

surrounding landscape that were disturbed by historic mining are in the process of being restored and enhanced. Ultimately the entire mine site and attached buffer lands of thousands of acres will become a wildlife preserve and an environmental studies field research station for the University of California.

The Stillwater Mine - located in southern Montana in the magnificent Beartooth Mountains on the northern edge of the Absaroka-Beartooth Wilderness, about 30 miles north of Yellowstone National Park, this platinum-palladium sulfide mine is an excellent example of environmentally responsible mining in an extremely beautiful and sensitive environment. Operating since 1987, the Stillwater Mine has maintained a clean environmental record. The only domestic source of these strategic minerals, the Stillwater operation includes an off-site smelter in Columbus, Montana with state-of-the-art pollution control equipment. This underground mine is recognized by regulators, environmental groups, and industry experts for its excellent concurrent reclamation activities, wildlife enhancement projects, community support programs, and responsive environmental management. In addition to its scenic attributes, the area around the mine is also recognized for its recreational opportunities - the mine is adjacent to the Stillwater River, a Montana Blue Ribbon Trout Fishery.

The Cannon Mine - located at the intersection of South Miller and Circle Streets, this gold mine was developed in 1985, one block south of the Wenatchee, Washington, city limits. This agricultural community of approximately 40,000, known as "the apple capital of the world", is about 150 miles east of Seattle. With residents, parks, churches, schools, hospitals, and an equestrian center as its neighbors, the Cannon Mine is a model of environmentally responsible mining in an established urban environment. The mine, which operated for nine years, is now in the final stages of reclamation, and nearly all traces of this once bustling underground mining and milling project are gone. All of the millsite buildings have been removed, the area regraded, and replanted; the mine portal has been plugged; and the tailings

management area has been reclaimed and planted with natural grasses. The local school district has converted the mine buildings into offices and an equipment maintenance facility. As quoted in a July 2, 1996 article entitled "A Promise Kept - Mine Tailings Cleaned Up" in the Wenatchee World, a local official states that the mine has done a good job living up to its promises - "The scale of the (reclamation) work is just amazing. It's been a good project."

The Flambeau Mine - Located in northern Wisconsin's Rusk County, partially within city limits of Ladysmith and immediately adjacent to the Flambeau River, this copper mine has complied with all applicable environmental regulations since opening in 1993. Stormwater runoff from sulfide waste material and the operating open pit, along with groundwater infiltration into the pit, are treated in a state-of-the-art water treatment facility that produces mine discharge water which has proven safe at 100 percent concentration (i.e., without dilution) for the most sensitive aquatic life, and meets state drinking water safety standards. Examinations of fish, crayfish, macro-invertebrates, and dragonfly; sediment sampling; and habitat characterization both above and below the mine discharge point prove the mine water has not adversely affected river life. Upon completion of mining in 1997, the open pit will be backfilled and the site will be recontoured and revegetated to pre-mining conditions. City officials credit the mine with creating an economic miracle for the local community of 4,000 people. Tax revenue from the mine has stimulated an economic development boom in Rusk County where the unemployment rate has fallen from 15.3% just prior to the mine opening to 4.0% in October 1996. The Flambeau Mine is one of Rusk County's top tourist attractions, with over 30,000 people per year visiting the mine's information center.

Southwestern Wisconsin Historic Lead-Zinc District - At least a dozen historic (i.e., closed) mines in the lead-zinc district southwestern Wisconsin and adjacent parts of Iowa and Illinois meet the arbitrary operating and closure criteria in the proposed legislation. As shown in Table 2,

mining in this district began as early as 1825, long before the enactment of federal and Wisconsin environmental laws and regulations. Mining in the district continued into the twentieth century, with the last zinc mine closing in the late 1970s. Most of the mines in southwestern Wisconsin were abandoned without formal reclamation; many were simply plowed under and today remain as nearly indiscernible features in the rolling farmlands characteristic of this part of Wisconsin. Although a few isolated and localized water quality problems are known at several mines in the district, there are literally hundreds of historic mines that do not create surface water or groundwater pollution problems. The ore bodies in this district contain abundant acid-generating iron sulfide minerals (pyrite and marcasite). However, ARD is not a problem in this district due to the high acid neutralization capacity of the carbonate host rocks. A number of communities in the area including Platteville and Dodgeville, Wisconsin; Dubuque, Iowa; and Galena, Illinois and are built on top of and adjacent to these historic mines.

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### **ACKNOWLEDGEMENTS**

The authors wish to gratefully acknowledge the extraordinary help and cooperation of their mining industry colleagues who graciously provided information, suggestions, and site tours during the course of collecting the information presented in this survey. The survey could not have been performed and this paper could not have been written without their assistance.

**Table 1**  
**Industry and Regulatory Agency Contacts Made During the Survey**

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Amax Gold Inc. - Corporate	Cyprus Amax Minerals Company
Amax Gold Inc. - Fort Knox Mine	Cyprus Climax Metals Company - Corporate
Amax Gold Inc. - Sleeper Mine	Cyprus Climax Metals Company Climax Mine
Amax Gold Inc. - Wind Mtn. Mine	CR Kendall
Arizona Department of Environmental Quality	Cyprus Climax Metals Company - Henderson Mine
ASARCO - Corporate	Cyprus Climax Metals Company - Henderson Mill
ASARCO - Exploration	Echo Bay Mines - Corporate
ASARCO - Mission Unit	Echo Bay Mines - Kettle River JV
ASARCO - Globeville Unit	Echo Bay Mines - McCoy/Cove Mine
Atlas Corporation	Echo Bay Mines - Round Mtn. Mine
Barrick Gold Corp.	Echo Bay Mines - Sunnyside Mine
Barrick - Goldstrike Mine	Ellis Environmental Engineering
Battle Mountain Gold Co. - Corporate	EnviroNet Inc.
Battle Mountain Gold Co. - Crown Jewel Project	Environmental Support Services
Battle Mountain Gold Co. - San Luis Mine	ESCO Associates, Inc.
Behre Dolbear & Co., Inc.	FMC Gold - Beartrack Mine
BHP Copper	Geochimica, Inc.
BHP - Corporate	Golder Associates Inc.
British Columbia Ministry of Energy, Mines and Petroleum	Greenwald & Associates
British Columbia Ministry of Environment, Lands, and Parks	Homestake Mining Company - Corporate
Brohm - Gilt Edge Mine	Homestake Mining Company - Homestake Mine
Brown and Associates	Homestake Mining Company - McLaughlin Mine
California Regional Water Quality Control Board	Hydrologic Laboratories, Inc.
Canyon Resources Corporation	Idaho Dept. of Health and Welfare
Chelan County Planning Dept.	Idaho Dept. Environmental Quality
Coeur d'Alene Mines Corp.	Independence Mining Company - Cresson Mine
Coeur - Rochester Mine	Independence Mining Company - Jerritt Canyon Mine
Colorado Mining Association	Inmet Mining - Samatofum Mine
Colorado Department of Public Health and Environment	Jefferson Group
Colorado Division of Minerals and Geology	Kennecott Corporation - Corporate
Consultants (3)	Kennecott Minerals Company
Crandon Mining Company	

**Table 1 (continued)**  
**Industry and Regulatory Agency Contacts Made During the Survey**

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Kennecott - Flambeau Mine	Stibnite Mine Inc.
Kennecott - Ridgeway Mine	Stillwater Mining Company
Kennecott Utah Copper	The Doe Run Company - Corporate
Kenneth R. Paulsen Consulting, Inc.	The Doe Run Company -
Kinross Gold USA, Inc. - Corporate	Viburnum Mine
Kinross Gold USA, Inc. -	Thompson Creek Mine
Exploration	USDA Forest Service
Kinross - Candelaria Mine	USDI Bureau of Land Management
Knight Piesold Inc.	U.S. EPA Region 10; Water
LSX, Inc.	Management Division
Matabi Mines Ltd.	U.S. Silica
Missouri Department of Environmental	University of Saskatchewan - Civil
Quality	Engineering Department
Montana Department of Environmental	Wharf Resources -
Protection, Reclamation Division	Golden Reward Mine
Montana Water Quality Bureau	Wharf Resources -
Nevada Division of Environmental	Wharf Mine
Protection	Wright Water Engineers, Inc.
Nevada Department of Minerals	ZCA Mining Division -
Nevada Mining Association	Balmat Operations
New Crest Resources, Inc.	
Noranda Mining & Exploration, Inc.	
Northwest Mining Association	
Pegasus Gold Corporation -	
Corporate	
Pegasus - Beal Mountain Mine	
Pegasus - Montana Tunnels Mine	
Pegasus - Zortman/Landusky Mine	
Placer Dome Canada -	
Equity Silver Mine	
Placer Dome U.S., Inc. -	
McDermitt Mine	
Placer Dome U.S., Inc. - Corporate	
Rio Algom Mining Corp. - Corporate	
Royal Gold, Inc.	
Royal Mountain King Mine	
RTR Resource Management, Inc.	
Selland Construction - Cannon Mine	
Sonora Mining Corp. -	
Jamestown Mine	

Table 2

**Comparative Dates of Historic Mining Activities in Selected U.S. Mining Districts  
and Enactment of State and Federal Environmental Laws and Regulations**

Date	Commencement of Mining Activities	Enactment of Environmental Laws or Regulations Affecting Mining
1825	Upper Mississippi Valley lead mining (Southwestern Wisconsin and adjacent Iowa and Illinois)	
1849	California - gold mining	
1858	Colorado - precious metals mining	
1859	Nevada - Comstock Lode silver and gold mining	
1862	Montana - gold mining	
1863	Utah - copper mining	
late 1860s	Upper Mississippi Valley zinc mining (Southwestern Wisconsin and adjacent Iowa and Illinois)	
1875	South Dakota - Black Hills gold mining	
1877	Colorado - base metal mining	
1877	Arizona - copper mining	
1882	Montana - copper mining	
1917	Colorado - molybdenum mining	
1965	Nevada - Carlin-type gold mining started	
1966		National Historic Preservation Act
1967		Air Quality Act
1969		National Environmental Policy Act (NEPA)
1970		Occupational Safety and Health Act (OSHA)
1970		Clean Air Act
1970		CA Environmental Quality Act (CEQA)
1971		MT Metal Mine Reclamation Act

