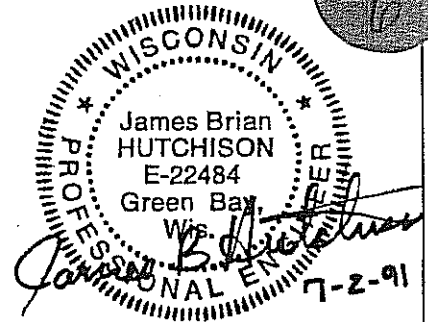


UPDATED MONITORING PLAN
for the
FLAMBEAU PROJECT



Prepared for:
FLAMBEAU MINING COMPANY

Prepared by:
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July 1991

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1.0 INTRODUCTION

In accordance with the Findings of Fact, Conclusions of Law, and Mine Permit Conditions, this report constitutes the updating of Flambeau Mining Company's (Flambeau) Monitoring Plan for its Flambeau project. The Flambeau project consists of the development and reclamation of an open pit copper mine near Ladysmith in Rusk County, Wisconsin. Per the Mine Permit conditions of approval, this updated Monitoring Plan addresses both construction and operation phase monitoring and long-term care and maintenance monitoring.

2.0 CONSTRUCTION AND OPERATION PHASE

2.1 Background

This portion of the monitoring plan has been developed for the construction and operation phase of the Flambeau Project in response to NR 132.06(3)(d), NR 182.08(2)(e)8 and NR 182.09(2)(a)7. This monitoring will cease, and the long-term care and maintenance program discussed in Section 3.0 of this plan will begin, when site closure has been completed. Closure is deemed to be completed when final site grading and initial revegetation of the site is complete.

Construction and operation phase monitoring includes individual programs for groundwater, Type I stockpile exfiltrate, surface water, terrestrial ecology, meteorology, pit inflows, total suspended particulate matter, asbestiform fibers, and Type II stockpile leachate. Each of these programs is discussed below in Sections 2.2 through 2.10, respectively.

2.2 Groundwater Monitoring

Under NR 132.11 and NR 182.13 groundwater monitoring during construction and operation is required. A discussion of monitoring locations, frequency, and parameters follows.

2.2.1 Monitoring Locations

Four of the baseline monitoring well nests will be sampled throughout construction and operation. These wells are shown on Figure 2-1. Well nests MW-1000 and MW-1004 are located downgradient of the pit, MW-1002 is located downgradient of the Type I stockpile, and MW-1005 is located upgradient of the site. Groundwater flow from the area of the Type II stockpile will be intercepted by the pit and would eventually be intercepted by either the MW-1000 nest or the MW-1004 nest.

One additional monitoring well, designated as MW-1010P, has been installed at the site since issuance of the mine permit. This well was installed in bedrock unit 2A in the area between the river and the pit, for the purpose of measuring water levels and groundwater quality. The location indicated on Figure 2-1 places the bottom of the well approximately in the center of Unit 2A, about 100 feet below the present water table. Details regarding the construction of this monitoring well are shown in Figure 2-2.

Two additional water table piezometers, designated as PZ-1011 and 1012 (Figure 2-1), have also been installed at the site for the purpose of measuring water levels. One was located approximately 1,100 feet east of piezometer PZ-1007, and the other approximately 1,100 feet west of PZ-1007. These wells will be used to assess the extent of groundwater drawdown to the north and northeast of the pit. Details regarding the construction of these two wells are shown in Figures 2-3 and 2-4.

Water levels in selected on-site wells will also be monitored to document the drawdown due to mine excavation. The identification and the location of wells included in the monitoring program for water level information are shown on Figure 2-1.

2.2.2 Monitoring Frequency, Parameters and Methods

NR 182.13(2) requires quarterly analysis of groundwater samples for water levels, specific conductance (field), pH (field and laboratory), total dissolved solids (TDS), and other parameters based on the results of the waste characterization studies. For the Flambeau Project, quarterly monitoring will occur in January, April, July, and October of each calendar year. In addition, NR 182.13(2) also requires annual testing of "other contaminants which would reasonably be expected to occur in leachate from the facility". The waste characterization and in-pit transport modeling studies completed for the project have identified iron, manganese, copper, and sulfate as principal constituents that may be generated at the site. These four parameters are included in the monitoring plan. Total alkalinity and total hardness as indicators of overall water quality will also be quarterly parameters.

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Denny Koep, Denny's Drilling

Well No.: MW-1010P

Drilling Method: Tricone and mud through Quaternary, Air Rotary
into bedrock

Date Installed: 6-4-91

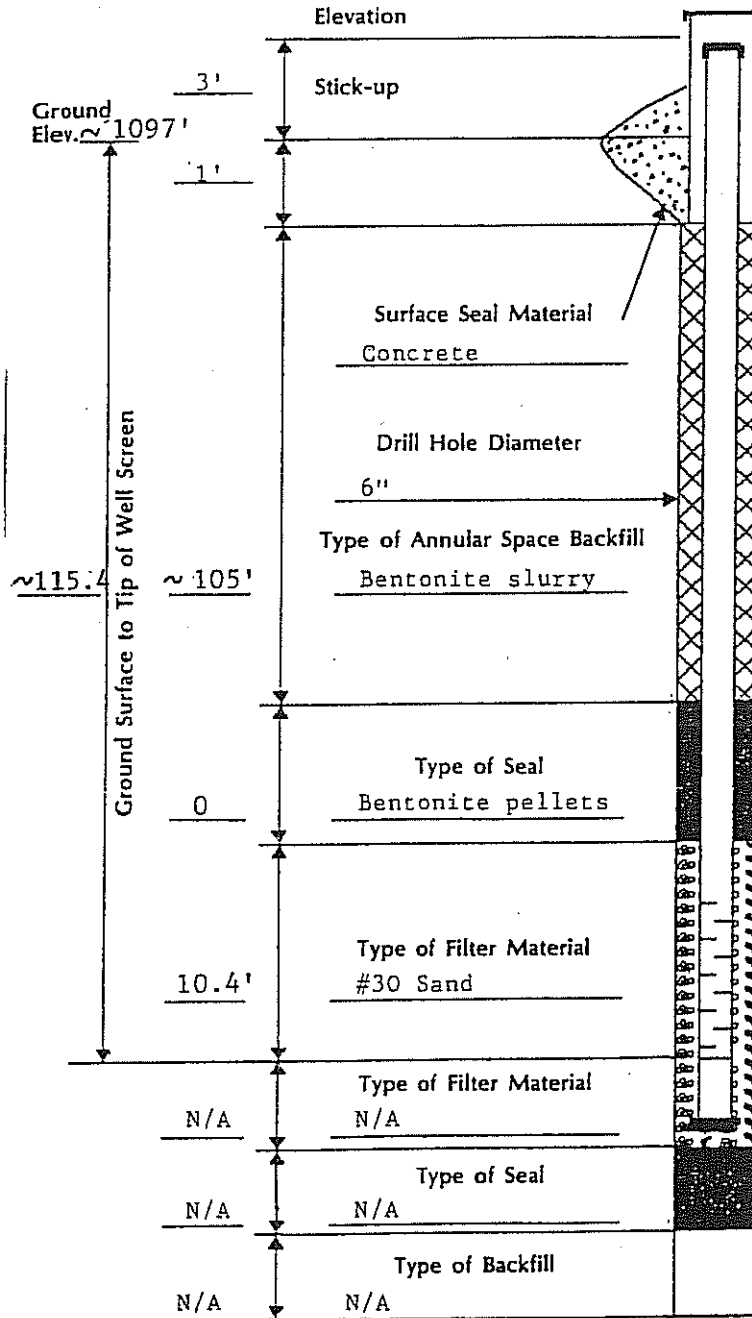
Coordinates: (see Figure No. 2-1)

Protector Pipe:

Size: 6"

Material: steel

Lock No.: --



Riser:

Diameter: 2" ID

Material: PVC

Sch.: 80

Type of Joints: Flush threaded

Stenciled? No

Screen:

Diameter: 2" ID

Material: PVC

Slot Size: 0.010"

Length: 5'

Sump:

Length: N/A

Type of Cap: PVC

Centralizer: Used
 Not Used

Depth to Water From Top of Riser at Completion: ~15'

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KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
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NOTES	APPROVAL	DATE
	DESIGNED BY BNP	11-26-89
	DRAWN BY JRB	11-30-89
	CHECKED BY JWS	12-1-89
	APPROVED BY JBH	7-1-91
	CAD No.	SCALE NONE

FIGURE 2-2 MONITORING WELL MW-1010P CONSTRUCTION DETAIL		
Job No	Dwg No	REV

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Brad Davis, Twin City Testing, Inc.

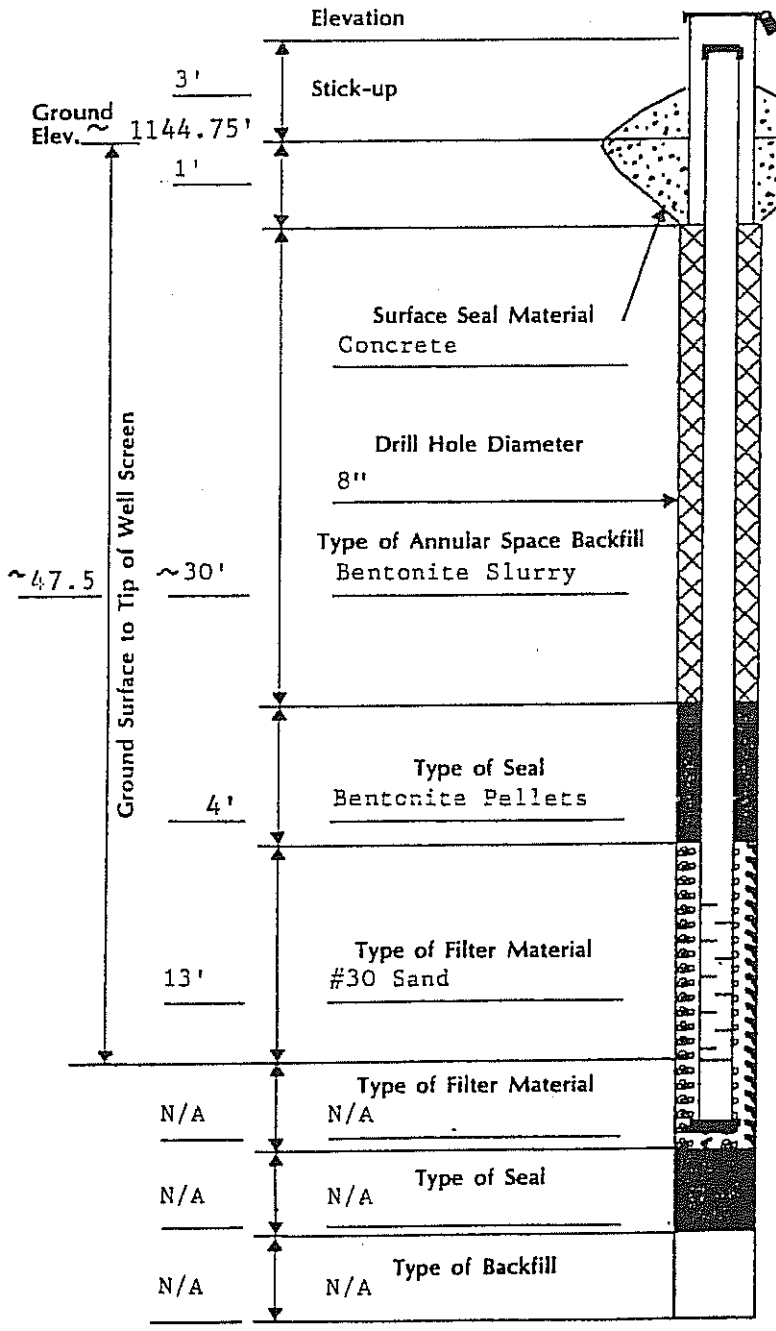
Well No.: PZ-1011

Drilling Method: HSA

Date Installed: 4-18-91

Coordinates: (See Figure No. 2-1)

Protector Pipe:
 Size: 4"
 Material: Steel
 Lock No.: -



Riser:
 Diameter: 2" I.D.
 Material: PVC
 Sch.: 80
 Type of Joints: Flush Threaded
 Stenciled? No

