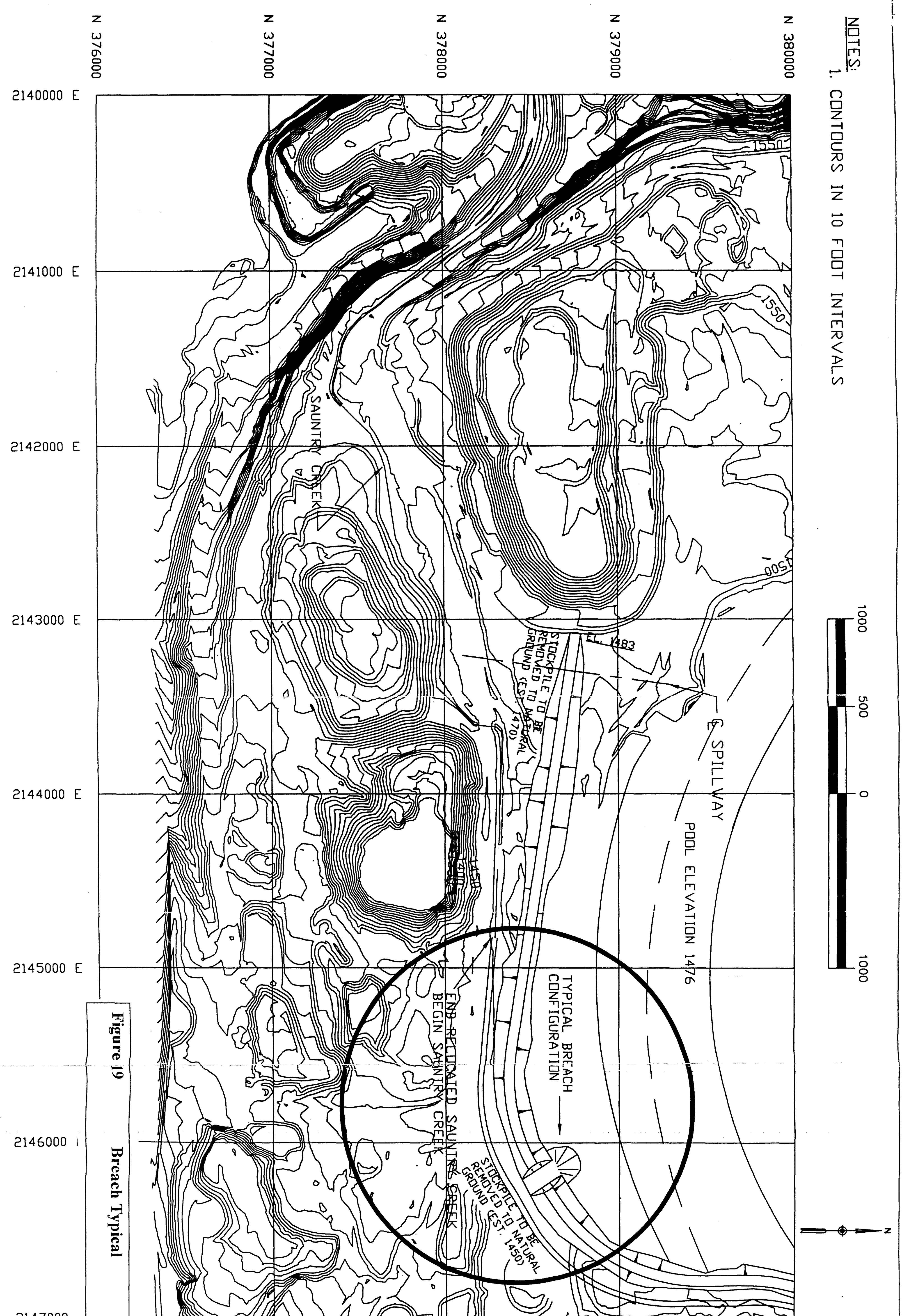


Figure 19 Breach Typical

PROJECT NO. 88-20-202.00	INLAND STEEL MINING COMPANY IN PIT TAILINGS DISPOSAL STUDY VIRGINIA, MINNESOTA	indeco P.O. BOX 1148 • 630 RIVER DRIVE BETTENDORF, IOWA 52722(319)359-5451 A SUBSIDIARY OF JOHNSON BROS. CORPORATION	DRAWN GTB CHECKED WDM APPROVED ---	SCALE AS SHOWN DATE 01/23/98
PLATE NO. 1	TITLE TYPICAL DAM BREACH 10 YEAR DEPOSITION - RELOCATED SAUNTRY CREEK			