**Table 2 (continued)**  
**Comparative Dates of Historic Mining Activities in Selected U.S. Mining Districts**  
**and Enactment of State and Federal Environmental Laws and Regulations**

Date	Commencement of Mining Activities	Enactment of Environmental Laws or Regulations Affecting Mining
1971		MT Environmental Protection Act (MEPA)
1972		Federal Water Pollution Control Act/Clean Water Act
1973		Endangered Species Act
1974		Safe Drinking Water Act (SDWA)
1974	Mining begins at Henderson Mine, CO	U.S. Forest Service Mining Regulations
1975		CA Surface Mined Land Reclamation Act (SMARA)
1976		Federal Land Policy and Management Act (FLPMA)
1976		Resource Conservation and Recovery Act (RCRA)
1976		Clean Water Act Amendments
1976		CO Mined Land Reclamation Act
1977		Mine Safety and Health Act (MSHA)
1977		Surface Mining Control and Reclamation Act (SMCRA)
1977		WI Metallic Mining Reclamation Act
1977		ID Surface Mining Act
1979		Archeological Resources Protection Act
1980	Mining begins at Jerritt Canyon, NV	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund
1981	Viburnum Mine No. 27 becomes drinking water source for Viburnum, MO	U.S. Bureau of Land Management Mining Regulations
1982		SD Mined Land Reclamation Act

**Table 2 (continued)**  
**Comparative Dates of Historic Mining Activities in Selected U.S. Mining Districts**  
**and Enactment of State and Federal Environmental Laws and Regulations**

Date	Commencement of Mining Activities	Enactment of Environmental Laws or Regulations Affecting Mining
1982		WI Metallic Mineral Mining (Ch. .NR 132) and Regulation of Metallic Mining Waste (Ch. NR 182)
1984		Hazardous and Solid Waste Amendments
1984		CA Chapter 15 Discharges of Waste to Land, Article 7, Mine Waste Management
1985	Mining begins at Cannon Mine, WA Mining begins at McLaughlin Mine, CA Mining begins at Sleeper Mine, NV	
1986	Mining begins at Goldstrike Mine, NV	Superfund Amendments and Reauthorization Act
1986	Mining begins at Montana Tunnels, MT	Emergency Planning and Community Right-to-Know Act
1987	Mining begins at Stillwater Mine, MT	UT Mined Land Reclamation Act (amended)
1988		ID Code §39-118A (statutory provision requiring permits for processing ore by cyanidation)
1989		NV Water Pollution Control Law
1989		NV Mined Land Reclamation Act
1990		MT Admin. R. §§26.4.160 to .168
1990		Clean Air Act Amendments
1993	Mining begins at Flambeau Mine, WI	CO Mined Land Reclamation Act Amendments

## *Mining Information Sheet*

Prepared by:  
Department of Natural Resources  
Box 7921, Madison, WI 53707  
Revised April 1997

# Protecting Groundwater at Mining Sites

## *Introduction*

Activities and processes occurring at mining sites have the potential to affect the quantity and quality of groundwater. Groundwater usually must be withdrawn to dewater surface or underground mines to allow mining to take place. This can affect groundwater levels, lake levels, and base flow in streams. Groundwater quality also can be affected by waste water discharge; the storage and handling of chemicals; reagents and fuels; and the handling, storage and disposal of mine wastes.

The policy of the state, as expressed in the mining laws and regulations, is to prevent degradation of natural groundwater quality through strict design and construction standards and to protect groundwater quantity through protection of groundwater and surface water. This mining information sheet summarizes the measures used to monitor and protect groundwater quality and quantity before mining begins, during site development and mining operations, and following site reclamation.

## *Overview of Groundwater Protection Requirements*

The environmental and permit review processes applicable to a potential mining site are comprehensive and may require four years or longer to complete. During the permit review process, a mining company must meet a number of requirements. Among these, it must prepare a detailed **mining plan**; a mine waste management feasibility report and plan of operation if it intends to permanently dispose of mine waste outside the mine; a proposed **monitoring plan** for affected resources; and a **site reclamation plan**. In each of these plans, the mining company or operator must design for groundwater protection. The Department of Natural Resources is responsible for approving these plans and verifying that groundwater resources would be adequately protected should the project be developed.

The **mining plan** requires a detailed explanation of the facility design and operating procedures for groundwater and surface water management. It must also provide evidence that the design is adequate to prevent adverse impacts to the groundwater resource. The portion of the **monitoring plan** addressing groundwater is designed to determine existing groundwater quality and characteristics immediately before mining. This information supplements baseline monitoring data collected during the permitting process. Groundwater quality and quantity would continue to be monitored by the company and Department. This monitoring would be



maintained throughout the mine's operation and reclamation to reveal any mining-induced impacts to groundwater. Early detection of ground-water impacts would allow intervention before environmental protection requirements would be violated. The **reclamation plan** must show that all waters from the mining site would be handled in a manner designed to prevent groundwater or surface water pollution.

Most mining projects would require disposal of waste rock and a large quantity of finely ground rock called tailings. Tailings, remaining after the desirable minerals have been separated from the host rock, generally have little or no value. These and all other mining wastes must be disposed in an environmentally safe manner. Before a mine operator can construct and operate a mine waste disposal facility, however, it must have an approved **feasibility report** and an **approved plan of operation**.

Both the feasibility report and plan of operation for a waste disposal facility must provide for groundwater protection. For example, in order for the Department to predict the potential environmental impacts from waste disposal, a detailed characterization of the wastes and an analysis of the waste's leaching potential must be completed by the company. Local ground-water quality and flow patterns must be described. Detailed groundwater monitoring must be conducted and provisions for long-term care must be developed.

Information from the waste characterization, facility design, and baseline groundwater conditions are used to predict the impacts to the ground-water quality. If the impacts are found to exceed the standards prescribed in state mining rules, the proposed site would be found unfeasible for waste site development. Such studies would be conducted by technical consultants and would be verified and reviewed by the Department.

Any waste disposal facility at a mining site must be carefully designed and engineered to protect the local groundwater during operation and for long after mining ends. The landowner of a mining waste disposal facility is responsible for the long-term care of the site and local environment **in perpetuity**. **The owner's long-term care responsibility never ends**, except if another person acquires the rights of ownership and is issued a new operating license, at which time the long-term care responsibility is transferred to the new owner.

### ***Groundwater Withdrawal***

A potential mine in Wisconsin, whether an underground or open pit mine, most likely would encounter groundwater. In order to prevent a mine from flooding, groundwater would have to be continuously pumped from the mine. If the pumping rate were to exceed 100,000 gallons per day, a **ground-water withdrawal approval** would be required. The Department of Natural Resources must review and approve the plan for groundwater withdrawal before any groundwater pumping could begin. The plan could include measure to mitigate impacts to surface waters, if the withdrawal would impact the public rights in the surface waters. The Department may not issue a plan approval if it would result in "... the unreasonable detriment

of public or private water supplies or the unreasonable detriment of public rights in the waters of the state" (section 144.855(3), Wisconsin Statutes).

### ***Damage to Private Water Supplies***

Because mining activities have the potential to negatively affect groundwater, the legislature has established a process for individuals whose private water supply might be damaged by mining. Such a person may file a complaint with the Department, and, if an alternate source of water is needed, with the appropriate local municipality. The Department is required to investigate the problem, and, after a hearing, determine whether or not the mining activity caused the change in amount or quality of water. The local municipality would be responsible for providing an adequate water supply while the alleged damage is being investigated. If the mining activity is found responsible, the mining operator must provide an adequate supply of water and reimburse the municipality responsible for supplying water during the process. If the mining operator is found not to be responsible for the damage to the water supply, the person responsible for filing the complaint must pay for the provision of water. The local agreement process may also address the provision of water by further defining the applicant's responsibilities.

### ***Groundwater Modeling***

Numerical modeling of proposed mining sites has several important goals: 1) to develop a more complete understanding of the groundwater system, 2) to predict the changes to the groundwater system from mine pumping (drawdown), 3) to predict the amount of water that would need to be pumped to maintain proper working conditions (mine inflow) 4) to predict changes to surface waters in response to the drawdown, 5) to predict potential contaminant movement, and 6) to provide an additional tool for monitoring during site operation.

An applicant for a proposed mine must develop both a groundwater flow model and a solute transport model to provide the necessary prediction capabilities. These models would be developed in concert with the collection and interpretation of groundwater and surface water monitoring data and area geologic data. They are, in effect, a simplified representation of the groundwater and surface water system at the proposed site programmed into a computer.

The Department reviews the models in detail to ensure that they reasonably represent the natural system before using them to develop impact predictions.

### ***Monitoring Groundwater at Mining Sites***

Groundwater monitoring at mining sites has four primary purposes: 1) to identify baseline groundwater quality, water table levels and horizontal and vertical flow patterns in the vicinity before mining begins; 2) to determine whether any contaminants are leaching from waste rock,

tailings or other waste materials into the groundwater during and after mining; 3) to discover if spills or accidental discharges have contaminated groundwater; and 4) to detect changes in water table levels and flow patterns after the start of mine dewatering.

Groundwater must be monitored by the mining company for 12 consecutive months at a mine site prior to operation of a waste disposal facility. The characteristics of the proposed waste site, proposed site design and hydrologic setting would be used to determine the number and placement of groundwater monitoring wells. This monitoring is designed to produce adequate samples representative of the groundwater quality both up- and down-gradient from the proposed disposal site.