Screen:
 Diameter: 2" I.D.
 Material: PVC
 Slot Size: 0.010"
 Length: 10'
 Sump:
 Length: N/A
 Type of Cap: PVC

Centralizer: Used
 Not Used

Depth to Water From Top \sim 39'
 of Riser at Completion: _____

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NOTES	APPROVAL	DATE
	DESIGNED BY BNP	11-26-89
	DRAWN BY JRB	11-30-89
	CHECKED BY JWS	12-1-89
	APPROVED BY JBHI	7-1-91
	CAD No.	SCALE NONE

FIGURE 2-3
 MONITORING WELL PZ-1011
 CONSTRUCTION DETAIL

Job No	Dwg No	REV
--------	--------	-----

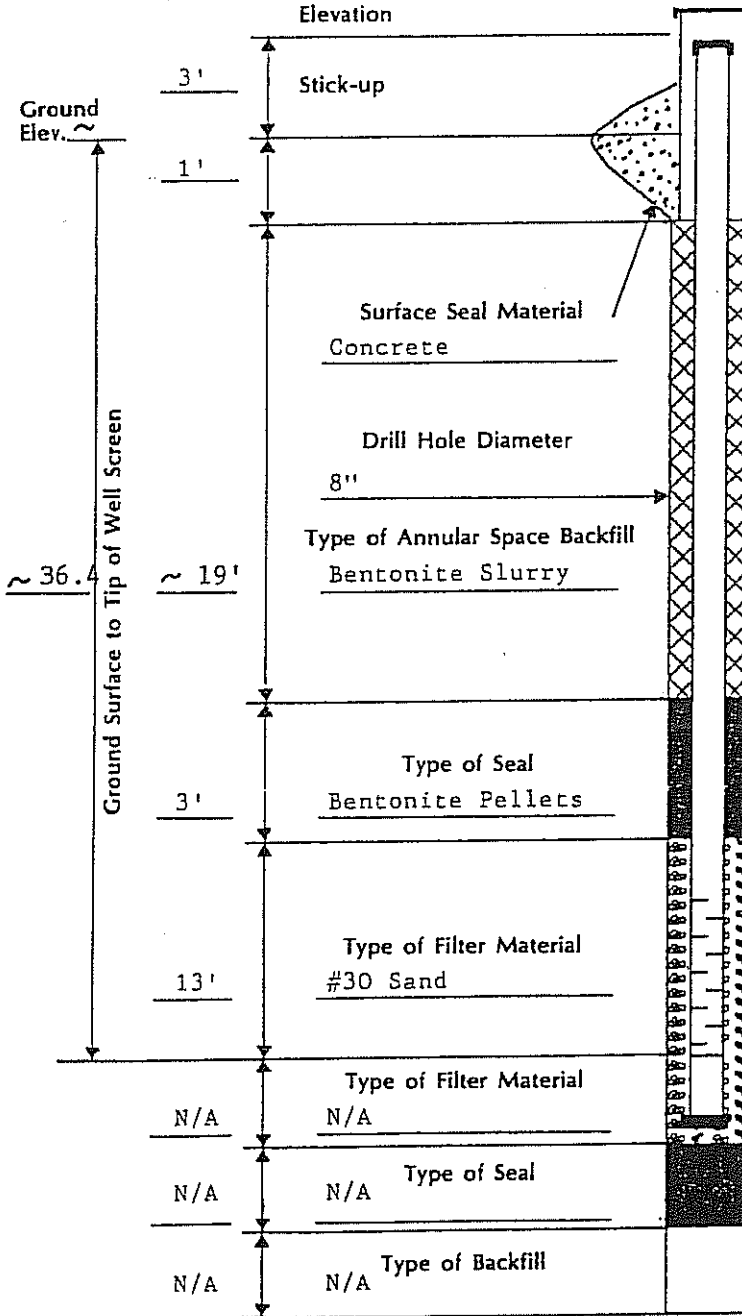
MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Brad Davis, Twin City Testing, Inc.
 Drilling Method: HSA

Well No.: PZ-1012
 Date Installed: 4-17-91

Coordinates: (See Figure No. 2-1)

Protector Pipe:
 Size: 4"
 Material: Steel
 Lock No.: -



Riser:
 Diameter: 2" I.D.
 Material: PVC
 Sch.: 80
 Type of Joints: Flush Threaded
 Stenciled? No

Screen:
 Diameter: 2" I.D.
 Material: PVC
 Slot Size: 0.010"
 Length: 10'
 Sump:
 Length: N/A
 Type of Cap: PVC

Centralizer: Used
 Not Used
 Depth to Water From Top of Riser at Completion: ~ 31'

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NOTES	APPROVAL	DATE	FIGURE 2-4 MONITORING WELL PZ-1012 CONSTRUCTION DETAIL			
	DESIGNED BY	BNP				11-26-89
	DRAWN BY	JRB				11-30-89
	CHECKED BY	JWS				12-1-89
	APPROVED BY	JBHI				7-1-91
	CAD No.	SCALE	NONE	Job No	Dwg No	REV

Quarterly measurements of groundwater levels will be conducted for the wells shown in the table on Figure 2-1. The table lists wells, screened intervals, sampling frequency and parameters for the construction and operation period of the Flambeau Project.

In addition to the above, background data will be collected for new groundwater monitoring well MW-1010P. This program will consist of testing the first eight quarterly samples from this well for the parameters on the regular quarterly program plus the following metals.

- Arsenic
- Barium
- Cadmium
- Total Chromium
- Lead
- Mercury
- Selenium
- Silver
- Zinc

These metals were selected either because they are the primary drinking water standard metals or because they may occur in the leachate from the Type II waste.

Since groundwater gradients will be towards the pit during the construction and operation phase of the project, a comprehensive analysis program as referenced in NR 182.13(2)(e)2 is not warranted during this phase of groundwater monitoring. A comprehensive program is a part of the long-term care and maintenance monitoring program as described in Section 3.0 of this plan.

Sampling procedures will be consistent with those stated in the report titled *Mining Permit Quality Assurance/Quality Control Document (QA/QC Plan)* prepared by Foth & Van Dyke in April 1991 or addenda thereto, which are incorporated herein by reference. The QA/QC plan identifies the proposed chemical parameters, preservatives, sample volume requirements, holding times, and detection limits for the program.

2.2.3 System Maintenance

Flambeau will immediately notify the WDNR if for any reason a monitoring well or device is destroyed or fails to function properly. Unless notified otherwise in writing by WDNR, Flambeau will restore, or properly abandon and replace, destroyed or failed monitoring devices within 60 days of the written notification referred to above.

2.3 Type I Stockpile Exfiltrate

The Type I stockpile will be equipped with a collection lysimeter at the location shown on Figure 2-1. The collection lysimeter will be used to determine the characteristics of the exfiltrate from the Type I stockpile.

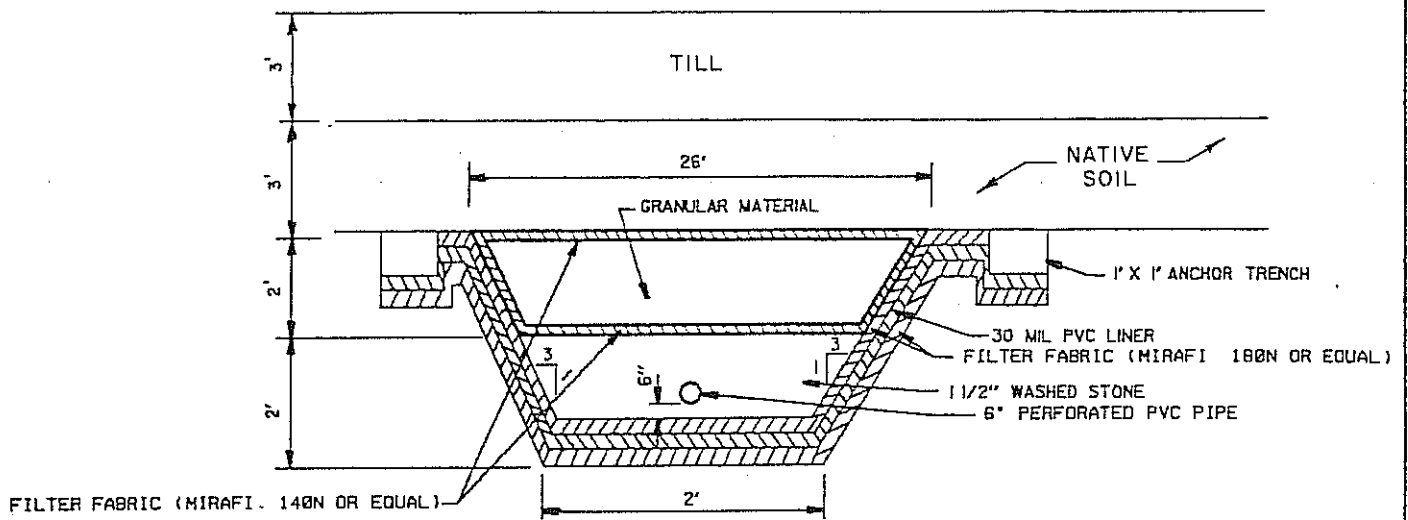
2.3.1 Design and Construction

The collection lysimeter will be located beneath that portion of the Type I stockpile designated for the storage of sandstone, since waste characterization studies have shown that this material is the most leachable of those to be stored in the Type I stockpile.

Details depicting the design of the collection lysimeter are shown in Figures 2-5 and 2-6. The till blanket and the upper portion of the till underlying the stored materials is predicted to react with the exfiltrate to remove constituents from the stored materials. Therefore, the collection lysimeter will be placed three feet below the till blanket. During construction, soil placed over the collection lysimeter will be compacted to a density approximately equivalent to undisturbed in-place soil.

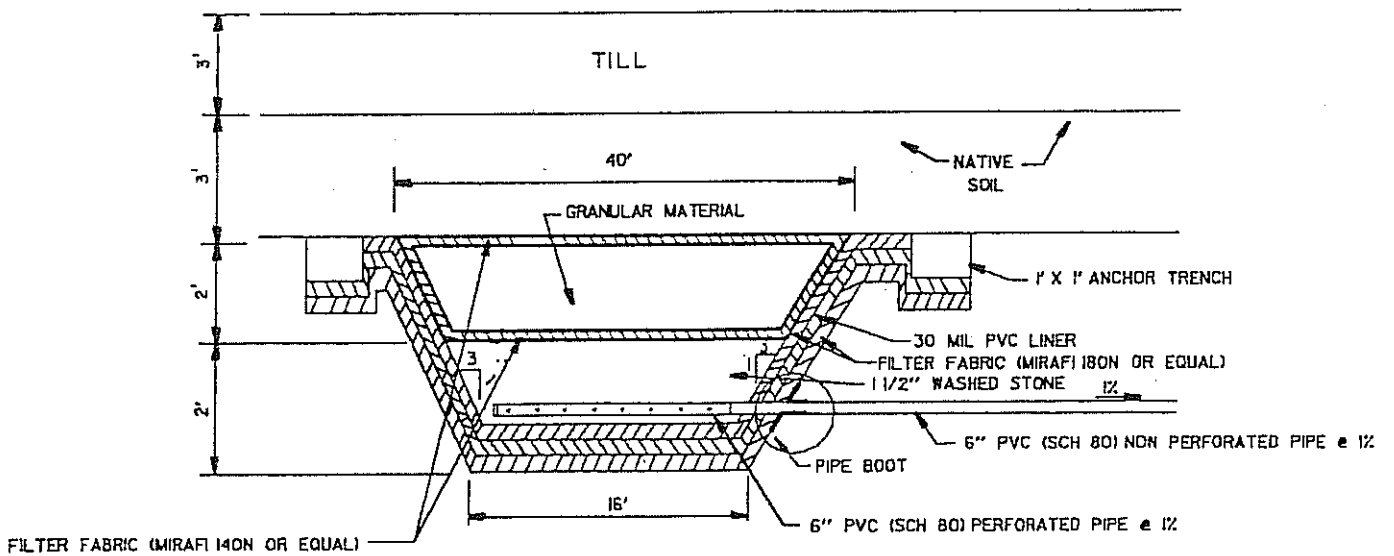
2.3.2 Monitoring Frequency, Parameters and Methods

The collection lysimeter will be sampled on a quarterly basis. Samples will be collected from the sampling riser and shall be analyzed for the parameters listed below. Where only small sample volumes are obtained, analyses shall be performed on as many parameters as feasible in the same order as the parameters occur on the list.