NO.	DESCRIPTION	DATE	APPROVED

DWG121-3.DWG

4.5 Wetlands

The 1974 Environmental Impact Statement, prepared for Ispat Inland's existing facility and operation, included analysis of the fully-constructed (expanded) tailings basin. In the interim, state policy has changed to give greater consideration to wetland protection. The proposed alternative would not result in wetland impacts. Wetland impacts from the No-Action alternative (expanding the existing tailings basin) are described below.

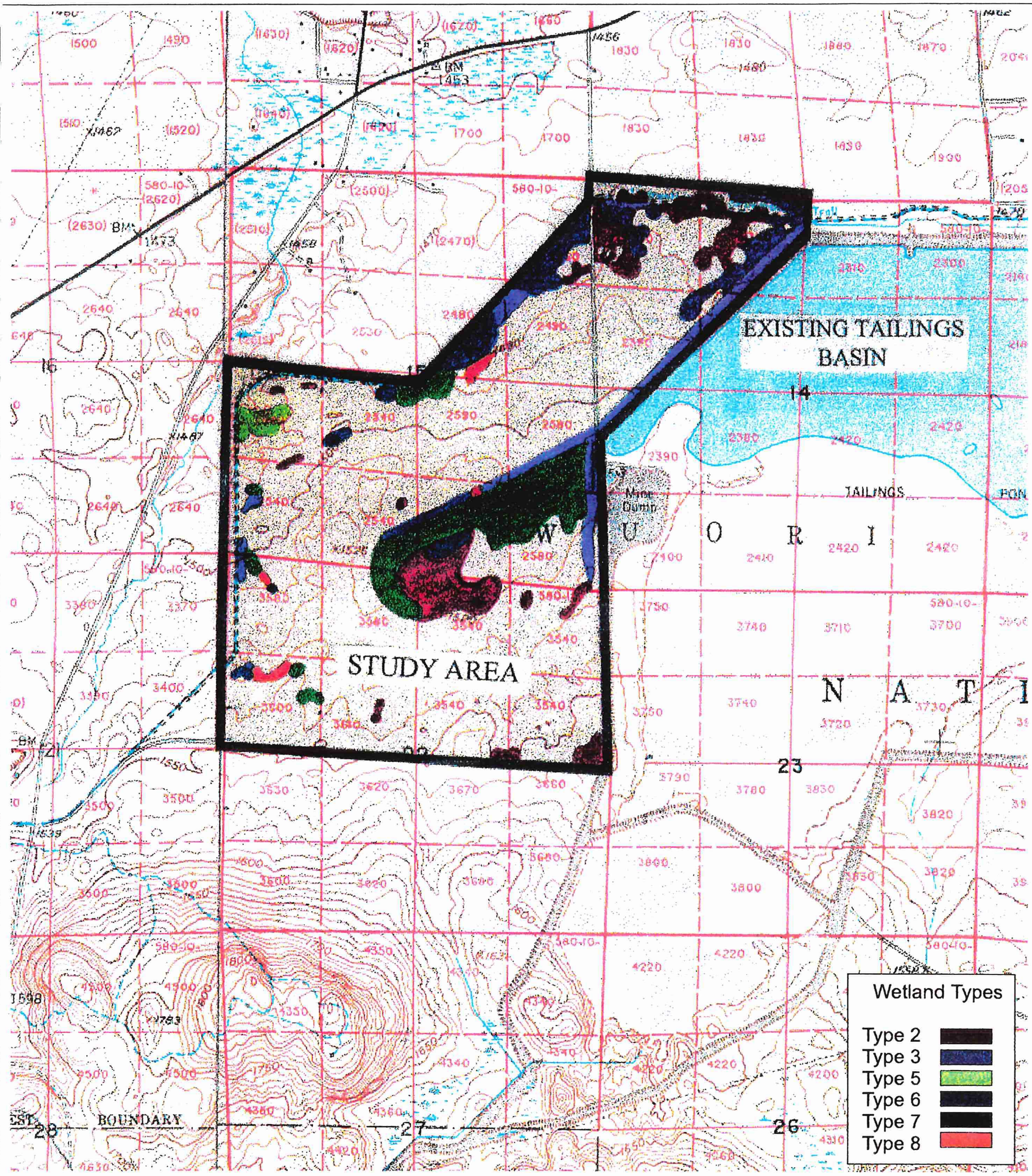
If Ispat Inland does not receive approval to deposit tailings into the Minorca pit, the company will expand the existing tailings basin to its originally planned and permitted limits. Under contract with Ispat Inland, HDR Engineering completed a wetland survey of the 800-acre area where the expansion would occur (*see Figure 20*). HDR performed transects of the site sufficient to map general boundaries of wetland types.