Monitoring of groundwater in the vicinity of a mine waste disposal site would continue throughout the site's operation and closure. Locations selected for monitoring would be situated around, directly beneath and within the waste site. After the start of waste disposal, groundwater monitoring would be used to determine whether waste products are leaching into the aquifer. Groundwater samples would be analyzed by both the mining company and Department to see if contaminants from the waste or materials stored on the site had reached the aquifer.

If analysis of groundwater collected after waste disposal started to show ground-water quality significantly different from the background water quality, the mine operator and Department would work to determine the cause of the difference. Possible causes might include a spill, a design failure or an improper operational procedure. The operator would have to evaluate the extent of any groundwater problem and implement the applicable portion of the contingency plan to respond to the problem and prevent further impacts.

### *Establishing Groundwater Standards for Mining Sites*

Under the current mining rules, at least six months before the start of the **master hearing** on a proposed mining site, the Department must propose a **compliance boundary** for the mining facilities. The compliance boundary is a line around a mining site or mining waste disposal facility at or beyond which the groundwater quality cannot exceed any of the groundwater standards. Compliance boundaries extend a maximum of 1,200 feet from mining facilities, but could be closer to the facility if required to protect public health, safety or welfare or if 1,200 feet would extend beyond the property boundary.

At the same time, the Department must propose the specific groundwater quality standards for each substance which could have an adverse impact on the groundwater quality. Numerical values for groundwater standards applied to mining facilities are the same as those imposed on other types of regulated facilities such as solid waste landfills and waste water treatment facilities.

In general, groundwater quality standards are set at the primary (public health) and secondary (public welfare) **maximum contaminant levels (MCLs)** developed by public health authorities for drinking water standards. These levels are the maximum concentrations of substances allowed in drinking water required to protect public health, safety and welfare. Examples of public health-related contaminants in groundwater include coliform bacteria, some heavy metals, cancer-causing substances and certain pesticides. Welfare-related contaminants include chloride, color and odor-causing substances, copper, iron, sulfate and dissolved solids. If necessary to protect public health, safety or welfare, the Department can propose groundwater quality standards which are more restrictive than the MCLs.

Under proposed changes to the mining rules, the **design management zone (DMZ)** for mines and mine waste sites are set to be 1200 feet from the limits of the mine or the waste site. The DMZ is analogous to the compliance boundary in that beyond the DMZ groundwater quality cannot exceed any of the groundwater standards. The DNR cannot extend beyond the property line of the applicant. During the master hearing, it can also be reduced if necessary to protect public health and the environment.

Under the proposed rules changes, the groundwater quality standards contained in the state's groundwater rules would apply to mine sites. These standards, which include **preventive action limits (PALs)** and **enforcement standards (ESs)** for each parameter, are the same numeric standards which apply at all other regulated facilities in the state. In general, the ES and MCL for most compounds are equal.

### *The Contingency Plan*

To prepare for the possible risk of groundwater contamination, a mining company must develop a **contingency plan** which specifies intervention steps and remedial actions that would be taken if an analysis of groundwater samples showed a developing problem. If a potential groundwater contamination problem is indicated or a problem becomes evident, the company and Department would determine the severity of the problem and the source of contamination. Additional monitoring wells could be placed down-gradient from a possible contaminant source to evaluate the horizontal and vertical extent of the contamination. Groundwater modeling of the aquifer might be employed to evaluate project impacts. Once the contamination source and extent are determined, the mining company would be required to implement remedial actions designed to abate and correct the problem.

### *Waste Disposal Fees and Groundwater Protection*

Generators of solid waste, including mining wastes, must pay on a per ton basis to dispose wastes in a licensed solid waste disposal facility. Two different fees, the **groundwater fee** and the **environmental repair fee**, have been established by the legislature. The groundwater fee of one cent per ton of mining waste is credited to the environmental fund, and is used for

groundwater management and protection throughout Wisconsin. The environmental repair fee, also one cent per ton, similarly is credited to the environmental fund. This money is used for investigations and remedial actions at any solid or hazardous waste site that causes or threatens to cause environmental contamination.

### **Exemptions**

The groundwater standards for a mine waste disposal facility are contained in section NR 182.075, Regulation of Metallic Mining Waste, Wisconsin Administrative Code. The code states that the groundwater quality standard shall be the maximum contaminant level unless an exemption is granted at the master hearing. However, in no case shall an exemption authorize concentrations in the groundwater which exceed the level required to protect public health, safety and welfare.

### **For More Information:**

Groundwater protection requirements associated with mining are spelled out in more detail in Wisconsin Administrative Code Chapter NR 132, Metallic Mineral Mining, and Chapter NR 182, Regulation of Metallic Mining Wastes. Groundwater protection provisions also have been established for mineral exploration (see Chapter NR 130, Metallic Mineral Exploration) and prospecting (see Chapter NR 131, Metallic Mineral Prospecting).

If you would like additional information or want to discuss any mining-related issue, please contact:

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Department of Natural Resources  
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*This mining information sheet is one in a series prepared by the Department of Natural Resources to explain how mining in Wisconsin is regulated and to explore other aspects of mining. Copies of the following mining information sheets are available from Department offices in Madison and Rhineland:*

- *Potential Mining Development in Northern Wisconsin*
- *Cumulative Impacts of Mining Development in Northern Wisconsin*
- *How a Mine is Permitted*
- *How the Department of Natural Resources Regulates Mining*
- *Local Decisions in Mining Projects*
- *Wisconsin's Net Proceeds Tax on Mining and Distribution of Funds to Municipalities*
- *Reclamation and Long-Term Care Requirements for Mine Sites in Wisconsin*
- *Protecting Groundwater at Mining Sites*
- *Responses to Public Concerns with Wisconsin's Laws Governing Mining*

# PROGRESS REPORT ON THE DEPARTMENT'S REVIEW OF THE MINE PROPOSED BY THE CRANDON MINING COMPANY

Department of Natural Resources  
Box 7921, Madison, WI 53707  
May 1997

**Introduction:** We begin this progress report with a focus on new items of interest and then provide more basic information relating to the proposed project and mining regulation for our new readers.

It has been a little over three years since the company filed its first documents and we started our regulatory review of their mining proposal. Since our previous status report last fall, the Department's staff and consultants have continued to review the Environmental Impact Report, permit applications, technical support documents, and other data provided by the Crandon Mining Company. We are also preparing our draft Environmental Impact Statement on the proposed mine. As expected, progress is slow in some areas. We want to be certain to completely evaluate the technical studies provided to us and consider all of the possible environmental impacts should the project be permitted and built. The final written decision on the mining permit will not be made for at least two years or longer, and will be based on the record developed during the final hearing process. (We intend to discuss the final hearing process in detail in a future report.)

## WHAT'S NEW?

**Public Meeting Schedule:** Recently, the Department released its schedule for holding a series of public meetings on the proposed Crandon Mine. Public meetings already have been held in New London (on the Wolf River) and the Town of Ainsworth in Langlade County (adjacent to the project site) in April. Additional meetings between Department staff and the public will be in the Crandon area on May 14 and in Wausau on May 28, in Tomahawk on June 18 and in Green Bay on June 19. We will hold a final meeting in Rhinelander, but it has not yet been scheduled. Contacts also have been made with tribal authorities to schedule a meeting with them.

The purpose of the public meetings is to discuss our progress and future schedule in reviewing the mining proposal, explain our regulatory authority over mining projects, and listen and respond to the concerns of the public and tribal members. The Department staff will tape the meetings and will write and distribute a meeting summary containing staff responses to public questions after each meeting.

**Wisconsin River BOD Modeling:** BOD stands for biochemical oxygen demand. This is a measure of the amount of oxygen needed in the biological processes to break down organic

matter or chemicals in water. The greater the degree of pollution by organic matter, the higher the BOD. As the amount of BOD in aquatic habitats increases, the availability of oxygen for aquatic life decreases. BOD may enter the river from non-point sources, such as agriculture or urban runoff, or from discharges into the river via permitted point sources such as industries and municipal wastewater treatment plants.

The Department regulates BOD in the river by limiting how much each industry or municipality can discharge to each segment of the river after establishing a ceiling on BOD discharges for each segment of the river. If too much organic material reaches the river, the dissolved oxygen in the river could fall below 5 parts per million. The Department's standard for dissolved oxygen in rivers is a minimum of 5 parts per million to support a balanced aquatic community of fish and aquatic life. Low levels of dissolved oxygen can cause problems for fish and aquatic life.

Segment A of the Wisconsin River, between Rhinelander and Grandmother Dam south of Tomahawk, is the discharge site preferred by the Crandon Mining Company. Several municipalities and industries discharge into this segment of the river. During summer months, however, occasionally the dissolved oxygen in the river falls below 5 parts per million. In other words, Segment A was "over-allocated" for BOD. The Department recently announced that it could not consider allowing a new source, such as the proposed Crandon discharge, if it would result in detectable amounts of BOD discharged into Segment A. Before a new source could be permitted, the BOD problem in the river would have to be remedied.

In order to reduce the amount of BOD that is discharged to Segment A of the Wisconsin River, the Department first will update its dissolved oxygen model for the segment. The model will help us to determine how much BOD reduction is needed to maintain the dissolved oxygen standard in the River. To reduce the amount of BOD that can be discharged from each industry and municipality, the Department will work with the public, current dischargers, and the Crandon Mining Company, if it chooses to participate, to develop a solution. Non-point sources of BOD will also be considered. Depending on the location and amount of their discharge, the amount of discharge permitted may be reduced for some dischargers. This discharge allocation process, including the dissolved oxygen modeling, could take several years to complete.