**TYPICAL SECTION PERPENDICULAR TO
COLLECTION LYSIMETER PIPING**

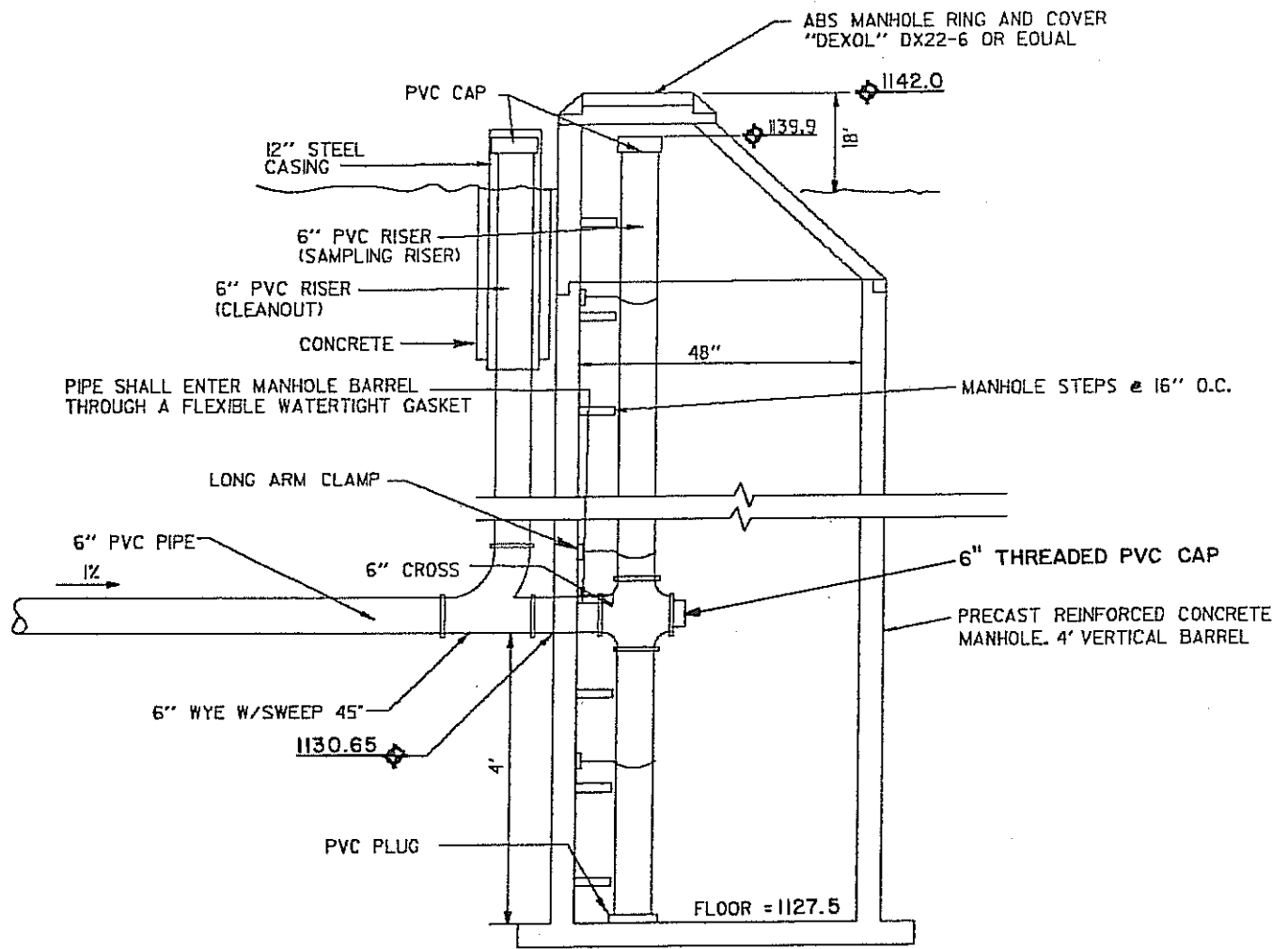
NOT TO SCALE



TYPICAL SECTION THRU COLLECTION LYSIMETER PIPING

NOT TO SCALE

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			FIGURE 2-5 COLLECTION LYSIMETER SECTIONS		
NOTES	APPROVAL	DATE			
	DESIGNED BY				
	DRAWN BY	DHS	12/89		
	CHECKED BY	GWS	12/89		
	APPROVED BY				
	CAD No.	SCALE			



COLLECTION LYSIMETER
STORAGE, SAMPLING & CLEANOUT RISER

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NOTES	APPROVAL	DATE	FIGURE 2-6 COLLECTION LYSIMETER RISER AND SUMP DETAIL		
	DESIGNED BY				
	DRAWN BY	DHS 12/89			
	CHECKED BY	GWS 12/89			
	APPROVED BY				
	CAD No.	SCALE NONE	Job No	Dwg No	REV

- pH (Field and Lab)
- Specific Conductance (Field)
- Total Chromium
- Copper
- Iron
- Manganese
- Sulfate
- Total Dissolved Solids
- Total Alkalinity
- Total Hardness

Sampling procedures will be consistent with those stated in the project's QA/QC plan. The QA/QC plan also contains information pertaining to preservatives, sample volume requirements, holding times and detection limits for the parameters on the program.

2.3.3 Liquid Level Measurement

The lysimeter will be bailed or pumped dry approximately one to two weeks prior to samplings to provide a "fresh" sample for analysis. For purposes of determining the flow rate of water captured by the lysimeter, the following procedures will be followed:

Bailing Site Visit

1. Upon arrival and prior to bailing or pumping, the elevation of the water in the lysimeter standpipe will be determined.
2. The elevation of the water in lysimeter standpipe will be compared to the elevation of the top of the lysimeter perimeter berm. If the elevation of the water in the lysimeter is below the top of the lysimeter berm, then the water will be bailed or pumped into a 55-gallon drum, and the volume of water required to pump the lysimeter dry will be determined. This volume divided by the time since the last lysimeter pumping will be used to determine the volume and flow rates of water captured by the lysimeter.

If the elevation of the water in the lysimeter standpipe is within 0.1 feet of the top of the lysimeter berm, it will be assumed that water has overflowed the lysimeter perimeter berm. Therefore, since no accurate volume measurements can be made, the contents of the lysimeter will be purged without measuring the volume of water.

Upon arrival at the site for sampling, one or two weeks later, water quality sampling all "wasted" water obtained from the lysimeter during sampling will be captured or the volume estimated. Upon completion of the sampling, the lysimeter will be pumped and the volume of water measured. This volume divided by the time since the last purging (one or two weeks prior) will then be used to determine volume and flow rates of water captured by the lysimeter.

2.4 Surface Water

Water-quality based effluent limitations have been established for the surface water discharges from the Flambeau Project. These limitations are designed to protect the sensitive components of the aquatic environment and they incorporate bioaccumulation and bioconcentration considerations in their development. The treatment technology to be installed for the Flambeau Project in order to meet these very strict effluent limitations is advanced and the best economically available system.

The purpose of the WPDES permit, therefore, is to protect the Flambeau River environment and the public health and welfare. Monitoring of the effluent for specific chemical parameters, together with bioassay tests provides the most direct and reliable measure of whether the effluent is within permit limits and whether it is toxic to aquatic life.

Monitoring of the Flambeau River in the vicinity of the discharge can also be undertaken to demonstrate the effectiveness of the effluent limits in protecting the environment. The Flambeau River, its sediments and aquatic life are influenced by a variety of factors not related to the mine site. It is estimated that the discharge from the Flambeau Project will constitute approximately one percent of the low flow (one-quarter of the 7Q10) of the river. As a result, should monitoring show changes in the chemical constituents in the Flambeau River, its sediments or aquatic life, they may not be directly related to the project.

Flambeau recognizes WDNR's interest in a secondary surface water monitoring program and believes such a program can provide information on the Flambeau River apart from serving regulatory or enforcement purposes.

If at any time during which the construction and operation surface water monitoring program is in effect, data collected show that certain aspects of the plan do not warrant continuation, Flambeau will request to discontinue those parts of the program.

The surface water monitoring program will include sampling and analytical testing of the following: sediments, fish, macroinvertebrates, water quality, habitat characteristics, and wetland surface flows. Unless noted below, construction and operation surface water sampling and/or monitoring will commence the year before discharges from the wastewater treatment plant begin, and cease at the time the discharge ceases. A discussion of each program element follows.

2.4.1 Sediments

Sediments in the Flambeau River will be collected once annually at two locations (Figure 2-7). An upstream sampling station will be established at Blackberry Lane, and a downstream station will be located at the old Port Arthur dam site. At each of these locations, three sediment traps will be installed after the spring runoff period is over. The traps will be suspended above the river bed in May of each year. Sediment samples will be analyzed individually for the following parameters:

- Particle Size
- Percent Volatile Solids
- Iron
- Manganese
- Aluminum
- Arsenic
- Silver
- Nickel
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Selenium
- Zinc

Sampling procedures will be consistent with those stated in the project's QA/QC plan. Holding times, levels of detection and analytical procedures to be used for sediments are also delineated in the QA/QC plan. Samples that contain adequate quantities to allow for analysis by the WDNR will be split prior to laboratory analysis and a sample will be provided to the WDNR for their quality assurance work.

2.4.2 Fish

Fish (walleye) will be collected once annually during the low flow period of the year from the Ladysmith Flowage upstream of the site and the Thornapple Flowage downstream of the site (Figure 2-7). Acceptable sampling methods will include hook and line, electroshocking and fyke nets. A reasonable effort will be made to collect walleyes from each location according to the following size ranges:

- Ten to 12 inches - one fish.
- Twelve to 15 inches - two fish.
- Fifteen to 18 inches - three fish.
- Eighteen to 22 inches - two fish.
- Greater than 22 inches - one fish.

It is possible that, even after a reasonable effort is put forth, individual fish to coincide with the prescribed size ranges may not be collected. Therefore, the sampling effort will cease after a reasonable effort is put forth. A reasonable effort is defined as an eight hour, nocturnal sampling period. The WDNR will be notified of each sampling effort prior to mobilization so that their representative can be present.

Fillets (with skin left on) will be tested for total mercury. The livers of the fish collected at each of the two sampling stations will be composited into one upstream and one downstream sample. Each will be analyzed for the metal parameters included on the list of analytical parameters for sediments. Each organism will be measured for total length, sexed, and the stomach contents noted. The age of each individual fish will be determined using commonly-accepted techniques. Fish monitoring, sampling, and analytical procedures are prescribed in the project's QA/QC plan.

2.4.3 Macroinvertebrates

Three sampling locations will be established for the collection of macroinvertebrates (Figure 2-7). An upstream station will be located at Blackberry Lane. Downstream stations will be located at the site immediately above the mouth of Meadowbrook Creek and at a site to coincide with the sediment sampling location near the old Port Arthur dam site. All macroinvertebrate collection stations will be restricted to within 50 yards of the eastern bank of the river.

Once per year, an adequate sample size of crayfish (25 individuals or more) will be collected from each site using the best available methods. Each of the three composite samples will be analyzed for:

- Aluminum
- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Mercury
- Zinc
- Selenium
- Nickel
- Silver

If an adequate sample size is not available after a reasonable effort, the tests will be run on the sample that is available, if any. At each of the three macroinvertebrate sampling stations, the macroinvertebrate fauna will be collected in the autumn of each year. Sample collection and an analytical method to be employed will be as specified in the project's QA/QC plan.