HDR classified wetland types using the U.S. Fish and Wildlife Service's Circular 39 Classification System. Wetlands comprise approximately 29% of the tailings basin expansion area, totalling approximately 230 acres. Types and acreages are provided in the following table.

Wetland Type	Approximate Acreage
Type 2	74.9 acres
Type 3	23.5 acres
Type 5	4.3 acres
Type 6	53.9 acres
Type 7	69.6 acres
Type 8	3.7 acres

Wetland mitigation is mandatory under both the Corps of Engineers 404 permit program and the Minnesota Wetlands Conservation Act, which would be implemented through the Permit to

Mine. The proposed alternative would not result in wetland impacts and therefore would not require wetland mitigation. If the proposed alternative is not approved, Ispat Inland would develop a wetland mitigation plan for tailings basin expansion as part of the permitting process.



Wetland Survey Date: July 29-31, 1997
Map Source: U.S. Geological Survey

HDR Engineering Inc.

Inland Steel Mining Company

Wetland Areas
Potential Tailings Basin
Expansion Area

Date: 9/97

Figure: 20

4.6 Economics

Ispat Inland would realize substantial cost savings by implementing the proposed project. Construction and operating costs for both in-pit tailings disposal and expansion of the existing tailings basin are displayed in figures 21 and 22.

At the time cost estimates were prepared, the existing tailings basin (Cell IIA) had approximately 5 years of remaining capacity. The Minorca pit has an approximate 10-year deposition capacity, and the tailings basin expansion (West Cell "No Action Alternative") would provide approximately 10 years of capacity. The costs are estimated for two scenarios: 1) Cell IIA for 5 years, then in-pit disposal for 10 years (Proposed Alternative), and 2) Cell IIA for 5 years, then West cell for 10 years (No Action Alternative).

The estimated cost (net present value) to implement the different scenarios for 15 years is as follows:

Cell IIA 5 years/In-Pit 10 years (Proposed alternative): $9,565,179.00
Cell IIA 5 years, West Cell 10 years (No Action alternative): $13,363,945.00
(Note: These figures do not include the cost of wetland mitigation if the existing tailings basin were expanded.)

Cost savings associated with in-pit tailings disposal result primarily from two factors: 1) lower construction costs, and 2) lower operational costs due to the elimination of coarse tailings haulage. In-pit disposal also would substantially reduce energy use associated with pumping. Ispat Inland presently pumps fine tailings and process water over the Laurentian Divide to the existing tailings basin approximately 3 miles from the plant. This pumping would continue if the tailings basin were expanded. If the in-pit proposal proceeds, the economic savings realized from lower energy costs would be offset by higher maintenance costs associated with pumping

Inland Steel Mining Company, In Pit Disposal Project
Sequence of Key Events
Cell IIA for 5 Years, West Cell for 10 Years, (Plan through 2013)