**Groundwater Modeling Update:** The Department, with the assistance of consultants, is continuing its review of the groundwater flow model submitted by the mining company in August 1996. A flow model is intended to help us to understand the direction and rate of groundwater movement and the interaction between groundwater and the surface waters in lakes, streams, wetlands and springs. We are carefully looking at the construction of the model, the model inputs, and the computation/numerical issues to make sure that the submitted model is an accurate representation of the natural system in the area of the mine. In January, we provided a comment letter to the mining company asking for additional information and clarification on many aspects of the flow model. We are evaluating the company's responses and anticipate providing another comment letter on similar issues in the near future. Once we are confident that we have an acceptable flow model, we will review the impact conclusions made by the mining company based on the flow modeling results.



The company submitted a revised solute (liquid contaminant) transport modeling report in November 1996. The transport model is designed to help us evaluate the impacts of potential contaminants that would leak from the waste disposal facility and the abandoned underground mine. Since the solute transport modeling is based on the flow model, we have not fully reviewed the transport model. Once we determine that we have an acceptable flow model, then we will begin our detailed review of the solute transport model.

**Crown Pillar Hydrology:** The crown pillar is the zone of bedrock at the top of the ore body, just beneath the glacial deposits, that would be left in place for stability and to prevent collapse of the adjacent underground workings. The mining company submitted a report dated May 1996 assessing how much water moves through tiny cracks in the crown pillar. Our mining engineering consultant recently completed his review of the report. He concluded that the assumptions used in the computer modeling of the rock stresses were questionable. Changes in rock stresses could change the amount of water moving through the crown pillar. In February, we forwarded those comments to the mining company with a letter requesting they revise the analysis using more reasonable assumptions and a different method of analysis. The company agreed to perform the analysis again based on our consultant's comments.

**Inter-basin Transfer of Water:** If the proposed surface water discharge to the Wisconsin River were approved, there would be an inter-basin transfer of water from the Great Lakes basin to the Mississippi River basin. State law concerning inter-basin transfers is contained in section 281.35 (144.026 old numbering system), Wisconsin Statutes. Chapter NR 142, (*Wisconsin Water Management and Conservation*, Wis. Admin. Code), addresses in further detail how the Department regulates withdrawals from waters of the State.

The State statutes identify three levels of water withdrawal and the approval process and information requirements necessary for each. If the withdrawal would average more than 100,000 gallons per day, an applicant must register the proposed withdrawal with the Department and report the rate and volume of withdrawal. For a withdrawal that would average greater than 2,000,000 gallons per day, an applicant must apply for a permit and provide additional information. The governors of the Great Lakes states and the premiers of the Canadian provinces bordering the Great Lakes must be consulted if the withdrawal would average more than 5,000,000 gallons per day.

Our preliminary calculation on the amount of water loss from the inter-basin transfer is less than the two million gallons per day threshold, thus the Crandon Mining Company needs only to register the withdrawal with the Department and report the volume and rate of withdrawal.

The 1986 Water Resources Development Act passed by the U.S. Congress refers to diversions of water from the Great Lakes or its tributaries, but does not include groundwater diversions or withdrawal. For this reason, our interpretation of the 1986 federal law is that it does not apply to the proposed mine.

**Proposed Mining Rule Revisions:** Proposed revisions to Chapter NR 132 (*Metallic Mineral Mining*, Wis. Admin. Code), would require a mining permit holder to establish an irrevocable trust fund to guarantee the availability of funds for necessary remedial actions. The proposed rule specifies appropriate uses of the fund and the mechanisms by which the fund is established, reviewed, and adjusted.

Proposed revisions to Chapter NR 182 (*Metallic Mining Wastes*, Wis. Admin. Code), would impose the groundwater quality provisions of Chapter NR 140 (*Groundwater Quality*, Wis. Admin. Code), to mining sites. Facilities on mining sites would be required to be designed and operated to achieve compliance with all the provisions specified in Chapter NR 140 (Wis. Admin. Code). Several key elements from the existing Chapter NR 182 (Wis. Admin. Code), which will supplement the provisions of Chapter NR 140 (Wis. Admin. Code), are proposed to be retained. These include provisions that require predictive modeling prior to project approval, preparation of a contingency plan on how to react to unforeseen impacts, and assessment of any statistically significant deviation from baseline groundwater quality detected during project monitoring.

The Natural Resources Board has authorized five public hearings on the proposed revisions to the mining rules. Hearings will be held in Eau Claire on May 19, Rhinelander on May 20, Shawano on May 21, Milwaukee on May 23, and in Madison on May 30.

## IMPORTANT PROJECT AND REGULATORY INFORMATION

**Description of the Proposed Mining Project:** The Crandon Mining Company has proposed construction of a large industrial facility to mine zinc, copper and lead, along with silver and gold, from a deep underground mine. In addition to the mine, there would be ore concentrating facilities, an above-ground waste (tailings) disposal facility, a water treatment plant, a buried pipeline to the Wisconsin River for discharging treated wastewater, and additional facilities. In total, the project would directly affect nearly 600 acres at the proposed project site, seven miles south of Crandon. There are no smelting or refining facilities in Wisconsin, thus the zinc, copper, and lead concentrates produced at the facility would be transported by rail to other states or countries for further processing.

The project proposal is to mine about 55 million tons of ore over approximately 28 years of operation. Construction would require about three years, and reclamation of the site would take an additional four years after mining ended.

During development of the underground passageways and ore removal, groundwater would seep into the mine and have to be pumped out. The continuous mine pumping would lower the groundwater levels around the mine and could affect the levels of local lakes and streams. The mining company, under the Department's review and approval, would be responsible for implementing a surface water mitigation plan for the project that would assure protection of the

public rights (e.g., boating, fishing, swimming, protection of aquatic and wildlife habitat) in those surface waters.

**Mining Waste Disposal:** Mining wastes include the finely ground tailings (the waste left after the valuable minerals are removed), waste rock, and water treatment plant solids, which are proposed for permanent disposal in the tailings management area. In total, nearly 24 million tons of waste would be placed in the facility and a nearly equal amount would be backfilled in the underground mine. The tailings management area would consist of four cells, each between 45-71 acres in size, and each with a multiple liner system on the bottom and sides to minimize leakage to the groundwater. A leachate (liquid) collection system on the bottom and the sides (just above the liner) also would help minimize liquid loss through the liner. The waste disposal cells would be filled and reclaimed sequentially as mining proceeded. The multiple liner system would incorporate compacted native soil, a manufactured bentonite clay layer and a flexible plastic membrane. A reclamation cap consisting of the same soil, bentonite and plastic membrane components, plus a drainage layer, would cover each cell after closure to minimize the amounts of water and oxygen reaching the wastes. The reclamation goal, through the use of the reclamation cap, is to limit over the long term the amount of water and oxygen reaching the wastes in order to reduce pollutants reaching the groundwater.

**Permits Needed:** The major State permits, approvals, and licenses required for the proposed mine are listed below:

- Mining Permit - includes the mining plan, environmental monitoring plan, the reclamation plan, risk assessment and contingency plan;
- Tailings Management Feasibility Determination, Plan of Operation Approval, and Solid Waste Operating License;
- Air Quality Permit;
- Surface Water Discharge (WPDES) Permit (proposed for Wisconsin River);
- High-capacity Well Plan Approval (for mine pumping);
- Wastewater Treatment Plant Plan Approval;
- Industrial Storm-water Runoff Permit (for construction);
- Chapter 30 (Navigable Waters) Permits - for stream crossings and discharge structures (if needed);
- Withdrawal of County Forest Land;
- Potable Water Supply Plan Approval;
- Additional permits and approvals may be required for the surface water mitigation plan, designed to maintain lake levels and stream flows that could be affected by the mine pumping. The plan has not been fully developed.
- Approval by the Public Service Commission for the electric transmission line and natural gas pipeline to serve the project.

The local units of government in the project area that have zoning and land use regulatory authority for the proposed mine must issue approvals before the Department could issue a mining

permit. Two local units of government, the Town of Nashville and Forest County, have signed local agreements implementing local approval.

The US Army Corps of Engineers is preparing a Federal Environmental Impact Statement on the proposal and has permitting authority for the proposed wetland dredging and filling. The Corps also has a responsibility to protect the resources on Native American lands. In addition, the Army Corps requires wetland mitigation to compensate for the wetlands that would be lost on the project site during development. To comply with that requirement, the Crandon Mining Company has proposed to re-establish wetlands on drained agricultural lands located on the Shawano and Oconto County border.

**Significant Environmental Concerns:** The following list includes the most significant environmental concerns associated with the proposed project that have been identified by the public. These issues, along with many more, will be fully evaluated in our Environmental Impact Statement:

- The potential for "acid rock" drainage from the mining wastes and mobilization of heavy metals in the acid leachate
- Groundwater contamination as the result of acid rock drainage from the mine or tailings disposal facility
- Destruction (during the life of the project) of nearly 600 acres of habitat plus additional acreage of secondary impacts
- Inter-basin transfer of water from the Great Lakes basin to the Mississippi basin
- Surface water impacts to the Wolf River and its tributaries, as well as to the Wisconsin River
- Groundwater drawdown due to mine pumping and resulting surface water and water well impacts
- Impacts to the adjacent Sokaogon Chippewa Reservation, including Rice Lake and its wild rice crop
- Impacts of mercury in groundwater and surface waters
- Social and economic changes to the project area
- Construction and tailings area fugitive dust
- Impacts of particulate deposition on soils, lakes, streams, and nearby residences
- Regional tourism impacts
- Noise impacts
- Potential chemical or concentrate spills

**Mining Information Sheets:** The Department's mining information sheets recently have been updated. These updated information sheets are available from Department offices in Rhinelander and Madison. These are prepared by the Department of Natural Resources to explain how mining in Wisconsin is regulated and to explore other aspects of metallic mining. Copies of the following nine mining information sheets are available:

- Potential Mining Development in Northern Wisconsin
- Cumulative Impacts of Mining Development in Northern Wisconsin
- How a Mine is Permitted
- Protecting Groundwater at Mining Sites
- Local Decisions in Mining Projects
- Wisconsin's Net Proceeds Tax on Mining and Distribution of Funds to Municipalities
- Reclamation and Long-Term Care Requirements for Mine Sites in Wisconsin
- Responses to Public Concerns with Wisconsin's Laws Governing Mining
- How the Department of Natural Resources Regulates Mining

We also have copies of "Public Concerns Regarding the Proposed Crandon Mine Discharge into the Wisconsin River." This is a compilation of citizen questions and Department responses from a May 1996 public meeting in Tomahawk.