2.4.4 Water Quality

Although the mass balance and mixing ratios of treated discharge to the Flambeau River show there will be no detectable increases in concentrations of the discharge parameters in the river, sampling of surface water in the Flambeau will be undertaken quarterly (January, April, July, and October) from two locations (Figure 2-7) as long as the permitted discharge is occurring. Parameters tested, methods and procedures

Dye test
will be those included in the WPDES Permit. A grab sample will be taken at each site. The upstream site will be located at the western end of Blackberry Lane and the downstream site will be located approximately one hundred yards below the wastewater treatment plant discharge at the point where a dye test conducted at the first sampling period demonstrates the sampling point is in the discharge plume.

Chemical parameters designated for testing in the program will be phased out of the monitoring program in a manner similar to that for the WPDES permit. Therefore, as substances included in the WPDES permit are eliminated from the discharge monitoring list because they are not found in the effluent, they will be eliminated from the surface water monitoring program at the same time.

2.4.5 Habitat Characteristics

The design and construction of the project features, including the discharge locations on the river bank, have been selected to minimize sedimentation. However, a physical evaluation of the river bottom habitats along the eastern bank of the Flambeau River from a point 100 yards upstream of the northern discharge location to a point 1,000 yards downstream of the southernmost discharge (Figure 2-7) will be done annually during the summer low-flow period. The evaluation will note the physical character of the bottom habitats (i.e., location of river sediment bars, percent of area that is sand or finer particle size, unusual biological growth) and include the production of a map of the bottom types in the area where habitat characterization was completed. The evaluation procedure will occur prior to the construction of the discharge structures on the bank of the river and approximately two months after discharges *both* begin to function. This analysis will be completed annually during the low flow period until the permitted surface water discharges from the site cease.

During the field investigation to monitor changes in habitat characteristics, the river bank and near shore habitats will be documented using a series of panoramic photographs taken from the river. The purpose of these photos will be to document visible changes, if any, that may occur downstream of the project.

2.4.6 Wetland Surface Flows

Water level gauges will be installed at the outflow locations of Wetland Nos. 1, 5c, 7 and 10a. A gauge will also be installed in Wetland 6c at a point that is representative of its water level. The locations of the various water level gauges are shown on Figure 2-1 and 2-7. Water levels will be read and recorded monthly from March to December of each year. The staff gauges will be installed and read beginning two months (or as soon as practical depending on the season) after project permits are granted in order to obtain preconstruction water levels. At the time the pit is backfilled, the data will be compared to preconstruction levels and the recent precipitation history for the region. If water levels indicate there has been no significant drawdown effects on these wetlands attributable to the project, readings will cease.



2.5 Terrestrial Ecology

Aerial and color infrared photography will be used during the construction and operation monitoring period to monitor the impact of the project on vegetation in and around the project area. The photography will be completed once prior to the start of construction and during the third and sixth year of site operations. The area to be photographed will consist of the entire project area, less the railroad spur line corridor east of STH 27, as defined on Figure 4-2 of the December 1989 Mining Permit Application and the area within and 500 feet beyond the maximum extent of drawdown as defined by Figure 12 of 19 of the July 1989 Groundwater Modeling Report completed for the project.

Photography work completed during site operation will be conducted in the late summer period. If at all possible, the preconstruction photography will be completed in the late summer also. If permitting and construction schedules preclude this from occurring, photography will be completed as close to late summer as possible. Copies of the aerial photos will be forwarded to the WDNR with the project's annual monitoring report for the years in which photos are taken.

2.6 Meteorology

Meteorological data will be collected in the vicinity of the mining site through the use of wind sensors and a precipitation gauge. The wind sensors will be mounted approximately 35 feet off the ground where they will be free of air turbulence caused by ground level obstructions such as buildings and trees. Obstructions close enough to cause turbulence will be removed from the vicinity of the sensors. The sensors will be used to continuously record wind speed and direction on an analog strip chart recorder.

A tipping bucket precipitation gauge will be used to gather data regarding precipitation occurring at the site. Precipitation amounts will be recorded on an externally-mounted digital strip chart recorder.

The meteorological instruments will be operated continuously from the commencement of construction until initial reclamation seeding has been completed. The equipment to be used will be the same or similar to that used during baseline monitoring activities. Quality Assurance/Quality Control procedures will be the same as those detailed in the QA/QC plan for the project.

**
met.
→ final
recl.*

The location of the meteorological station is the same as that used during baseline sampling. The site is approximately one mile south of the southeast sampling site at the northwest corner of Highways 27 and P.

2.7 Pit Inflows

Estimates of groundwater inflow into the open pit during stripping of overburden and mining will be calculated using the following procedures.

The total estimated amount of water pumped from the open pit will be recorded through the use of either flow measurement equipment or by calculating flow using recorded pump running time and the specific discharge rate-versus-head relationship for the pumps used to remove water from the pit. Groundwater inflow will be

calculated by subtracting precipitation recorded using the precipitation gauge, less evaporation, from the volume of water pumped. In addition, adjustments to the calculation will be made to reflect the volume of runoff that flows into the pit from the area immediately surrounding the pit and from the pit access road, and to reflect overflows from the runoff pond back into the pit. Given the adjustments that are required, it should be recognized that the calculated inflow rate will be a reasonable estimate of the actual rate.

Inflow will be calculated in the above fashion on a monthly basis.

2.8 Total Suspended Particulate Matter (TSP)

The total suspended particulate matter (TSP) concentration in the ambient air will be monitored. Particulate matter will be generated by the mine through operations such as drilling, rock blasting, crushing, screening, loading and unloading, and heavy vehicular traffic and from storage piles. Monitoring will be conducted during the preproduction, active mining and reclamation phases of the project. A discussion of monitoring locations, frequency, parameters and sampling and analytical methods follows.

2.8.1 Monitoring Locations

The TSP ambient air concentration using high-volume air samplers will be monitored at each of four sites. Site selections were based on USEPA siting criteria as described in the Ambient Monitoring Guidelines for Prevention of Significant Deterioration, EPA 450/4-87-007. The four sites are described below.

North Site (Rusk County Hospital)

Location: Southwest corner of the intersection of Highway 27 and College Avenue West.

General

Description:

The samplers will be located on the roof of the hospital. The face plate of the sampler is 45 feet from the ground.

College Avenue runs approximately 300 feet on the north side of the hospital complex and Highway 27 runs approximately 250 feet along the east side. The Flambeau River flows 200 feet to the south. There are woods and adjacent hospital buildings to the west. The sampler is sufficiently high enough and far enough away so that interferences should not be encountered.

Southeast Site

Location:

Northwest corner of the intersection of Jansen Road and Highway 27.

General

Description:

The sampler will be located on a wooden platform such that the face plate of the sampler is seven feet from the ground. The sampler will be located 125 feet west of Highway 27 and 80 feet north of Jansen Road. The samplers will be located outside of the wake effects region created by the Type II stockpile. Sufficient clearance from the trees that stand east and south of the monitoring site will be provided in order to meet siting criteria.

Northeast Site

Location:

Southwest corner of the intersection of Highway 27 and Blackberry Lane.

General

Description: The sampler will be located on a platform such that the face plate of the sampler is sixteen feet from the ground. The platform is located on the roof of a small garage. The platform is above the roof of the adjoining house. This site sits 140 feet west of Highway 27 and 260 feet south of Blackberry Lane.

Blackberry Lane

Location: South of Blackberry Lane and east of Kennecott Lane.

General

Description: The sampler will be located approximately 650 feet south of Blackberry Lane and 40 feet east of Kennecott Lane. The old gravel pit is approximately 300 feet to the east. Two stands of trees grow approximately 150 feet northeast and 150 feet south of the sampling location.

2.8.2 Operating Schedule and Parameters

The high volume samplers will operate every third day (24 hours on, commencing at midnight, and 48 hours off) during the preproduction and reclamation phases. During the mining phase, each monitor shall be operated once every other day (24 hours on and 24 hours off commencing at midnight). If after one year of monitoring during either the mining or reclamation phases, there have been no exceedances of a TSP standard, the sampling schedule may be reduced to no less than once every six days.

*Part of
the
operating
phase*

Filters will be installed one day prior and removed one day after the operating day to avoid non-representative-particulate loading. In addition to analyzing the filters for TSP concentration, the filters will also be analyzed for arsenic, beryllium, cadmium, chromium, mercury and nickel. If the TSP 24-hour concentration at a monitoring site exceeds 500 micrograms per cubic meter, monitoring for both TSP and PM₁₀ shall be conducted at the site where the exceedance occurred. The PM₁₀ monitor shall be operated for a minimum of one year on an every-other-day basis. If the 24-hour exceedance is attributed to an exceptional event, PM₁₀ monitoring will not be required.

2.8.3 Total Suspended Particulate (TSP) Monitors

Each of the four sampling sites will be equipped with a TSP high volume sampler consisting of the following:

- Sierra-Anderson High Volume Air Sampler (motor and enclosure).
- Pressure Transducer Flow Recorder.
- Combined Flow Controller/Digital Timer-Programmer.
- Glass Fiber Filter Media.
- Wooden Support Platform.

With the high volume air sampler the flow rate is easily adjusted with an adjustable resistor (potentiometer) mounted in the electronics enclosure. The flow will be adjusted to approximately 50 cfm so that it is in the required range of 40-60 cfm.

2.8.4 Calibrations and Audits

Calibration procedures are described in the project's QA/QC plan. It is anticipated that the WDNR will audit the instruments at the start of the monitoring period and annually thereafter.

2.8.5 Particulate Filter Conditioning and Weighing

In order to determine particulate loading, each of the glass fiber filters will be conditioned and pre- and post-weighed. A copy of the conditioning and weighing procedures is included in the project's QA/QC plan.

The filters will be numbered sequentially and placed in a manila folder. The folder will be placed into a resealable plastic bag to maintain their integrity during transportation and storage.

2.8.6 Field Operation

The sampling procedures to be used in this network are specified in the project's QA/QC plan.

2.8.7 Data Validation

If any of the following conditions exist, the sample should be voided in the field. "VOID" should be written in large letters in the remarks section of the Field Data Sheet followed by the reason for voiding the sample.

Flow

If the instrument reading ever indicates a flow outside the flow rate range of 40 cfm to 60 cfm for more than six hours the sample must be voided. Corrective action should be taken.

Time

Whenever the sampling time is less than 23 hours or greater than 25 hours, or whenever the start and stop times are not within one hour of midnight, the sample must be voided.

Filter

The number on the filter must correspond to the number on the Particulate Sample Record sheet. If there is no tare mass on the sheet, the filter is invalid. The filter will be visually checked for defects (rips, holes and gasket leaks) before and after use. Any defects will be recorded on the Field Data Sheet. Physical damage to the filter after sampling does not always invalidate the sample as long as all pieces of the filter are included in the folder. However, any loss of sample due to leakages during the sampling period caused by holes or tears in the exposed portion of the filter or to loss of loose particulates from the filter after sampling (e.g., loss of particulates when folding the filter) will invalidate the sample.

2.8.8 Filter Analyses

After being removed from the sampler, the filter samples will immediately be sent to Superior Testing Laboratories and weighed as soon as possible after reaching the lab. Superior Testing Laboratories will notify Foth & Van Dyke of the results.

After weighing each filter, a portion of it will be saved. Once every three months, these filter sections will be composited and analyzed for arsenic, beryllium, cadmium, chromium, mercury and nickel.

A microscopic analysis will be conducted on all TSP filters exceeding 500 ug/m^3 averaged over a 24-hour period. A total of three filters will be analyzed per TSP sampler. In the event that less than three filters per monitor exceed 500 ug/m^3 (when at least one filter exceeds 500 ug/m^3), the three filters having the highest concentration will be analyzed.

2.8.9 Exceedance Reporting

Should a TSP or PM_{10} 24-hour concentration at a monitoring site exceed standards, the exceedance will be reported to the WDNR within two working days of having determined the sample concentration. Such an exceedance will be investigated and a report will be forwarded to WDNR with the following information: an analysis of the monitoring filter; a wind rose for the exceedance period; and information about the operating conditions at the mining site during the exceedance period (i.e. number of trucks and mining vehicles in operation; amount of production occurring at the facility, etc.).

2.8.10 Maintenance

Maintenance procedures to be used for ambient air monitoring equipment are described in the project's QA/QC plan.