NORAMCO Project No. 97754
BEK, 6/25/98

Task No.	Task	Estimated Capital Cost		Estimated Mine Service Costs		Estimated Operating Cost		Total Escalated Dollars	NPV at 12 %/Year
		1998 Dollars	Escalated Dollars (3%/yr)	1998 Dollars	Escalated Dollars (3%/yr)	1998 Dollars	Escalated Dollars (3%/Yr)		
9.0	Year 9, Continue Operation of West Cell (2007)								
9.1	Continue Operation of West Cell								
9.2	Continue Construction of West Cell, Coarse Tails Placement, Liner, Rip-Rap	$1,146,000	$1,452,000	$661,000	$837,000	$550,000	$697,000	$2,986,000	$1,205,995
10.0	Year 10, Continue Operation of West Cell (2008)								
10.1	Continue Operation of West Cell								
10.2	Continue Construction of West Cell, Coarse Tails Placement	$7,000	$9,000	$353,000	$461,000	$550,000	$718,000	$1,188,000	$428,405
11.0	Year 11, Continue Operation of West Cell (2009)								
11.1	Continue Operation of West Cell								
11.2	Conclude Construction of West Cell, Coarse Tails Placement	$161,000	$216,000	$129,000	$173,000	$200,000	$269,000	$658,000	$211,858
11.3	Deposit Excess Coarse Tails on Dump	$0	$0	$0	$0	$350,000	$470,000	$470,000	$151,327
12.0	Year 12, Continue Operation of West Cell (2010)								
12.1	Continue Operation of West Cell								
12.2	Deposit Excess Coarse Tails on a Dump	$0	$0	$0	$0	$550,000	$761,000	$761,000	$218,769
13.0	Year 13, Continue Operation of West Cell (2011)								
13.1	Continue Operation of West Cell								
13.2	Deposit Excess Coarse Tails on a Dump	$0	$0	$0	$0	$550,000	$784,000	$784,000	$201,233
14.0	Year 14, Continue Operation of West Cell (2012)								
14.1	Continue Operation of West Cell								
14.2	Deposit Excess Coarse Tails on a Dump	$0	$0	$0	$0	$550,000	$808,000	$808,000	$185,173
15.0	Year 15, Conclude Operation of West Cell (2013)								
15.1	Conclude Operation of West Cell								
15.2	Deposit Excess Coarse Tails on a Dump	$0	$0	$0	$0	$550,000	$832,000	$832,000	$170,244
16.0	Year 16, (2014)								
16.1	Begin Reclamation of West Basin	$759,000	$1,182,000	$0	$0	$0	$0	$1,182,000	$215,947
17.0	Year 17, (2015)								
17.1	Conclude Reclamation of West Basin	$68,000	$109,000	$0	$0	$0	$0	$109,000	$17,780

Inland Steel Mining Company, In Pit Disposal Project
Sequence of Key Events
Cell IIA Tailings 5 Years Disposal, In-Pit 10 Years (Plan through 2013)

NORAMCO Project No. 97754
BEK, 6/25/98

Task No.	Task	Estimated Capital Cost 1998 Dollars	Estimated Capital Cost Escalated Dollars (3%/yr)	Estimated Mine Services Cost 1998 Dollars	Estimated Mine Services Cost Escalated Dollars (3%/yr)	Estimated Operating Cost 1998 Dollars	Estimated Operating Cost Escalated Dollars (3%/Yr)	Total Escalated Dollars	NPV at 12 %/Year
	After Receipt of Completed Permits								
1.0	Year 1, Continue Deposition in Cell IIA, (1999)								
1.1	ContinueDepositing Tails in Cell II A								
1.2	Continue Raising Cell IIA, Relocate Pipeline	$2,000	$2,000	$658,000	$658,000	$550,000	$550,000	$1,210,000	$1,210,000
2.0	Year 2, Continue Deposition in Cell IIA (2000)								
2.1	Continue Depositing Tails in Cell IIA								
2.2	Continue Raising Cell IIA,	$2,000	$2,000	$353,000	$364,000	$550,000	$567,000	$933,000	$833,036
3.0	Year 3, Continue Deposition in Cell IIA (2001)								
3.1	Continue Depositing Tails in Cell IIA								
3.2	Continue Raising Cell IIA,	$2,000	$2,000	$353,000	$374,000	$550,000	$583,000	$959,000	$764,509
4.0	Year 4, Continue Deposition in Cell IIA (2002)								
4.1	Continue Depositing Tails in Cell IIA								
4.2	Continue Raising Cell IIA,	$2,000	$2,000	$353,000	$386,000	$550,000	$601,000	$989,000	$703,951
5.0	Year 5, Conclude Deposition in Cell IIA (2003)								
5.1	Conclude Use of Cell IIA								
5.2	Deposit Excess Coarse Tails on a Dump	$0	$0	$0	$0	$550,000	$619,000	$619,000	$393,386
	Install Tails Line. Road Crossings								
	Install Tails Line Pipeline Road								
	Install First Tails Pipeline								
	Purchase and Install Return Water Pipeline and Pumps.								
5.3	Make Plant Modifications for Pumping Coarse Tails	$1,924,000	$2,165,000	$308,000	$347,000	$0	$0	$2,512,000	$1,596,421
6.0	Year 6, Begin Deposition In-Pit (2004)								
6.1	Begin Depositing Tails in In-Pit Basin	$0	$0	$0	$0	$120,000	$139,000	$139,000	$78,872
6.2	Begin Reclamation of Cell IIA	$637,000	$738,000	$0	$0	$0	$0	$738,000	$418,761
6.3	Install Second Tails Line	$274,000	$318,000	$639,000	$741,000	$0	$0	$1,059,000	$600,905
7.0	Year 7, Continue Deposition In-Pit (2005)								
7.1	Continue Depositing Tails in In-Pit Basin	$0	$0	$0	$0	$120,000	$143,000	$143,000	$72,448
7.2	Complete Reclamation of Cell IIA	$62,000	$74,000	$0	$0	$0	$0	$74,000	$37,491
8.0	Year 8, Continue Deposition In-Pit (2006)								
8.1	Continue Depositing Tails in In-Pit Basin	$0	$0	$0	$0	$120,000	$148,000	$148,000	$66,948