The most comprehensive explanation of mining regulation is found in *An Overview of Metallic Mineral Regulation in Wisconsin* by Thomas Evans. It was published as Special Report 13 (revised in 1996) by the Wisconsin Geological & Natural History Survey, Madison, and can be ordered by calling (608) 263-7839.

**For More Information on the Department's Crandon Project Review Contact:**

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## **Mining Information Sheet**

Prepared by:  
Department of Natural Resources  
Box 7921, Madison, WI 53707  
Revised - April 1997

# **How the Department of Natural Resources Regulates Mining**

Wisconsin's mining statutes designate the Department of Natural Resources as the primary state agency responsible for regulating mining activities. Mining activities include exploration for minerals, prospecting (large quantity sampling for bench-scale and pilot plant scale tests), mining and reclamation. The majority of the Department's effort in mining involves reviewing mining permit applications, assuring that a proposed mine would comply with all environmental protection requirements, and, after a mine is approved, monitoring construction, mining and reclamation activities.

The statutes and administrative codes refer to mining metallic minerals such as iron, copper, zinc, lead, silver and gold. Sand and gravel mining or rock quarrying are not included under the metallic mineral mining laws. In recent years, there has been one operating metallic mineral mine in Wisconsin, the Flambeau Mine in Ladysmith. Permitted in January 1991, this small, open pit copper mine began ore production in early 1993 and is already ending production. Reclamation of the Flambeau site should be nearly completed during 1998.

The staff of the Department are guided and constrained by the mining statutes and applicable administrative codes and must apply the laws of the state in reviewing mining proposals and regulating mining. Other statutes and codes also apply to mining projects because they require other Department approvals, permits and licenses. In that sense, mines are similar to other industrial or municipal facilities with regulated discharges to the environment.

## **Regulating a Typical Mining Proposal**

A typical mine proposed in Wisconsin would be regulated under the mining law as well as the more general regulatory programs such as those for wastewater treatment and discharge, air pollution control, solid waste disposal and groundwater withdrawal (due to dewatering the mine). Most of these permits, approvals and licenses are not specific to mining projects. The Department reviews mining proposals using the same standards and criteria as municipal or industrial proposals except in the areas of groundwater quality and wetlands.

Under the administrative codes, the point of standards application for groundwater quality for a mining facility is further from the facility than for other regulated facilities in the state. In addition, groundwater protection requirements for mining sites are contained in a different administrative code than are the requirements for all other facilities, because the mining rules

were developed first. However, proposed groundwater rules now being considered would require that all facilities be regulated in the same manner.

For wetlands analysis, the codes provide very specific criteria on how wetlands are to be characterized and protected, **although the presence of wetlands at a potential mining site will not necessarily prevent development for mining.** The mining law mandates that impacts to wetlands must be minimized.

In addition to the above regulatory review, a proposed mine in Wisconsin requires a mining permit and approved plans for environmental monitoring, mining and reclamation. These approvals must be obtained prior to construction. The Department prepares an environmental impact statement on the mining proposal, in order to evaluate the environmental impacts, consider alternatives which could minimize negative impacts, and involve the public in reviewing the proposal.

The scope of the Department's review of mining projects is very broad, and the review process is comprehensive. Many consider Wisconsin's mining regulations to be among the toughest. However, there are several features of the laws which are apparently poorly understood by the general public. For example, if a proposed mine is found to meet all environmental protection standards, comply with all applicable laws, receive local zoning approval and minimize impacts to wetlands, **the Department must issue a mining permit.** The statutes do not allow the Department the option to deny a mining permit under such circumstances. Public acceptance of a proposed mine cannot be considered by the Department in reviewing a mining proposal. **There is no "popular vote" on the public acceptance of a proposed mine.** Similarly, the Department cannot choose the "no project" alternative as long as the proposal conforms with **all laws and standards.** Basically, the law says that mining is acceptable if the environment will be adequately protected during and after the project.

### ***Local Zoning Approval of Mining***

The mining statutes make it clear that a local municipality within which a mine site is located - whether a town, city, village, county or tribal government - has zoning approval authority over a proposed mine. Before a proposed mine can receive state authorization, the local municipality must have granted its approval under its zoning or land use ordinances. Local municipalities have other authorities related to mining as well, such as signing exploration and mining leases on public lands and withdrawing public lands for mining.

### ***The Department's "Position" on Mining***

Because the Department regulates mining in Wisconsin, it has no "position" on mining. Department staff are neither in favor of nor against mining, but are responsible for assuring compliance with the laws and codes to the best of their professional ability. The policy decision on the acceptability of mining already has been made by the state legislature: **Mining is an**

essential industrial activity which must be conducted in an environmentally acceptable manner.

Department staff must work closely with mining company officials and their consultants, not only to familiarize them with the mining regulations, standards, environmental and public review processes, but also to minimize potential environmental degradation from a proposed project. For mining projects, this process can last several years. Developing effective communications with company officials makes this process smoother and more effective. However, some observers of this process may conclude that the Department is primarily helping an applicant gain approval for its mining plan. In reality, a close working relationship with an applicant is necessary for the Department to be effective in shaping a project to avoid adverse impacts. The entire process is open to public scrutiny, and the Department welcomes public review of its regulatory activities.

### *Anticipated Future Mining Projects*

The Flambeau Mine at Ladysmith received the necessary permits and approvals in 1991 and began operation in 1993. The mine is already ending production and entering the reclamation phase. The Crandon Mining Company (an Exxon/Rio Algom partnership) applied for permits in 1995 to mine the Crandon deposit in Forest County. The Department is reviewing the Environmental Impact Report for this project, and is drafting an Environmental Impact Statement. The best current estimate is that the permitting process will extend into the middle of 1999 before a written decision is made.

In addition, two other mining companies have contacted the Department about mining ore bodies (areas of mineralization rich enough to justify mining) in northern Wisconsin. The orebodies are located in Oneida and Taylor Counties, and are Noranda's Lynne Project and the Jump River Joint Venture's (ASARCO Incorporated and Cyprus Gold Exploration Corporation) Bend Project, respectively. Noranda started the regulatory review process with the Department early in 1992, but has since withdrawn from the process. During the first portion of 1992 exploration drilling continued at the Bend project, but no further activity has occurred.

There are as many as 20, or perhaps more, areas of mineralization in northern Wisconsin, that have been discovered since the advent of modern mineral exploration techniques. These areas of mineralization lack enough valuable minerals per ton of ore, or are too small in overall tonnage, to be considered ore bodies. This makes them uneconomical to mine into the foreseeable future.

The data gathering, environmental analysis and regulatory review processes for a proposed mine in Wisconsin take a minimum of three to five years. Therefore, if the Oneida and Taylor County ore bodies are economical, feasible to mine and are permitted, and if the Crandon mine was permitted, there could be two or three operating mines in the state by the year 2005. No other ore bodies are known in northern Wisconsin, although mineral exploration by several companies continues in the region. In any case, it is unlikely that a large number of mines would be simultaneously operating in Northern Wisconsin at any time in the foreseeable future.



## Exemptions to the Mining Code

Administrative codes like the mining code, Chapter NR 132, allow applicants to make requests for exemptions in cases where it is impractical, unnecessary or excessive to follow the code. The Department reviews proposed exemptions to administrative codes and analyzes the potential impacts if the exemption were granted. In general, if a proposed exemption to a mining code would result in significant negative environmental impacts or violate any environmental laws or rules, the Department would recommend that the decision maker deny the exemption.

The burden of proof is on the company to show there would not be significant negative impacts if the exemption were granted. If the Department agrees with a proposed exemption, it means there would be no significant negative environmental impacts if the exemption were approved. Ultimately, the hearing examiner for the project would make the decision on whether or not to grant the exemption after receiving testimony on the issue at the master hearing. **Contrary to popular opinion, granting an exemption or variance for a mining proposal does not mean environmental protection has been compromised or the law weakened.**

### For More Information:

If you would like additional information or want to discuss any mining-related issue, please contact:

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This mining information sheet is one in a series prepared by the Department of Natural Resources to explain how mining in Wisconsin is regulated and to explore other aspects of mining. Copies of the following mining information sheets are available from Department offices in Madison and Rhineland:

- How the Department of Natural Resources Regulates Mining
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- Cumulative Impacts of Mining Development in Northern Wisconsin
- Responses to Public Concerns with Wisconsin's Laws Governing Mining

## ***Mining Information Sheet***

Prepared by:  
Department of Natural Resources  
Box 7921, Madison, WI 53707  
Revised April 1997

# **Reclamation and Long-Term Care Requirements for Mine Sites in Wisconsin**

## ***Introduction***

The Department of Natural Resources is the primary state agency authorized by the legislature to regulate metallic mineral mining in Wisconsin. Metallic mineral mining includes the mining of ores of iron, copper, lead and zinc along with the precious metals silver and gold. A company must obtain a mining permit, along with other permits, approvals and licenses, from the Department before beginning to mine metallic minerals. A very important component of the mining permit is the reclamation plan. The reclamation plan, once approved, becomes part of the mining permit.

This information sheet describes the requirements for a reclamation plan and explains its role in protecting the environment during and after mining. In addition, it describes the responsibilities of the mining company for the long-term care of the entire mining site including any waste disposal facilities that may exist.