2.9 Asbestiform Fibers

2.9.1 Sampling Locations and Schedule

Asbestiform samples will also be collected at three of the sites where total suspended particulate samples are collected. These are the northeast, Blackberry Lane, northwest, and southeast sites. Details regarding sampling and analytical procedures and quality control for asbestiform sampling were submitted to WDNR on May 30, 1991. An overview of sampling procedures is presented below.

Samples will be collected one day a month at each site for each month during the period May through September for a total of 15 samples per year. One sampling event will be coordinated with a blasting day at the mine or during another significant material handling procedure. Monitoring during blasting will be conducted only once if no asbestiform fibers are detected. The remaining samples will be collected according to the commonly employed national sampling schedule.

Each monitoring event will be conducted over an eight-hour duration coincident with the normal daily operating schedule of the mine. Two samples will be collected at each site, one at a low flow rate and the other at a high flow rate. Two flow rates will be used in order to prevent voiding a sampling event due to overloaded or underloaded samples.

Monitoring shall begin when the mining phase (ore removal) begins and shall be repeated annually. If monitoring during the first three years of active mining does not detect asbestiform fibers from the mining operations, monitoring will be discontinued.

2.9.2 Sampling Equipment

In the sampling process, air is drawn through a filter at a known rate by a flow-controlled pump. The sampling components are described below.

2.9.2.1 Filter Media and Cassettes

Commercially available filters comprised of the filter media and cassettes will be used for sample collection. The cassette shall be loaded with a 25 mm diameter mixed cellulose ester filter of pore size 0.81 μm . The filter shall be backed with a 5.0 mm pore size MCE filter followed by a cellulose support pad. The support pad is provided so that distortion of the filter caused by differential pressure across it does not occur during sampling. The cassettes shall be purchased with the required filters in position. The cassettes will be sealed by the manufacturer or prevent air leakage.

The movement of air through the filter may cause a significant buildup of static charge on the cassettes. The static charge, in turn, is likely to affect the distribution of fibers on the filter and may cause fibers to collect on the cassette walls rather than on the filter. To guard against static buildup, a metal cowl or electrically-conductive cassette shall be used in conjunction with the sampling train.

2.9.2.2 Sampling Pump

The sampling pump shall be capable of achieving flow rates of two to 12 liters per minute (lpm) and of pumping over an eight-hour duration. Flexible tubing shall be used to connect the filter cassette to the sampling pump. The sampling pump shall provide a non-fluctuating air-flow through the filter, and shall maintain the initial flow rate to within ± 10 percent throughout the sampling period. A critical orifice will be used to meet this requirement. Because slight changes in size and shape of the orifice (due to wear or accumulation of particles) will change the orifice characteristics, orifices shall be inspected during each sampling event.

2.9.2.3 Rotameter

A high-quality rotameter with arbitrary unit graduations shall be used to monitor the sample flow rate through the sampling apparatus. The flow measuring device shall be inserted downstream of the filter and the pump assembly. The rotameter shall be accurate to ± 5 percent of the expected sampling flow rate. The rotameter shall be calibrated before and after each sampling event against a NBS traceable primary flow standard with an accuracy of ± 1 percent.

2.9.3 Sampling Procedures

2.9.3.1 Air Volume

The sampling rate and period of sampling shall be selected to yield as high a sampled volume as possible. Two samples will be collected over an eight-hour period. One

sample rate will be at three to four lpm and the other at six to eight lpm in order to collect an optimum volume of air per unit area of filter. This will minimize the potential that filters will have to be rejected for analysis due to overloading or unloading.

2.9.3.2 Sampling Operation

Before air samples are collected, unused filters shall be analyzed to determine the mean background asbestos structure count for the analytical procedure. Air samples shall be collected using the cassettes described above. Each cassette assembly will be visually checked for leaks both before and after each sampling event.

Sampling shall be conducted with the cassette open-face. During sampling, the filter cassette shall be supported on a stand so that it is isolated from the vibrations of the pump. The cassette shall be held facing vertically downward at a height of approximately 2.1 meters above ground level and connected to the pump with a flexible tube. It may be sufficient to collect samples with a standard cassette configuration. If conditions dictate the need for additional protection, however, an extension cowl may be affixed to the front of the cassette.

The sampling pumps will be calibrated with a loaded cassette in line. A rotameter which has been calibrated against a primary standard will be inserted downstream of the filter and the pump assembly. Once the sampling equipment is in place, and has been calibrated, the sampling site location, start time, filter number, pump number and other pertinent information will be recorded. The pump will be started and the flow rate recorded. Flow will be verified after 15 to 30 minutes of sampling. The critical orifice should maintain the set flow rate. The rate will be verified at least every two hours. If at any time the measurement indicates that the flow rate has decreased by more than 30 percent, the sampling will be terminated. The mean value of these flow rate measurements will be used to calculate the total air volume sampled.

At the end of each sampling event, the final flow rate and the stop time will be recorded. A cap will be placed over the open end of the cassette, and the cassette will be packed in a clean plastic bag for return to the laboratory. Field blank filters will also be included in the shipment to the laboratory and will be processed through the remaining analytical procedures along with the samples.

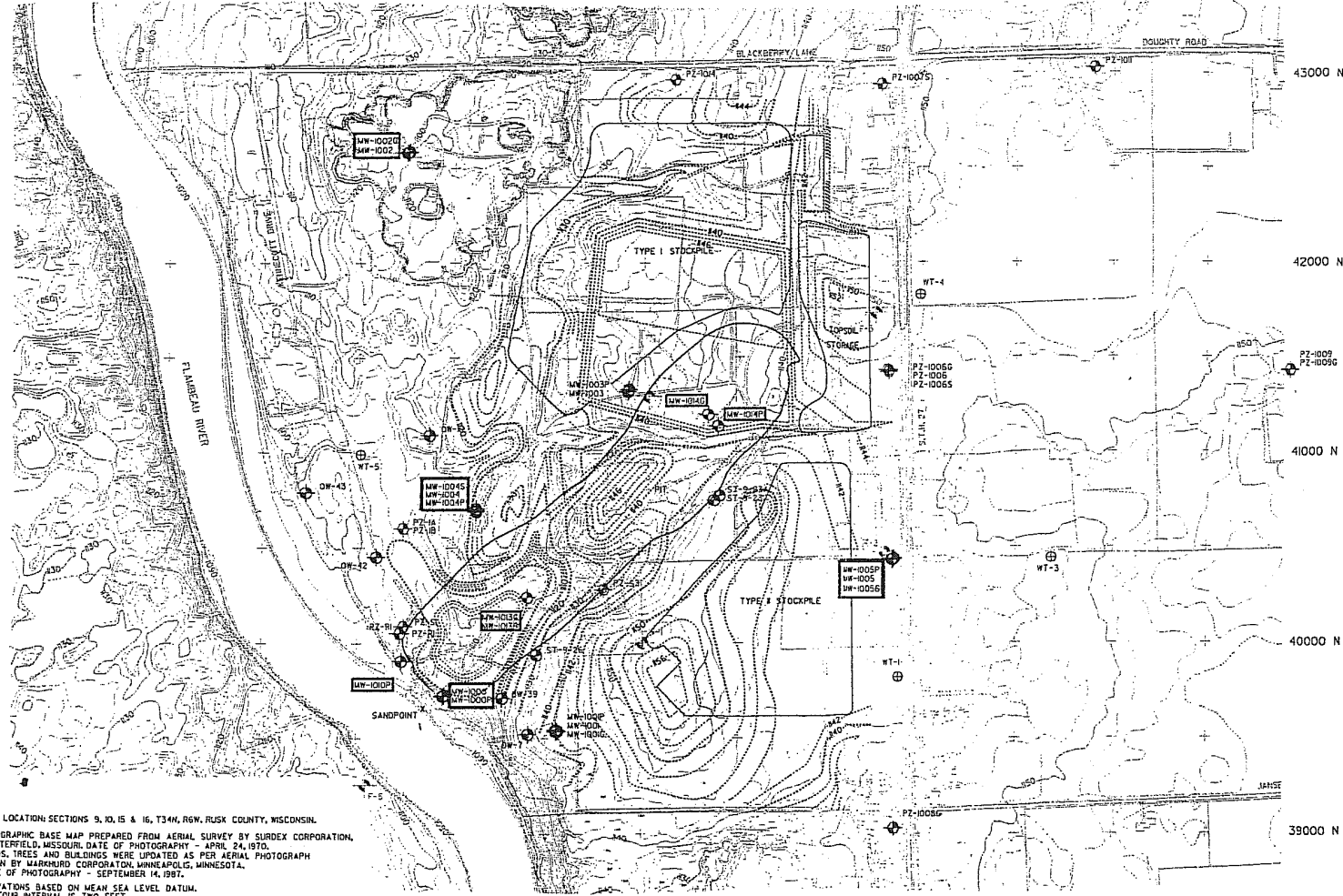
2.10 Type II Stockpile Leachate

Leachate from the Type II stockpile will be monitored on a quarterly basis during operation. Parameters to be measured will include pH (field), conductivity (field), TDS, dissolved iron, dissolved copper, dissolved manganese, sulfate, total alkalinity, and total hardness.

A representative sample of leachate will be collected at the leachate collection manhole. Samples will be withdrawn with a dedicated PVC bailer. Metal sample aliquots will be filtered in the field through a 0.2 micron membrane prior to preservation. Conductance and pH readings will be performed at the sampling point. Observations of color, odor, and turbidity will be noted. The sampling point has been located such that a representative leachate sample will be obtained prior to mixing with other sources of water.

Preservatives, sample volume requirements, holding times, and detection limits for this program will be the same as those identified in the project's QA/QC plan for collection lysimeter sampling.

37000 E 38000 E 39000 E 40000 E 41000 E 42000 E 43000 E



NOTES:

- SITE LOCATION: SECTIONS 9, 10, 15 & 16, T34N, R6W, RUSK COUNTY, WISCONSIN.
- TOPOGRAPHIC BASE MAP PREPARED FROM AERIAL SURVEY BY SURDEX CORPORATION, CHESTERFIELD, MISSOURI. DATE OF PHOTOGRAPHY - APRIL 24, 1970. ROADS, TREES AND BUILDINGS WERE UPDATED AS PER AERIAL PHOTOGRAPH TAKEN BY HARRNORD CORPORATION, WINNEAPOLIS, MINNESOTA. DATE OF PHOTOGRAPHY - SEPTEMBER 14, 1987.
- ELEVATIONS BASED ON MEAN SEA LEVEL DATUM. CONTOUR INTERVAL IS TWO FEET.
- HORIZONTAL DATUM BASED ON PROJECT SITE GRID SYSTEM. SITE GRID COORDINATES CORRELATION TO STATE PLANE COORDINATES DERIVED AS FOLLOWS:

SITE GRID COORDINATES	STATE PLANE COORDINATES
CONTROL MONUMENT F-1	
48888 N ±	587,357,8887 N
48888 E ±	1,712,516,1229 E

THE ANGULAR ROTATION FROM STATE PLANE BEARINGS TO SITE GRID BEARINGS IS 359°19'23" RIGHT WITH CONTROL POINT F-1 AS THE BASE POINT.
- SEE FIGURE NO. 2-1 FOR THE LOCATION OF WETLAND STAFF GAUGE WT-2 AND FOR SURFACE WATER MONITORING LOCATIONS.