Figure 22 **Cost Estimates No Action Alternative**

Inland Steel Mining Company, In Pit Disposal Project
Sequence of Key Events
Cell IIA Tailings 5 Years Disposal, In-Pit 10 Years (Plan through 2013)

NORAMCO Project No. 97754
BEK, 6/25/98

Task No.	Task	Estimated Capital Cost 1998 Dollars	Estimated Capital Cost Escalated Dollars (3%/yr)	Estimated Mine Services Cost 1998 Dollars	Estimated Mine Services Cost Escalated Dollars (3%/yr)	Estimated Operating Cost 1998 Dollars	Estimated Operating Cost Escalated Dollars (3%/Yr)	Total Escalated Dollars	NPV at 12 %/Year
9.0	Year 9, Continue Deposition In-Pit (2007)								
9.1	Continue Depositing Tails in In-Pit Basin	$0	$0	$0	$0	$120,000	$152,000	$152,000	$61,390
9.2	Move Sauntry Creek	$39,000	$49,000	$3,260,000	$4,130,000	$0	$0	$4,179,000	$1,687,828
10.0	Year 10, Continue Deposition In-Pit (2008)								
10.1	Continue Depositing Tails in In-Pit Basin								
10.2	Move Higgins Substation	$150,000	$196,000	$0	$0	$0	$0	$196,000	$70,680
10.3	Build 10 Year Disposal Dike on South and West Sides of Pit	$537,000	$701,000	$678,000	$885,000	$479,000	$625,000	$2,211,000	$797,309
	Note, 10 Year Dike will require 714000 Cu Yd Coarse Tails, 59000 Cu Yd Rock. The coarse tails are within one year's available quantity.								
11.0	Year 11, Continue Deposition In-Pit (2009)								
11.1	Continue Depositing Tails in In-Pit Basin								
12.0	Year 12, Continue Deposition In-Pit (2010)								
12.1	Continue Depositing Tails in In-Pit Basin								
13.0	Year 13, Continue Deposition In-Pit (2011)								
13.1	Continue Depositing Tails in In-Pit Basin								
14.0	Year 14, Continue Deposition In-Pit (2012)								
14.1	Continue Depositing Tails in In-Pit Basin								
15.0	Year 15, Conclude Deposition In-Pit (2013)								
15.1	Continue Depositing Tails in In-Pit Basin								
16.0	Year 16, (2014)								
16.1	Lower In-Pit Basin Pool to 1460'	$20,000	$31,000	$0	$0	$0	$0	$31,000	$5,664
16.2	Remove Reclaim Pumps and Tails Pipelines from In-Pit Basin	$150,000	$234,000	$0	$0	$0	$0	$234,000	$42,751
16.3	Begin Reclamation of In-Pit Basin	$369,000	$575,000	$0	$0	$0	$0	$575,000	$105,050
17.0	Year 17, (2015)								
17.1	Complete Reclamation of In-Pit Basin	$68,000	$109,000	$0	$0	$0	$0	$109,000	$17,780
	Total of Escalated Costs		$5,198,000		$7,885,000		$4,127,000	$17,210,000	$9,565,179