## ***Mine Reclamation***

Successful reclamation means the restoration of all areas disturbed by mining activities including aspects of the mine itself, waste disposal areas, buildings, roads and utility corridors. It is the product of thorough planning and execution of a well conceived reclamation plan. Restoration means returning of the site to a condition that minimizes erosion and sedimentation, supports productive and diverse plant and animal communities and allows for the desired post-mining land use.

To better understand how the reclamation plan functions to achieve the goal of revegetation, it is helpful to provide a brief overview of state law and how it relates to successful reclamation.

There are several **minimum standards** for reclamation that guide the development of a company's reclamation plan. These standards are:

- 1) Topsoil from the areas disturbed by mining must be salvaged and either stockpiled or used in on-going reclamation or stockpiled for use in final reclamation.

- 2) Disturbed areas must be revegetated or otherwise stabilized as soon as possible after disturbance.
- 3) Native species of vegetation are required for final reclamation unless this is shown to be impossible or undesirable.
- 4) All toxic and hazardous wastes, refuse and mine tailings must be safely disposed.
- 5) Surface structures must be removed unless they are converted to a beneficial function in accordance with the approved post-mining land use.
- 6) Tunnels, shafts or underground openings must be sealed.
- 7) Measures must be taken to prevent subsidence. If subsidence occurs, corrective actions must be taken.

In order for reclamation to be considered successful, the following **environmental protection goals** must be met:

- 1) Ensure that surface water quality is maintained by designing erosion and sedimentation control systems.
- 2) Protect the surface water from non-point sources of pollution and sedimentation.
- 3) Ensure that vegetative cover is established and that it functions to promote soil conservation, site stabilization and enhances the infiltration of precipitation into the soil (helps to restore the local hydrologic balance).
- 4) Protect against slope failures on steep slopes by incorporating additional stabilization measures in those areas.
- 5) Control wind erosion and thereby air pollution which might otherwise result from fugitive dust.
- 6) Promote species diversity in plant, insects and wildlife in accord with the goal of reestablishing native communities.

### ***The Reclamation Plan***

The reclamation plan is a detailed technical document designed to meet the goals which lead to successful reclamation. In order to better understand how the reclamation plan is developed and how it functions to achieve the goals of reclamation, a more complete summary follows:

**Pre-mining Planning Phase** - An applicant for a mining permit must prepare a reclamation plan for review by the Department and the public. The goal of this reclamation plan is to achieve successful reclamation of the site disturbed by mining. In addition, the plan addresses the proposed final land use and the relationship of the reclaimed mine site to the surrounding local land use. The responsibility of the Department is to ensure that the plan would comply with the law and protect the environment.

**Selection of Plants to be Used in Site Revegetation** - The key to ensuring that the site is returned to a condition that is capable of supporting the approved post-mining land use is successful revegetation. It is also important to select species that are compatible with the approved post-mining land use. For example, if the goal is to provide wildlife habitat, then the seed mix is selected to provide good browse and cover. In general, the seed mix used for reclamation will consist of native species that are ecologically suited to the area.

**Revegetation And Site Stabilization Activities During Mining** - During the construction and the mining phase of a project, erosion control and site stabilization are of primary importance. State law requires that areas disturbed by mining must be revegetated and stabilized as soon as practicable. The erosion control system is installed prior to and concurrently with construction activities and would be maintained during the life of the mine to protect surface water.

To control erosion it is necessary to minimize the surface water that contacts the disturbed area by diverting the water around the disturbed area when possible. Next, to address the runoff that results from direct precipitation on the disturbed area, measures must be taken to lessen its erosive potential and to collect it for treatment prior to its discharge to surface water courses.

Treatment of runoff containing sediment is usually accomplished by detention in a sediment pond to allow for the settling of solids.

In addition to revegetation, numerous other stabilization measures are employed at the disturbed area to control surface water runoff and minimize erosion and sedimentation. These include the use of mulch, erosion control blankets, tackifiers (binders used to hold mulch in place), rip-rap, slope control and many others.

**Final Site Reclamation** - Once a mining operation is completed, all surface structures are removed and underground openings (if any) are sealed, unless other uses for the structures are deemed appropriate. Next, any impermeable caps or cover layers are installed if needed. The site is then graded both to achieve the designated contour and to prepare the site for the redistribution of the topsoil that has been stockpiled.

After final grading has been accomplished to approximate the pre-mining landscape condition, the topsoil and in some cases the subsoil is/are redistributed at the thickness necessary to facilitate revegetation. The results of a soil analysis are used to prescribe the proper rate of fertilizer application.

In addition to commercial fertilizer, soil amendments such as manure, sludge, or compost may be applied to further enhance the soil and facilitate plant establishment.

The application of mulch is often required in order to conserve moisture, suppress weed growth and keep soil temperature at a level conducive for plant growth.

### ***Bonding and Bond Release***

After a mining company has received approval of its mining permit application, but before mine construction or mining begins, the operator must file a performance bond, or the equivalent. The purpose of this guarantee is to ensure that the state has the financial resources to complete the reclamation activities contained in the reclamation plan in the unlikely event that the company fails to do so. The reclamation plan is used as the basis for calculating the estimated cost of reclamation. This cost is reflected in the bond provided to the state by the mining company. Annually thereafter, the Department reviews the mining and reclamation plans and may change the amount of the bond posted to cover the estimated reclamation costs if they have changed.

When mining has been completed and the reclamation of the site is finished, the company will notify the Department. A minimum of four years after the Department concurs that reclamation is complete, the operator may petition the Department to issue a certificate of completion of reclamation for the site and reduce the amount of the bond. After a public hearing, the Department must issue a certificate of completion if it finds that the operator has successfully completed site reclamation. The main criteria used to evaluate reclamation success are cover, productivity, and diversity.

Good cover allows the vegetation to protect the soil against the impact of rainfall and protect the soil against runoff, thus minimizing erosion and sedimentation.

**Productivity** is used as a measure to ensure that plant regrowth is acceptable and sustainable.

**Diversity** can be used to evaluate the stability and vigor of the plant community.

Additional monitoring activities may include periodically evaluating the system used to isolate potentially deleterious materials such as mining waste from the environment.

For at least the next 20 years the operator must continue to monitor and maintain the mining site. After that time, if the operator has met the environmental protection goals stated in their reclamation plan, the Department must release the remaining portion of the bond.

### ***Maintenance, Monitoring and Management***

There is a need to evaluate the success of the revegetation program after plants are established to ensure the reclamation is proceeding as planned. Monitoring of revegetation success and the effectiveness of systems designed to protect surface or groundwater and provide erosion control occurs during the active mining phase and continues after the mining company notifies the Department of completion of its reclamation activities.

Should monitoring reveal that any systems designed to protect the environment are not functioning properly or that the revegetation is not completely satisfactory, corrective maintenance would be performed by the mining company.

Long-term management is critical during the post mining period and before the bond is released. The management must be ecologically sound and correspond to the designated post-mining land use. Thus, the effect of state regulations, as implemented by the reclamation plan, is to ensure that the local environmental and socioeconomic needs are met.

### ***Long-term Care of the Mining Waste Site***

Many mining operations would include mining waste disposal facilities. The operator/owner of mining waste disposal facilities is required to provide and maintain proof of financial responsibility (such as a bond or other financial security) for long term care of the waste facility. Following closure, the operator/owner is required to maintain the waste facility and periodically monitor the site as well as the local environment to assure that no problems are developing. The monitoring plan, approved during the permitting process, would identify the types of monitoring required from before mining started, during operations and throughout the long-term care period. After a minimum of 40 years following closure, the owner may petition the Department to terminate the owner's obligation to maintain proof of financial responsibility. However, the landowner's responsibility for long term care activities at the mine waste disposal facility does not end.

*A proposed administrative rule would require a mining company to establish a dedicated trust fund to cover costs associated with necessary remedial actions in the case of unforeseen environmental contamination at the mining site and also costs of periodic replacement of protective features of a mining waste site, such as the cover system. Public hearings are scheduled for May, 1997.*

### ***Reclamation Violations***

If the Department finds a violation of law or a deviation from the approved reclamation plan, it must issue the mine operator an order requiring compliance. If an operator fails to comply with the Department's order, the Department must cancel the mining permit held by the operator. In a case where the reclamation of the mine site is not proceeding as specified in the reclamation plan the Department must order compliance within a certain period of time. If the

operator still has not corrected the problem the Department must reclaim the mine site using the money that was held as a bond. The operator is liable to the state for the full cost of reclamation.

**For More Information:**

Reclamation and long-term care requirements associated with mining are spelled out in more detail in Wisconsin Administrative Codes Chapter NR 132, Mineral Metallic Mining, and Chapter NR 182, Regulation of Metallic Mining Wastes. Reclamation requirements also have been established for mineral exploration (see Chapter NR 130, Metallic Mineral Exploration) and prospecting (see Chapter NR 131, Metallic Mining Prospecting).

A reclamation plan was prepared by the Flambeau Mining Company for its project at Ladysmith, Wisconsin. During the review of that project, the Department proposed numerous conditions of approval for the plan, which were subsequently approved in the written decision on the project. This reclamation plan and the approval conditions are in Department files and are available for public review. With the end of the production phase of the Flambeau Mine, the reclamation plan is now being implemented.

If you would like additional information or want to discuss any mining-related issue, please contact either:

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## Mining Information Sheet

Prepared by:  
Department of Natural Resources  
Box 7921, Madison, WI 53707  
in cooperation with the  
Wisconsin Geological and Natural History Survey  
Revised - April 1997

# Potential Mining Development in Northern Wisconsin

### Issue

What is the likelihood for significant metallic mining development in northern Wisconsin? Will northern Wisconsin become a mining district; that is, will there be many mines operating or wanting to operate in northern Wisconsin? How can one project for mining be evaluated without considering what the potential is for other mines to be operating, as well?