LEGEND

- EXISTING CONTOUR
- EXISTING PAVED ROADWAY
- EXISTING TRAIL/GRAVEL SURFACE
- TREES AND/OR BRUSH
- FENCE
- CONTROL MONUMENT
- MW-10001 MONITORING WELL
- PZ-R3 PIEZOMETER
- MW-10001 WELL ON THE WATER QUALITY MONITORING PROGRAM
- WT-5 WETLAND STAFF GAUGE



40 YEAR LONG TERM CARE AND MAINTENANCE PLAN		
	TIMES PER YEAR	DURATION
1. INSPECTIONS INSPECT RECLAIMED SITE FOR ERODING VEGETATION GROWTH, SOIL EROSION AND MONITORING DEVICE INTEGRITY	PHASE I PHASE II SPRING & FALL LATE SUMMER	4 YEARS 36 YEARS
2. MAINTENANCE A. LANDFORM B. VEGETATION C. MONITORING DEVICE	AS NEEDED AS NEEDED AS NEEDED	40 YEARS 40 YEARS 40 YEARS
3. GROUNDWATER MONITORING A. OUTSIDE BACKFILLED PIT WELL NESTS - 101501, 101502, 101503 WELL - 101504	QUARTERLY ¹ ANNUALLY ²	40 YEARS
B. INSIDE BACKFILLED PIT WELL NESTS - 10151014	QUARTERLY ¹ ANNUALLY ²	SEE FOOTNOTE 3
4. WATER LEVELS PHASE I PHASE II	QUARTERLY ⁴ QUARTERLY ⁵	UNTIL WATER LEVELS STABILIZE REMAINDER OF PERIOD
A. SEDIMENTS, MACROINVERTE- BRATED & FISH PHASE I PHASE II (GRAY FISH ONLY) PHASE III (FISH ONLY)	ANNUALLY ANNUALLY ONCE	2 YEARS UNTIL ISSUANCE OF NOTICE OF COMPLETION 30 YEAR CERTIFICATE OF COMPLETION IS ISSUED
D. WATER QUALITY	THREE IN TWO YEAR PERIOD	2 YEARS
C. WETLAND SURFACE FLOWS ⁷	SPRING, SUMMER & AUTUMN	UNTIL WATER LEVELS STABILIZE
5. VEGETATION & WILDLIFE HABITAT A. PERCENT COVER B. BIOMASS C. DIVERSITY D. SURVIVORSHIP OF ROOSTY PLANT STOCK E. WETLAND VEGETATION F. HABITAT EVALUATION	SEE FOOTNOTE 8 SEE FOOTNOTE 8 SEE FOOTNOTE 8 SEE FOOTNOTE 8 SEE FOOTNOTE 8 SEE FOOTNOTE 8	UNTIL ISSUANCE OF CERTIFICATE OF COMPLETION UNTIL ISSUANCE OF CERTIFICATE OF COMPLETION UNTIL ISSUANCE OF CERTIFICATE OF COMPLETION UNTIL ISSUANCE OF CERTIFICATE OF COMPLETION
6. TERRESTRIAL ECOLOGY PHASE I PHASE II	ANNUALLY (LATE SUMMER) EVERY FIVE YEARS	4 YEARS 35 YEARS
7. SURFACE SUBSIDENCE (SLOPE, TOPOG. MAP)		0, 3, 7, 10, 20, 40TH YEAR AFTER RECLAMATION

¹ PARAMETERS: SPECIFIC CONDUCTANCE (FIELD, PH (FIELD AND LAB)), TOTAL DISSOLVED SOLIDS, TOTAL ALKALINITY, TOTAL HARDNESS, IRON, MANGANESE, COPPER, SULFATE.
² PARAMETERS: ARSENIC, BARIUM, CADMIUM, TOTAL CHROMIUM, LEAD, MERCURY, SELENIUM, SILVER, ZINC (LATE QUARTERLY ROUND).
³ MINIMUM OF EIGHT ROUNDS FROM EACH WELL (SEE REPORT).
⁴ LOCATIONS: SEE FIGURE 2-1. INCLUDES WELL NESTS 1013 & 1014.
⁵ LOCATIONS: WELLS FOR WHICH WATER QUALITY SAMPLING IS PERFORMED.
⁶ SEE SECTION 2.4 OF REPORT FOR SAMPLING LOCATIONS AND ANALYTICAL PARAMETERS.
⁷ MONITORING TO BE CONDUCTED ONLY IF WATER LEVEL MEASUREMENTS DURING THE CONSTRUCTION AND OPERATION MONITORING PROGRAM INDICATE A SIGNIFICANT DRAINAGE EFFECT ON A MONITORED WETLAND WHICH IS ATTRIBUTABLE TO THE PROJECT.
⁸ AT DISCRETION OF APPLICANT TO DEMONSTRATE THAT MINIMUM STANDARDS HAVE BEEN MET BEFORE ISSUANCE OF NOTICE OF COMPLETION OF RECLAMATION BY THE APPLICANT AND ISSUANCE OF CERTIFICATE OF COMPLETION OF RECLAMATION BY WMD. SEE SECTION 3.15 OF REPORT FOR MINIMUM STANDARDS AND MONITORING PROCEDURES.
⁹ AERIAL AND COLOR COMPARED PHOTOGRAPHY.

REV.	DATE	DESCRIPTION
34		

FOTH & VAN DYKE
 GEOLOGICAL & ENVIRONMENTAL MANAGEMENT DIVISION
 GREEN BAY, WISCONSIN

FLAMBEAU PROJECT
 LADYSMITH, WISCONSIN

KENNECOTT
 MINERALS
 COMPANY

55 MINERAL SQUARE
 SALT LAKE CITY, UTAH
 84142

FIGURE 3-1
 LONG TERM CARE
 AND MAINTENANCE PLAN

SCALE SEE BAR SCALE

3.0 LONG-TERM CARE AND MAINTENANCE PHASE

Long-term care for the site will commence at the completion of site closure. This will be the point in time when final site grading and initial site revegetation, as defined in the site reclamation plan, have been completed.

The following discussion addresses specific long-term care and maintenance requirements as per NR 132.08, NR 182.09, NR 182.16, and NR 182.19. These requirements relate to the procedures to be used, the estimated costs and financial responsibility for the 40-year long-term care period.

3.1 Procedures

Long-term care and maintenance for the project relates to inspections of the site; maintenance of landforms, vegetation and monitoring devices; and monitoring groundwater, surface water, vegetation, terrestrial ecology, and surface subsidence. Each of these topics is discussed in the succeeding paragraphs. Sampling and analytical procedures to be used during the long-term care and maintenance period for groundwater and surface water monitoring will be the same as described in Section 2.0.

3.1.1 Inspections

Flambeau will inspect the reclaimed site semi-annually for the first four years during the long-term care and maintenance period, and once per year thereafter. The semi-annual inspections will occur in the spring and fall. The annual inspection will occur in the late summer. The inspections will be performed by a person qualified to evaluate conditions associated with erosion, vegetation growth, settling and monitoring device integrity.

3.1.2 Maintenance

Maintenance activities for purposes of this plan will consist of landform, vegetative and monitoring device maintenance.

3.1.2.1 Landform

The method of backfilling the pit and the nature of the backfilled material will result in only a slight amount of settling. In the eastern portion of the pit, a mounding will be provided to compensate for anticipated settling. It is calculated that an approximate six-foot mound will allow for the final grade over the pit to be near the original grade following settlement. In the west end of the pit, a few feet of settling will augment the formation of the proposed wetland located in that area. Current plans are to revegetate the open pit site and allow the land to settle to a final form. Erosion control will consist of regrading and revegetating eroded areas.

3.1.2.2 Vegetation

After reclamation has been certified as complete, additional revegetation of eroded areas will be completed on an as-needed basis. Revegetation techniques will be those specified in Section 5.11 of the December 1989 Mining Permit Application for revegetation of the site as a whole.

3.1.2.3 Monitoring Devices

Flambeau will immediately notify the WDNR if for any reason a groundwater monitoring well or device is destroyed or fails to function properly. Unless otherwise notified in writing by WDNR, Flambeau will restore or properly abandon and replace destroyed or failed monitoring devices within 60 days of the written notification referred to above.

3.1.3 Groundwater Monitoring

Groundwater monitoring will include water level measurements and water quality data collection in monitoring wells located both in the backfilled pit and outside the pit. In addition, water level measurements will be made in selected piezometers outside the pit.

3.1.3.1 Groundwater Quality Monitoring Outside the Backfilled Pit

Water quality monitoring and water level measurements outside the pit perimeter will include four well nests (MW-1000, MW-1002, MW-1004, and MW-1005) and monitoring well MW-1010P (Figure 3-1). Well nests MW-1000 and MW-1004 and well MW-1010P are included in the program since they are located downgradient of the backfilled pit. Well nest MW-1002 is included since it is downgradient of the Type I stockpile. Well nest MW-1005 is included as the upgradient well nest for background water quality data purposes.

Sampling will be performed quarterly (January, April, July, and October) during the long-term care and maintenance period. Analyses will be performed for the following parameters:

- Specific Conductance (Field)
- pH (Field and Lab)
- Total Dissolved Solids
- Total Alkalinity
- Total Hardness
- Iron
- Manganese
- Copper
- Sulfate

Once per year, during the June monitoring round, each of the above monitoring wells will also be monitored for the following metals:

- Arsenic
- Barium
- Cadmium
- Total Chromium
- Lead
- Mercury
- Selenium
- Silver
- Zinc

3.1.3.2 Groundwater Quality Monitoring Inside the Backfilled Pit

As shown on Figure 3-1, two monitoring well nests will be placed in the backfilled pit following the completion of reclamation construction activities. Each nest will consist of two wells. In each nest, the deeper

wells, MW-1013P and MW-1014P, will be bottomed in Type II waste rock material approximately 30 feet above the bottom of the backfilled pit. The shallower wells, MW-1013G and MW-1014G, will be bottomed in backfilled till and/or outwash on top of the backfilled saprolite layer. Monitoring wells MW-1013G and MW-1014G shall be constructed with screened intervals ten feet long and wells MW-1013P and MW-1014P shall have screened intervals 15 feet long. The specific planned well construction details for each of the four wells are shown on Figures 3-2 through 3-5.

After installation and upon the water level in the backfilled pit reaching each well, *in situ* permeability tests will be conducted and then monitoring of the wells for water quality will commence. Each well will be monitored quarterly (January, April, July, and October) for two years for the parameters listed below:

- Specific Conductance (Field)
- pH (Field and Lab)
- Total Dissolved Solids
- Total Alkalinity
- Total Hardness
- Iron
- Manganese
- Copper
- Sulfate

During each July sampling round, the following metals will be added to the parameter list:

- Arsenic
- Barium
- Cadmium
- Total Chromium
- Lead
- Mercury
- Selenium
- Silver
- Zinc

Water quality monitoring of the four wells will be conducted quarterly at all the wells until at least eight samples have been collected from each well. At that time, a reduction in monitoring frequency will be requested by Flambeau. Provided that the monitoring results confirm the predictive modelling of water

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: ---

Well No.: MW-1013G

Drilling Method: HSA

Date Installed: ---

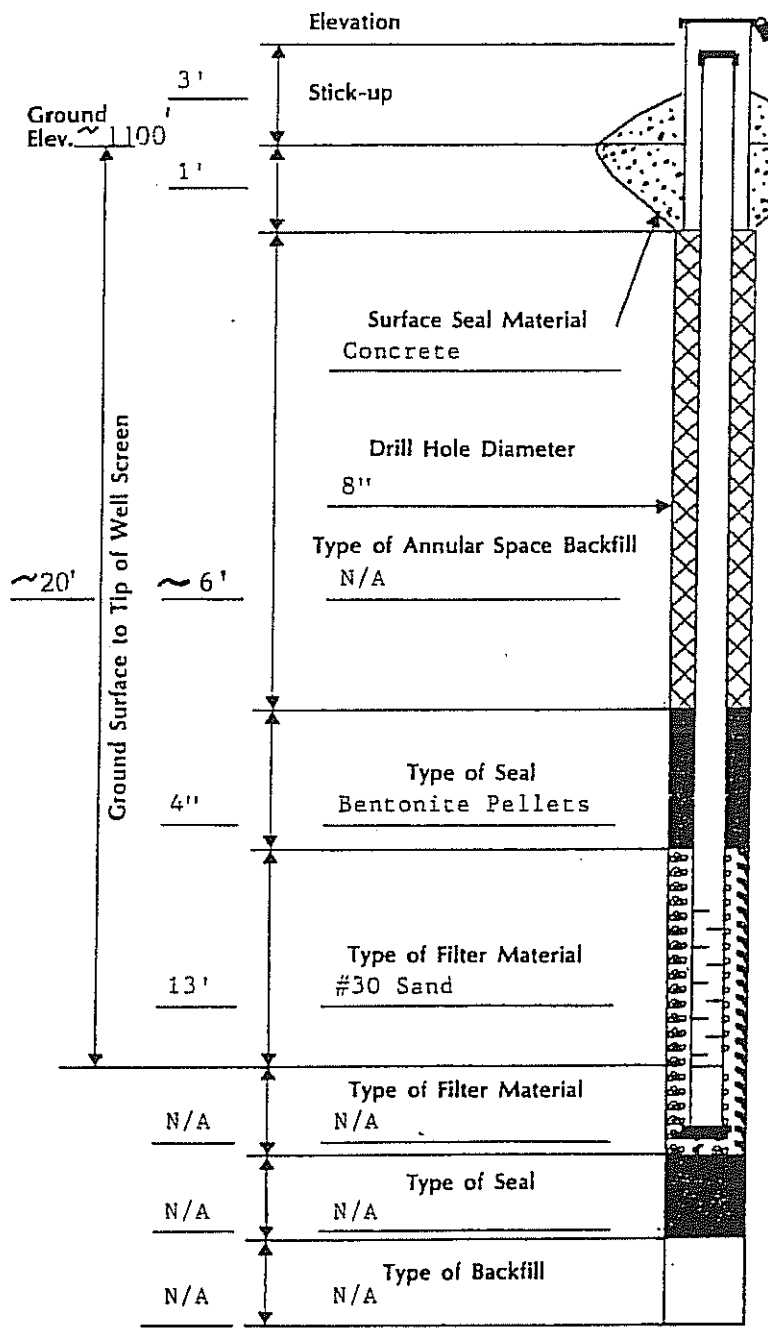
Coordinates: (See Figure 3-1)