Inland Steel Mining Company, In Pit Disposal Project
Sequence of Key Events
Cell IIA for 5 Years, West Cell for 10 Years, (Plan through 2013)

NORAMCO Project No. 97754
BEK, 6/25/98

Task No.	Task	Estimated Capital Cost		Estimated Mine Service Costs		Estimated Operating Cost		Total Escalated Dollars	NPV at 12 %/Year
		1998 Dollars	Escalated Dollars (3%/yr)	1998 Dollars	Escalated Dollars (3%/yr)	1998 Dollars	Escalated Dollars (3%/Yr)		
	Total Escalated Costs		$6,424,000		$7,870,000		$10,230,000	$24,524,000	$13,363,945

4.7 Summary of Potential Impacts and Mitigation

4.7.1 Surface Water

The proposed project will affect Sauntry Creek, which flows through the project area and eventually feeds Virginia and Silver lakes in the City of Virginia. The proposed project will require rerouting of a portion of Sauntry Creek, which is not expected to affect flows or water quality. Without existing pumping, Sauntry Creek flows would be intermittent. Ispat Inland, at the request of the City of Virginia, has agreed to continue pumping throughout project life to augment creek flows. After project closure, a portion of the Sauntry Creek watershed will be restored by reclaiming the filled Minorca pit and constructing a permanent outlet at the pit's southern end. This outlet will be located and designed to maximize surface water outflow, minimizing potential ground water outflow. Sauntry Creek also will receive water from the Sauntry Creek settling basin, where the stream originates.

4.7.2 Ground Water

The proposed project is not expected to significantly affect ground water quality. Extensive study indicates under the "worst case" scenario, there is the potential for the project to result in slightly elevated levels of manganese, fluoride, and molybdenum in the Mesabi Mountain pit. Even under worst case conditions, the levels are not expected to exceed health-based or secondary standards or to require mitigation.

The Department of Health has recommended the following ground water monitoring strategies: ground water monitoring between the Minorca and Mesabi Mountain pits, monitoring of natural water sites near the Minorca pit, limnologic profiling of the Mesabi Mountain pit, process water monitoring, and avoiding (through reclamation) introduction of organic material into the Minorca pit. With the exception of limnologic profiling of the Mesabi Mountain pit, Ispat Inland proposes to implement the recommended measures. Ispat Inland has initiated discussions with the City of Virginia regarding how to accomplish Mesabi Mountain pit limnologic profiling.

4.7.3 Dam Safety

Analysis indicates a breach of the proposed dike will not affect public health or safety. No mitigative strategies are proposed. Through the dam safety permit program, the dike will be subject to regular inspection and monitoring during construction and project operation.

4.7.4 Wetlands

The proposed project will not result in wetlands impacts and would not require wetland mitigation. If the "No Action" alternative is implemented, mitigation (through the Permit to Mine) will be required for approximately 230 acres of affected wetlands.

4.7.5 Economics

Compared to the "No Action" alternative, the proposed project would likely result net over $3 million in savings to Ispat Inland, as well as reduce overall energy consumption.

Section Five

5.0 Government Approvals

Ispat Inland Mining Company must obtain the following permits and approvals for the proposed project.

Permitting Authority:	Minnesota Department of Natural Resources
Type of Permit:	Amendment to Permit to Mine
Comments:	The proposed change in tailings disposition would require an amendment to the Permit to Mine.

Permitting Authority:	Minnesota Pollution Control Agency
Type of Permit:	NPDES Reissuance
Comments:	The proposed project would create a new tailings discharge point, requiring a reissuance of Ispat Inland's NPDES permit.