### Introduction

The current activity for the Crandon Project has focussed public attention on the issues and emotions related to mining metallic mineral deposits in northern Wisconsin in much the same manner as the Flambeau Mine proposal did in the late 1980s. Will the operation of the Flambeau Mine signal the renewal of major metallic mining activities in the state? Are there other concentrations of minerals in quantities warranting consideration for mining?

In 1976, the State of Wisconsin published a forecast of future mining in the North in "The Impact of Mineral Resource Development in Wisconsin: Toward a State Policy" prepared by an interagency committee of state officials. This report stated that:

*"Based on current estimates of base metal reserves and on current trends, the potential exists for the development of 20 new metallic mines over the next 20 to 30 years with 10 copper and iron ore mines possible in northern Wisconsin and 10 lead and zinc mines possible in southwestern Wisconsin."*

Further, the report stated that six copper mines and two iron mines could be operational by 1996 with a new copper mine coming into production every four years. Obviously, the anticipated pace of metal mining since the date of these forecasts has been significantly different. A single copper mine has been permitted in the 21 years since the forecast. The following paragraphs describe what has happened to affect the anticipated pace of mineral development.



### *Factors that influence the assessment of Wisconsin's mining potential*

The potential and pace for metal mining in northern Wisconsin is affected by the geology of the region, by the prices for metals on national and international commodities markets, and the time involved in completing the state's environmental review and permitting processes.

#### *... geology*

Within the bedrock of northern Wisconsin, beneath the tens to hundreds of feet of glacial deposits at the land surface, there are complex assemblages of igneous and metamorphic rocks that contain metal-bearing minerals. In localized areas, these minerals may occur in concentrations of sufficient tonnage (size) and grade (richness of the metal content) so as to warrant further evaluation as a potential mining project. Such occurrences are commonly known as orebodies. Northern Wisconsin's geology may include dozens of local mineralized areas, but the presence of metals in sufficient tonnage and grade for *possible* development is extremely rare and these rare occurrences are known as mineral deposits.

**Figure 1 - Known mineral deposits in Wisconsin**

\*(opt = ounces per ton)

Deposit Name	Bend (Found: 1985)	Crandon (Found: 1975)	Flambeau Mine (Found: 1968)	Lynne (Found: 1990)
Location	Taylor County (Chequamegon National Forest)	Forest County (private land)	Rusk County (private land)	Oneida County (County-owned land)
Holder of Mineral Rights	Jump River Joint Venture	Crandon Mining Co. (Exxon Minerals and Rio Algom)	Flambeau Mining Co.	Noranda Minerals-Wisconsin Corp
Ore Body Tonnage	> 3.7 million tons	30 million tons (first phase); 25 million tons in more copper-rich 2nd phase	1.9 million tons	5.8 million tons
Mineral Composition of Ore	Copper: 2.8% Gold: 0.28 opt*	<u>First phase:</u> Zinc: 9.4%, Copper: 0.4% Lead, gold & silver: minor	Copper: 10.5% Gold: 0.1 opt	Zinc: 8.9% Lead: 1.7% Silver: 2.3 opt Gold: minor Copper: minor

Development Status	Exploration drilling ceased mid-1992	DNR reviewing mining permit application; drafting E.I.S.	Production nearly done; reclamation in progress	Review began 1992; Currently suspended
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The *Flambeau Mine* had been extracting about 1000 tons per day of copper-rich ore, but production is nearly completed. Reclamation of the mining site is beginning and is projected to be nearly complete by the end of 1998. The *Crandon deposit* is presently being evaluated for the required environmental impact analyses and the mining permit and other related permits, licenses, and approvals necessary before mineral extraction could begin. If permitted, the mine

Figure 2 - Other known mineral occurrences in Wisconsin (no expectation for development):

Name	Location	Description	Comments
Richie Creek	Price County	copper, gold, lead, zinc	insufficient tonnage and grade known
Reef	Marathon County	gold	too costly to mine at foreseeable prices
Thornapple River	Rusk County	copper, zinc	insufficient tonnage and grade known
Pelican River	Oneida County	copper, zinc	insufficient tonnage and grade known
Round Lake	Sawyer County	iron, titanium, vanadium	metal recovery too low due to complex mineralogy
Duval	Marinette County	iron pyrite	low grade; no real market for pyrite
Horseshoe	Lincoln County	zinc, lead, copper, gold	insufficient tonnage and grade known
Thunder River	Price County	zinc	insufficient tonnage and grade known
Horseshoe	Lincoln County	zinc, copper	insufficient tonnage and grade known
Catwillow Creek	Forest County	base and precious metals	insufficient tonnage and grade known
Mole Lake	Forest County	base and precious metals	no current interest in development

School House, Clear Creek, G-23, Hawk , Spirit, Somo, Prentice East	Various counties	base and precious metals	considered to be occurrences only; no potential to develop
Mercer	Iron County	gold	potential unknown

would begin operation by the year 2000, at the earliest. The *Lynne deposit* is no longer under active consideration for development. The *Bend deposit* is still being explored and economic evaluation is continuing.

It is possible that other areas of mineralization will be located because exploration is proceeding in some northern Wisconsin counties. Whereas the likelihood of finding an orebody at any one exploration site is remote, it is possible that an occurrence not known at this time could be sufficiently large and contain enough recoverable metal to be called an orebody. It is unlikely, however, that there will be dozens of additional orebodies discovered.

Since records have been kept, beginning in 1978, just under 400,000 acres of land have been leased for exploration and over 1200 drill holes have been constructed in the search for metallic mineralization. In that time, only the Lynne and Bend deposits have been discovered and nearly all of the acreage originally leased for mineral exploration is no longer under any lease agreement. On a worldwide basis, studies of mineral exploration programs show that out of 1000 local areas of mineralization discovered, only 10 are eventually determined to be orebodies and only 1 of these is developed into a profitable mining operation.

The Department of Natural Resources estimates that there could be no more than five metallic mineral mines developed in Wisconsin over the next twenty years. This includes the Flambeau Mine now in operation, the Crandon Project being evaluated at this time, the Lynne Project no longer being considered, the Bend Project known but not yet under consideration, and one additional orebody not now known. This estimate is based on the current state of knowledge about the geology of northern Wisconsin and the steps necessary to discover an orebody and the time it takes to complete the regulatory requirements.

### ... metal prices and world commodities markets

Prices for metals are the key determinants of whether a mineral occurrence can be considered economically viable, and thus termed an orebody. If metals prices increased significantly and held their levels, mineral occurrences could become more valuable, and some of the economically marginal prospects in northern Wisconsin might then be valuable enough to be mined. Mineral economists do not expect significant long-term increases in metals prices and, therefore, the Department does not expect potential mineral development in northern Wisconsin will be based upon metal price increases to any significant extent.

The prices mining companies receive for metals recovered from orebodies tends to be a reflection of world demand for the metal in question and the supply, or availability, of the metal to satisfy that demand. Copper, for example, is an important metal for a wide variety of manufacturing applications, and its price is sensitive to the supply of raw copper in the world. The more copper that becomes available on the world market the lower will be the price for which it can be sold. Gold prices, however, tend more to reflect world-wide speculative influences and respond more to concerns with international economic stability than to changes in the manufacturing markets.

The cost of mining is generally a knowable cost determined by the nature of the mineralized material itself, the manner in which it must be extracted, and the degree to which it must be processed before it can be used in making other products. These costs once determined for the mineral deposit in question tend to be fixed, subject mainly to inflation, with the cost of labor also known to be a generally rising cost of doing business. Changes in the prices of metals being recovered, however, tend to be beyond the control, or even the predictive capabilities of the mining company.

Thus, large deposits of metal-bearing minerals may never become orebodies simply because the cost of recovering the metal is too high relative to the metal prices available. Mining companies decide on investments in mining projects using projections of metal prices and costs of mining and processing and then comparing the anticipated rate of return they might receive on any one investment to other investment opportunities or mining projects available.

### *... time involved in evaluating a proposed mining project*

In Wisconsin, it takes a minimum of four years from the determination that a mineral occurrence is truly an orebody (and the decision is made by the mining company to proceed with permitting activity) to the completion of the state's environmental and socio-economic evaluations and the review of permit applications. This span of time tends to spread out the effects of any cumulative mining impacts that may be hypothesized, as the likelihood of several mines being in operation at any one time is very small.

The history of mining in Wisconsin indicates that metal mining projects develop slowly. The Flambeau Mine began its operations in 1993, nearly 25 years following its discovery. The Crandon deposit, currently under evaluation by the Department, was discovered in 1975. These long time periods result from many factors including changing metal prices, environmental analyses of potential project effects, changes in a mining company's commitment to pursue a potential mining proposal, and changes in the state's regulatory programs.

Currently, and in the most recent four years, the extent of exploratory drilling and the leasing of private and public lands for mineral evaluation is significantly below the level of such activities in the 1970s and 1980s. Recent announcements of reductions in exploration interest by once-active mining companies indicate that this reduced level of activity will not be different

in the near future. Announcements of new discoveries or progress in permitting known orebodies could stimulate renewed interest in mineral exploration in Wisconsin.

### *Will There Be Significant Mining Development in Northern Wisconsin?*

For there to be significant mining development in northern Wisconsin, there has to be a sufficient number of orebodies. These, in turn, must be permitted and become operating mines. In addition, the operating mines in the region must achieve a certain level of economic importance in the overall economy of the region. Since we have already discussed the low number of orebodies and the slow pace of mining expansion to date, let's consider other factors which could determine how mining could affect the North.