Protector Pipe:

Size: 4"

Material: Steel

Lock No.: ---



Riser:
 Diameter: 2" I.D.
 Material: PVC
 Sch.: 80
 Type of Joints: Flush Threaded
 Stenciled?: No

Screen:
 Diameter: 2" I.D.
 Material: PVC
 Slot Size: 0.010"
 Length: 10'
Sump:
 Length: N/A
 Type of Cap: PVC

Centralizer: Used
 Not Used

Depth to Water From Top of Riser at Completion: (dry)

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GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION GREEN BAY, WISCONSIN		
NOTES	APPROVAL	DATE
	DESIGNED BY BNP	11-26-89
	DRAWN BY JRB	11-30-89
	CHECKED BY JWS	7-1-91
	APPROVED BY	
	CAD No.	SCALE NONE

KENNECOTT MINERALS COMPANY		
FLAMBEAU PROJECT		
LADYSMITH, WISCONSIN		
FIGURE 3-2		
PROPOSED WELL MW-1013G		
CONSTRUCTION DETAIL		
Job No	Dwg No	REV

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: _____

Well No.: MW-1013P

Drilling Method: Tricone & mud through soil backfill; air rotary
through backfilled waste rock

Date installed: _____

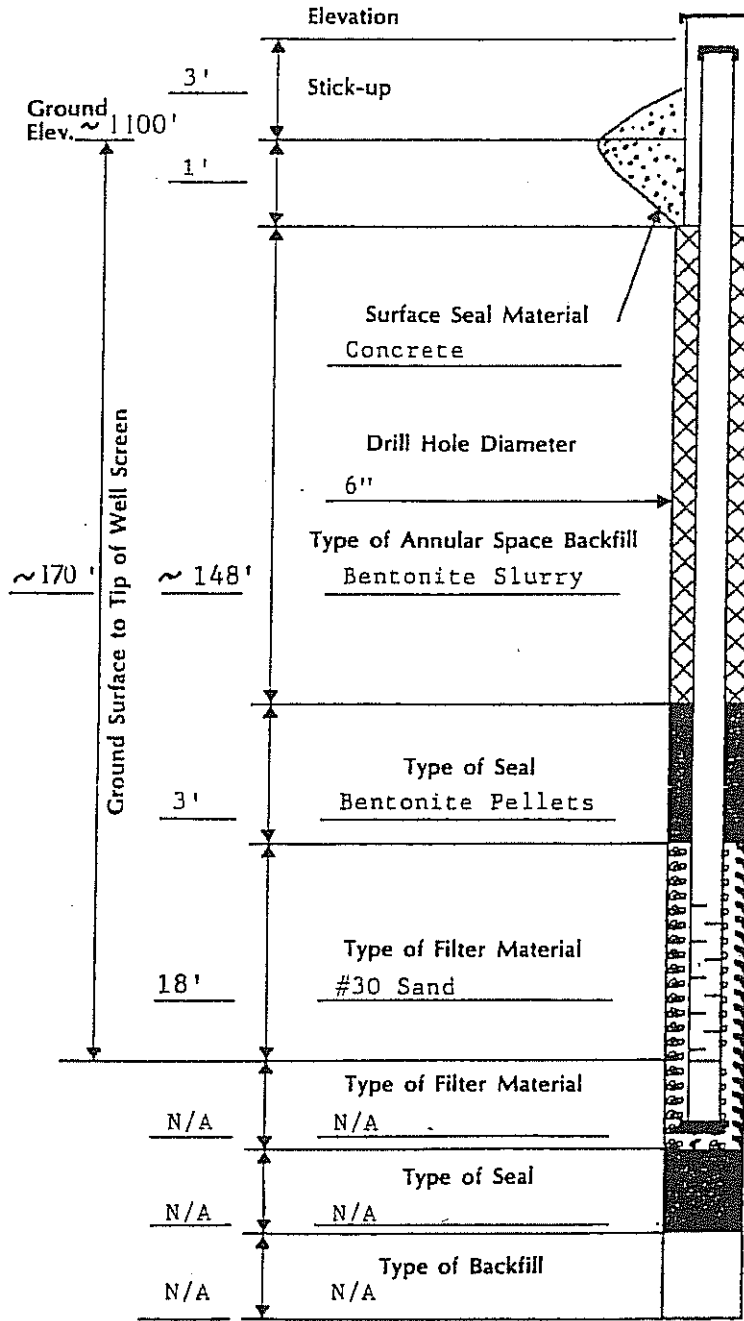
Coordinates: (See Figure No. 3-1) _____

Protector Pipe:

Size: 6"

Material: Steel

Lock No.: _____



Riser:

Diameter: 2" I.D.

Material: PVC

Sch.: 80

Type of Joints: Flush Threaded

Stenciled? ---

Screen:

Diameter: 2" I.D.

Material: PVC

Slot Size: 0.010"

Length: 15'

Sump: _____

Length: N/A

Type of Cap: PVC

Centralizer: Used
 Not Used

Depth to Water From Top of Riser at Completion: (Unknown)

FOTH & VAN DYKE		
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION GREEN BAY, WISCONSIN		
NOTES	APPROVAL	DATE
	DESIGNED BY BNP	11-26-89
	DRAWN BY JRB	11-30-89
	CHECKED BY JWS	7-1-91
	APPROVED BY _____	
	CAD No. _____	SCALE NONE

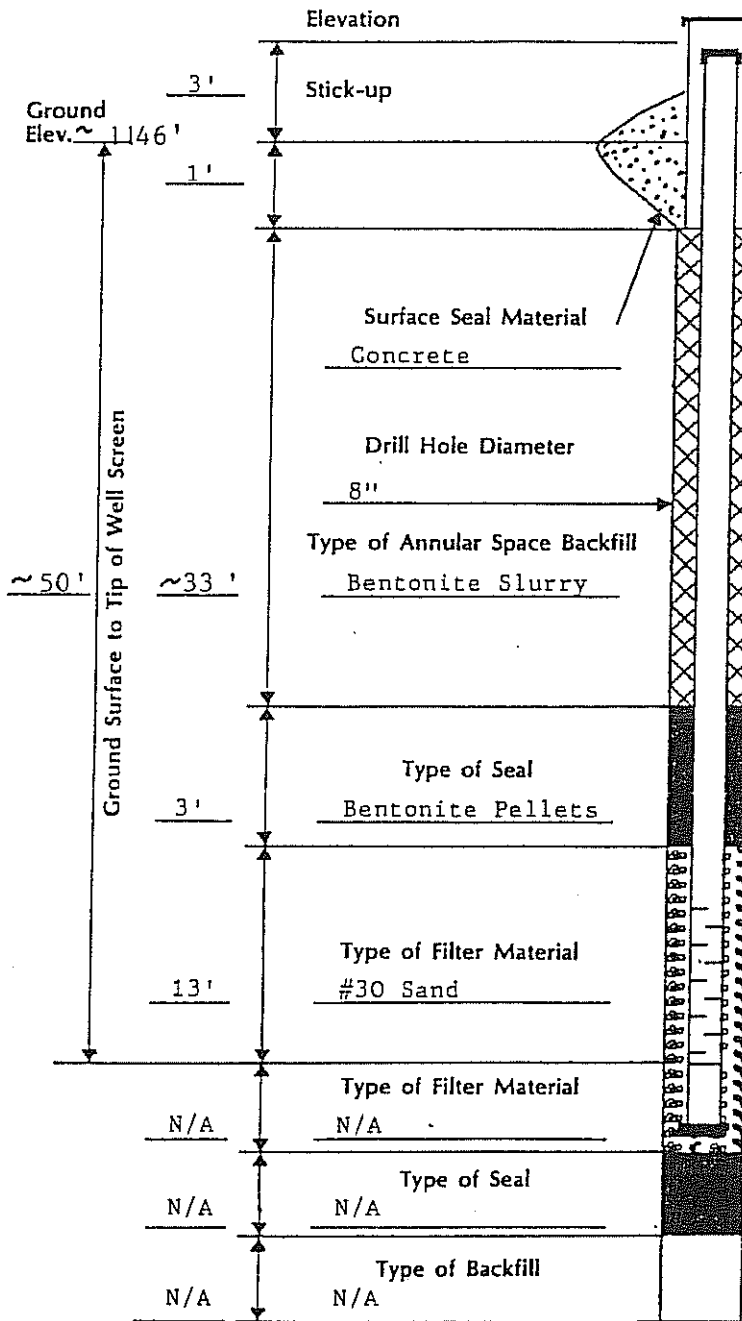
KENECOTT MINERALS COMPANY		
FLAMBEAU PROJECT		
LADYSMITH, WISCONSIN		
FIGURE 3-3		
PROPOSED WELL MW-1013P		
CONSTRUCTION DETAIL		
Job No	Dwg No	REV

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: _____ Well No.: MW-1014G
 Drilling Method: HSA Date Installed: _____

Coordinates: (See Figure No. 3-1) _____

Protector Pipe:
 Size: 4"
 Material: Steel
 Lock No.: _____



Riser:
 Diameter: 2" I.D.
 Material: PVC
 Sch.: 80
 Type of Joints: Flush Threaded
 Stenciled? No

Screen:
 Diameter: 2"
 Material: PVC
 Slot Size: 0.010"
 Length: 10'
Sump:
 Length: N/A
 Type of Cap: PVC

Centralizer: Used
 Not Used
 Depth to Water From Top (dry) of Riser at Completion: _____

FOTH & VAN DYKE GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION GREEN BAY, WISCONSIN		
NOTES	APPROVAL	DATE
	DESIGNED BY <u>BNP</u>	<u>11-26-89</u>
	DRAWN BY <u>JRB</u>	<u>11-30-89</u>
	CHECKED BY <u>JWS</u>	<u>7-1-91</u>
	APPROVED BY _____	
	CAD No. _____	SCALE <u>NONE</u>

KENNECOTT MINERALS COMPANY		
FLAMBEAU PROJECT		
LADYSMITH, WISCONSIN		
FIGURE 3-4		
PROPOSED WELL MW-1014G		
CONSTRUCTION DETAIL		
Job No _____	Dwg No _____	REV _____

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: _____

Well No.: MW-1014P

Drilling Method: Tricone and mud through soil backfill; air rotary
through backfilled waste rock