Permitting Authority:	Minnesota Department of Natural Resources
Type of Permit:	Dam Safety Permit
Comments:	The proposed project includes construction of a dike to increase Minorca pit tailings capacity. Dike construction would require review and permitting by the DNR Division of Waters Dam Safety Program.

Section Six

6.0 List of Preparers

These individuals and companies are primarily responsible for preparing and reviewing the Draft Supplemental Environmental Impact Statement or background studies. The SEIS was prepared by staff in the Minnesota Department of Natural Resources, and reviewed by staff from the Department of Health and the Minnesota Pollution Control Agency. Background studies were completed by staff from the Department of Natural Resources, Department of Health, and the University of Minnesota. Staff from Ispat Inland Mining Company, and their consultants, HDR Engineering, Noramco Engineering, and Indeco, Inc., provided relevant project details and background data and analysis.

John Adams	Minnesota Department of Natural Resources
Project Role:	Hydrogeologic Data Collection and Evaluation; Hydrogeologic Modeling, Risk Assessment and SEIS Review
Years Experience:	29
Focus of Experience:	Mineland Hydrology, Forestry
Education:	B.S., Forest Hydrology

Craig Affeldt	Minnesota Pollution Control Agency
Project Role:	Risk Assessment and SEIS Review
Years Experience:	30
Focus of Experience:	Environmental Review, Water Quality
Education:	B.S., Biology M.S., Ecology

Hillary Carpenter:	Minnesota Department of Health
Project Role:	Health Risk Assessment Preparation, SEIS Review
Years Experience:	22
Focus of Experience:	Research, Toxicology
Education:	B.S., Zoology M.A., Biology Ph.D., Pharmacology

Richard Clark:	Minnesota Pollution Control Agency
Project Role:	Health Risk Assessment and SEIS Review
Years Experience:	13
Focus of Experience:	Mining NPDES Permits, Ground Water Quality Review
Education:	B.S., Geological Engineering M.S., Geology

Emmelyn Jakel:	Department of Natural Resources
Project Role:	Tailings Geochemistry, Ground Water Impacts Analysis, SEIS Review
Years Experience:	8
Focus of Experience:	Aqueous Environmental Geochemistry
Education:	B.S., Chemistry Ph.D., Geochemistry

Gus Josephson	Ispat Inland Mining Company
Project Role:	Project Proposer Representative, Supply Project Information, Risk Assessment and SEIS Review
Years Experience:	22
Focus of Experience:	Safety and Environmental Management
Education:	B.S., Industrial Technolgoy M.S., Industrial Safety

Kim Lapakko:	Department of Natural Resources
Project Role:	Tailings Geochemistry, Ground Water Impacts Analysis, SEIS and Risk Assessment Review
Years Experience:	20
Focus of Experience:	Environmental Mine Waste Management
Education:	B.S., Mathematics M.S., Civil Engineering

Joe Maki:	Minnesota Department of Natural Resources
Project Role:	Collect, Assess, and Analyze Hydrologic Data, SEIS Review
Years Experience:	6
Focus of Experience:	Mineland Hydrology
Education:	B.S., Geology/Hydrogeology

Paul Pojar	Minnesota Department of Natural Resources
Project Role:	Engineering Review
Years Experience:	28
Focus of Experience:	Mineland Reclamation, Mining Engineering
Education:	B.S., Geological Engineering

Rebecca Wooden	Minnesota Department of Natural Resources
Project Role:	SEIS Project Manager, SEIS Preparation and Coordination
Years Experience:	17
Focus of Experience:	Environmental Review, Natural Resources Policy & Planning
Education:	M.S., Wildland Recreation Management/Wildlife Management B.S., Biology

HDR Engineering:	Environmental Science and Engineering Consultant to Ispat Inland
Company Contact:	Mark Wollschlager, J.D., Senior Vice President
Project Role:	Feasibility Studies, Hydrogeology, Mapping, Wetlands Evaluation

Indeco, Inc.:	Engineering Consultant to Ispat Inland
Company Contact:	William C. McDonald, P.E., Vice-President
Project Role:	Project Design, Dam Safety

Noramco Engineering	Engineering Consultant to Ispat Inland
Company Contact:	Bruce Kettunen, Process Engineer
Project Role:	Project Planning & Design, Cost Analysis