Date Installed: _____

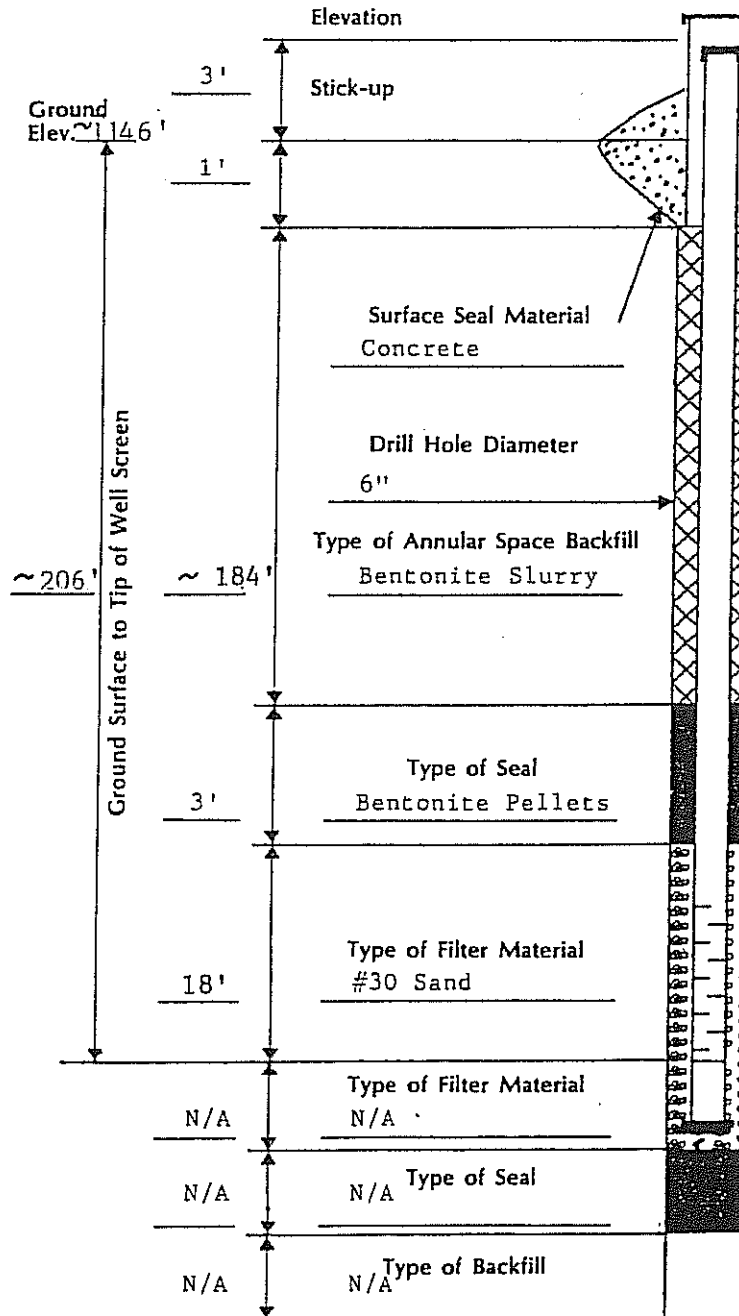
Coordinates: (See Figure No. 3-1)

Protector Pipe:

Size: 6"

Material: Steel

Lock No.: _____



Riser:

Diameter: 2" I.D.

Material: PVC

Sch.: 80

Type of Joints: Flushed Threaded

Stenciled? ---

Screen:

Diameter: 2" I.D.

Material: PVC

Slot Size: 0.010"

Length: .15'

Sump:

Length: N/A

Type of Cap: PVC

Centralizer: Used
 Not Used

Depth to Water From Top (Unknown)
 of Riser at Completion: _____

FOTH & VAN DYKE

GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
 GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY

FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

NOTES	APPROVAL	DATE
	DESIGNED BY BNP	11-26-89
	DRAWN BY JRB	11-30-89
	CHECKED BY JWS	7-1-91
	APPROVED BY _____	
	CAD No. _____	SCALE NONE

FIGURE 3-5 PROPOSED WELL MW-1014P CONSTRUCTION DETAIL		
Job No	Dwg No	REV

quality within the backfilled material and verify that no adverse impacts to water quality within the Flambeau River will occur, the WDNR has gone on record indicating it may approve such a request. The provisions of NR 140, Wis. Adm. Code, shall be used to determine statistically significant changes in the groundwater quality.

3.1.3.3 Water Level Measurements in Selected Wells

Quarterly water level measurements at wells MW-1013G, 1013P, 1014G, and 1014P, as well as all wells used for this purpose during construction and operations monitoring (Figure 2-1) shall be continued into the long-term care and maintenance period, until water levels are stabilized. Water levels shall be deemed as stable when no significant net annual changes occur in water levels over a two-year period. An acceptable range of annual fluctuations in groundwater levels shall be based on a statistical analysis of observed pre-mining annual fluctuation ranges of those wells with a pre-mining monitoring record which are to be included in the long-term monitoring program. To the extent technically feasible, the entire record of pre-mining water level measurements from the applicable wells shall be considered when determining the normal or acceptable annual fluctuation range.

The average annual range will be based on the combined average of the annual fluctuation ranges of all the wells presently on-site that are to be included in the long-term monitoring program, plus or minus one standard deviation. During the post-reclamation period as the water table recovers, the net annual fluctuation should be relatively large, showing an upward movement of the water table. As stability is approached, this net upward fluctuation will be reduced through time, eventually falling back into the average annual range that exists today. When the average annual fluctuation falls within this range for two consecutive years, the water table will then be deemed to have stabilized. At this point, water level measurements will only be taken at wells for which water quality sampling is performed.

3.1.4 Surface Water

The objective of the post-operational monitoring of surface waters is to confirm the findings of the monitoring during operations. In the unlikely event that operational monitoring results link increases in certain metals to the site, the proposed surface water monitoring program proposed in this section may need to be revised.

At the time at which the groundwater conditions in the reclaimed pit have rebounded so that there is a groundwater flow toward the Flambeau River, the groundwater data will be evaluated. If the conditions predicted by groundwater flow and water quality modelling are met, the post-operational surface water monitoring program will be deemed complete and no additional monitoring will be required.

Following is a discussion of the targeted long-term care and maintenance surface water monitoring program.

3.1.4.1 Sediments, Macroinvertebrates and Fish

After discharges from the wastewater treatment facilities have ceased, sediments, crayfish and fish will be collected once each year for two years at the same location shown on Figure 2-7.

During the third year after the cessation of wastewater discharges and for each year thereafter, until the notice of completion of reclamation is issued by Flambeau, crayfish will be sampled and analyzed according to methods discussed in Section 2.4.3. Fish will be sampled during the year that the certificate of completion is issued according to methods discussed in Section 2.4.2.

3.1.4.2 Water Quality

During the two years following the cessation of the wastewater discharge, three surface water samplings will be made at the locations shown on Figure 2-7. Two of these samplings will occur at the time of spring runoff during each of these years.

One additional sample will be taken during a stormwater runoff event so that the downstream sample taken in the Flambeau River includes runoff from the mine site. All surface water sampling will be terminated two years after the cessation of the wastewater discharge.

3.1.4.3 Wetland Surface Flows

If water level measurements collected during the construction and operation monitoring program indicate significant drawdown effects on a monitored wetland which is attributable to the project, then wetland surface flows will be monitored at that location during the long-term care and maintenance period three times per year (spring, summer, and autumn) until water levels in monitored groundwater monitoring wells stabilize. At this point in time, monitoring will cease.

3.1.5 Vegetation and Wildlife Habitat

Monitoring of vegetation will occur between the time planting has been completed and the certificate of completion of reclamation has been issued by the WDNR. The procedures to be followed during the vegetation and wildlife habitat monitoring program are described below. Monitoring will occur annually, beginning prior to submittal of the notice of completion of reclamation, and ending at certification of completion and consist of the following measurements.

3.1.5.1 Percent Cover

Acceptable cover will constitute no less than 70 percent cover averaged over the site at 90 percent statistical confidence during interim revegetation periods for purposes of site stabilization and for final reclamation at the notice of completion of reclamation and for certificate of completion. Cover will be determined as total cover as measured by the coverage of the canopy (vertical projection of plant parts) and will be recorded by species. Cover will be measured annually during any and all reclamation over the entire revegetated site at no less than 160 randomly-placed one-square-meter quadrats. The timing for measurement will approximate peak biomass during the period from mid-August to early September. These measurements

should correlate with the aerial color infrared photography. Sampling will be designed so as to accommodate different community types (i.e., along moisture gradients). The actual number of sample units per community type will be determined at the time of sampling based on mean/variance tests and may be fewer than 160 quadrats.

3.1.5.2 Biomass

Total above-ground herbaceous biomass will be determined once for the notice of completion and once at the certificate of completion as a relative measure of temporal productivity. Biomass will be harvested at no less than 25 randomly-placed quadrats of one square meter in size. The biomass at the certificate of completion should be no less than 80 percent of the biomass during the notice of completion at 90 percent statistical confidence. Burning of grassland will be planned so as not to interfere with biomass measurements.

3.1.5.3 Diversity

The frequency of occurrence by species will be reflective of its relative ratio in the seed mix or planting schedule. The similarity of the standing crop should be no less than 80 percent of the original mixture at 90 percent statistical confidence with a minimum of 15 planted species per community type.

3.1.5.4 Survivorship of Woody Plant Stock

A representative population sample of woody species will occur at the time of the notification of completion of reclamation and again at the time of the certificate of completion. No less than 80 percent of the initially planted species must survive in a similar proportion to the initial planting and show signs of vigor and health.

3.1.5.5 Wetland Vegetation

Vegetation measurements will consist of frequency of occurrence and density. The similarity of the standing crop will be no less than 80 percent of the initial planting at 90 percent statistical confidence with a minimum of 12 planted species.

3.1.5.6 Wildlife Habitat

Beginning two years after revegetation has commenced, and once a year for three years thereafter, a habitat evaluation (i.e., HEP analysis, U.S. Fish and Wildlife Services) will be conducted on the wetland and terrestrial areas that have been reclaimed.

3.1.6 Terrestrial Ecology

Aerial and color infrared photography will be completed in the late summer for four consecutive years following completion of closure and every five years thereafter throughout the long-term care and maintenance period to monitor the success of revegetation. The area to be surveyed will be the same as described in Section 2.5.

3.1.7 Surface Subsidence

Surface subsidence monitoring will consist of topographically mapping, following reclamation, the ground surface of the 32-acre pit area by aerial photography. The initial survey will be performed during the fall or early spring immediately following the completion of reclamation activities in the area of the pit. Subsequent surveys will occur in the third, tenth, twentieth, and fortieth year after reclamation activities in the area of the pit are completed. Following the completion of each aerial survey, a topographic map of the 32-acre pit area will be produced. The map will have a two-foot contour interval. Each map that is produced will be submitted to the WDNR with the appropriate annual report of reclamation activities required under Condition 26(d) of Part 3 of the Mining Permit. A brief discussion will be included in the report addressing changes in the surface topography of the pit area that are noted as a result of aerial mapping work.

Frederick

4.0 REPORTING

Monitoring data and results will be submitted to the WDNR within 30 days after completion of the required analyses. The results of the wetland surface flow monitoring will be submitted quarterly with the water quality monitoring results. Meteorological data and average monthly pit inflow rates will be summarized annually and submitted with the project's annual report.

Air monitoring data will be submitted in accordance with guidelines provided by the Air Monitoring Section of the Bureau of Air Management. A hard-copy transmittal letter and summary of missing data will be included with each submission. The letter will contain an explanation relating to any missing data.

A summary of the year's monitoring activities and a discussion of any observed trends in the monitoring data will be included in the annual report required per Condition 8, Part 1 of the Mine Permit.

5.0 SPILLS OR RELEASES

Immediately following any unforeseen spill or release of gasoline, fuel oil, diesel fuel, or other organic compounds in the course of construction, operation or closure of the mine, Flambeau will inform the WDNR in accordance with the provisions of Sec. 144.76, Stats., and undertake monitoring of wells as the WDNR may require pursuant to the provisions of Sec. 144.768, Stats.

6.0 NOTIFICATION OF SAMPLING

A reasonable notice of sampling activities will be given to the WDNR prior to the scheduled activities such that the WDNR can make appropriate arrangements to monitor the sampling activities if they desire to do so.

7.0 MONITORING PLAN MODIFICATIONS

Flambeau recognizes that the Department may modify provisions of this Monitoring Plan if results of the monitoring indicate that a revised frequency or intensity is necessary or that a different, additional method of monitoring is appropriate.

Modifications to the Monitoring Plan shall be processed using the procedures specified in ss. NR 131.12(2) and (3)(a), Wis. Adm. Code.