Historically, mining was an important part of regional economies in southwestern Wisconsin, as a result of zinc and lead mining, and in northwestern Wisconsin as a result of iron mining. In the zinc and lead district there were literally hundreds of small mining operations from its beginnings in the early 1800s through its heyday in the middle part of the nineteenth century. The settlement of that part of the state was a direct result of mining development. In the Hurley and Montreal areas, iron mining began in the 1880s with dozens of corporations formed to extract iron ore from the Gogebic Range. Here, too, the economy of the region was dominated at first by the extensive mining activity.

These examples of past mining dominance of regional economies cannot be repeated in today's economy for two basic reasons: (1) the extent of mineral resources in northern Wisconsin relative to other resources present in the area is not large enough to be dominant; and (2) the breadth and diversity of the northern Wisconsin economy in the twentieth century is far greater than what was available in frontier southwestern Wisconsin or in the woodlands of northwestern Wisconsin more than a hundred years ago.

Another way to assess the significance of mining in northern Wisconsin is to evaluate the potential economic importance by the number of jobs that might be created. For example, if mining occurred simultaneously at all four known orebodies in the North at once (an impossibly extreme situation), the total direct and stimulated (indirect) employment would be an estimated 1300 jobs. Even this significant number of jobs, however, would represent only about 3.5% of the combined total employment in the four counties of Taylor, Oneida, Rusk, and Forest. Within a local area, however, mining employment effects may be more noticeable and local economies may need to consider the costs and benefits of expanded employment on local services and revenues, as well.

### **Summary**

Potential mining development in northern Wisconsin is ultimately determined by the geology of the region. Although the bedrock in this area is considered to be "mineral rich" in comparison to other regions in the state and to neighboring states having similar geology, the number of

orebodies discovered over the last 30 years or so is four. Of these four, only two could be active at the end of this century, including one—the Flambeau Mine— that is already active. However, mineral exploration continues in northern Wisconsin and based on the experience of the recent past, the Department believes that one additional orebody is likely to be discovered over the course of the next one or two decades. Because of the length of time it takes for a mineral deposit to be evaluated and then permitted, as well as the rate at which new orebodies have been discovered in northern Wisconsin, the development of metallic mineral deposits is expected to play only a limited role in the resource management issues and economics of the region.

### ***For More Information ...***

If you would like additional information or want to discuss any mining-related issue, please contact:

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*This mining information sheet is one in a series prepared by the Department of Natural Resources to explain how mining in Wisconsin is regulated and to explore other aspects of mining. Copies of the following mining information sheets are available from Department offices in Madison and Rhinelander:*

- How the Department of Natural Resources Regulates Mining
- How a Mine is Permitted
- Protecting Groundwater at Mining Sites
- Reclamation and Long-Term Care Requirements for Mine Sites in Wisconsin
- Wisconsin's Net Proceeds Tax on Mining and Distribution of Funds
- Local Decisions in Mining Projects
- Potential Mining Development in Northern Wisconsin
- Cumulative Impacts of Mining Development in Northern Wisconsin
- Responses to Public Concerns with Wisconsin's Laws Governing Mining



**PROGRESS REPORT ON  
THE DEPARTMENT'S REVIEW OF THE MINE PROPOSED BY  
THE CRANDON MINING COMPANY**

Department of Natural Resources  
Box 7921, Madison, WI 53707  
May 1997

**Introduction:** We begin this progress report with a focus on new items of interest and then provide more basic information relating to the proposed project and mining regulation for our new readers.

It has been a little over three years since the company filed its first documents and we started our regulatory review of their mining proposal. Since our previous status report last fall, the Department's staff and consultants have continued to review the Environmental Impact Report, permit applications, technical support documents, and other data provided by the Crandon Mining Company. We are also preparing our draft Environmental Impact Statement on the proposed mine. As expected, progress is slow in some areas. We want to be certain to completely evaluate the technical studies provided to us and consider all of the possible environmental impacts should the project be permitted and built. The final written decision on the mining permit will not be made for at least two years or longer, and will be based on the record developed during the final hearing process. (We intend to discuss the final hearing process in detail in a future report.)

## **WHAT'S NEW?**

**Public Meeting Schedule:** Recently, the Department released its schedule for holding a series of public meetings on the proposed Crandon Mine. Public meetings already have been held in New London (on the Wolf River) and the Town of Ainsworth in Langlade County (adjacent to the project site) in April. Additional meetings between Department staff and the public will be in the Crandon area on May 14 and in Wausau on May 28, in Tomahawk on June 18 and in Green Bay on June 19. We will hold a final meeting in Rhinelander, but it has not yet been scheduled. Contacts also have been made with tribal authorities to schedule a meeting with them.

The purpose of the public meetings is to discuss our progress and future schedule in reviewing the mining proposal, explain our regulatory authority over mining projects, and listen and respond to the concerns of the public and tribal members. The Department staff will tape the meetings and will write and distribute a meeting summary containing staff responses to public questions after each meeting.

**Wisconsin River BOD Modeling:** BOD stands for biochemical oxygen demand. This is a measure of the amount of oxygen needed in the biological processes to break down organic



matter or chemicals in water. The greater the degree of pollution by organic matter, the higher the BOD. As the amount of BOD in aquatic habitats increases, the availability of oxygen for aquatic life decreases. BOD may enter the river from non-point sources, such as agriculture or urban runoff, or from discharges into the river via permitted point sources such as industries and municipal wastewater treatment plants.

The Department regulates BOD in the river by limiting how much each industry or municipality can discharge to each segment of the river after establishing a ceiling on BOD discharges for each segment of the river. If too much organic material reaches the river, the dissolved oxygen in the river could fall below 5 parts per million. The Department's standard for dissolved oxygen in rivers is a minimum of 5 parts per million to support a balanced aquatic community of fish and aquatic life. Low levels of dissolved oxygen can cause problems for fish and aquatic life.

Segment A of the Wisconsin River, between Rhinelander and Grandmother Dam south of Tomahawk, is the discharge site preferred by the Crandon Mining Company. Several municipalities and industries discharge into this segment of the river. During summer months, however, occasionally the dissolved oxygen in the river falls below 5 parts per million. In other words, Segment A was "over-allocated" for BOD. The Department recently announced that it could not consider allowing a new source, such as the proposed Crandon discharge, if it would result in detectable amounts of BOD discharged into Segment A. Before a new source could be permitted, the BOD problem in the river would have to be remedied.

In order to reduce the amount of BOD that is discharged to Segment A of the Wisconsin River, the Department first will update its dissolved oxygen model for the segment. The model will help us to determine how much BOD reduction is needed to maintain the dissolved oxygen standard in the River. To reduce the amount of BOD that can be discharged from each industry and municipality, the Department will work with the public, current dischargers, and the Crandon Mining Company, if it chooses to participate, to develop a solution. Non-point sources of BOD will also be considered. Depending on the location and amount of their discharge, the amount of discharge permitted may be reduced for some dischargers. This discharge allocation process, including the dissolved oxygen modeling, could take several years to complete.

**Groundwater Modeling Update:** The Department, with the assistance of consultants, is continuing its review of the groundwater flow model submitted by the mining company in August 1996. A flow model is intended to help us to understand the direction and rate of groundwater movement and the interaction between groundwater and the surface waters in lakes, streams, wetlands and springs. We are carefully looking at the construction of the model, the model inputs, and the computation/numerical issues to make sure that the submitted model is an accurate representation of the natural system in the area of the mine. In January, we provided a comment letter to the mining company asking for additional information and clarification on many aspects of the flow model. We are evaluating the company's responses and anticipate providing another comment letter on similar issues in the near future. Once we are confident that we have an acceptable flow model, we will review the impact conclusions made by the mining company based on the flow modeling results.

The company submitted a revised solute (liquid contaminant) transport modeling report in November 1996. The transport model is designed to help us evaluate the impacts of potential contaminants that would leak from the waste disposal facility and the abandoned underground mine. Since the solute transport modeling is based on the flow model, we have not fully reviewed the transport model. Once we determine that we have an acceptable flow model, then we will begin our detailed review of the solute transport model.

**Crown Pillar Hydrology:** The crown pillar is the zone of bedrock at the top of the ore body, just beneath the glacial deposits, that would be left in place for stability and to prevent collapse of the adjacent underground workings. The mining company submitted a report dated May 1996 assessing how much water moves through tiny cracks in the crown pillar. Our mining engineering consultant recently completed his review of the report. He concluded that the assumptions used in the computer modeling of the rock stresses were questionable. Changes in rock stresses could change the amount of water moving through the crown pillar. In February, we forwarded those comments to the mining company with a letter requesting they revise the analysis using more reasonable assumptions and a different method of analysis. The company agreed to perform the analysis again based on our consultant's comments.

**Inter-basin Transfer of Water:** If the proposed surface water discharge to the Wisconsin River were approved, there would be an inter-basin transfer of water from the Great Lakes basin to the Mississippi River basin. State law concerning inter-basin transfers is contained in section 281.35 (144.026 old numbering system), Wisconsin Statutes. Chapter NR 142, (*Wisconsin Water Management and Conservation*, Wis. Admin. Code), addresses in further detail how the Department regulates withdrawals from waters of the State.

The State statutes identify three levels of water withdrawal and the approval process and information requirements necessary for each. If the withdrawal would average more than 100,000 gallons per day, an applicant must register the proposed withdrawal with the Department and report the rate and volume of withdrawal. For a withdrawal that would average greater than 2,000,000 gallons per day, an applicant must apply for a permit and provide additional information. The governors of the Great Lakes states and the premiers of the Canadian provinces bordering the Great Lakes must be consulted if the withdrawal would average more than 5,000,000 gallons per day.

Our preliminary calculation on the amount of water loss from the inter-basin transfer is less than the two million gallons per day threshold, thus the Crandon Mining Company needs only to register the withdrawal with the Department and report the volume and rate of withdrawal.

The 1986 Water Resources Development Act passed by the U.S. Congress refers to diversions of water from the Great Lakes or its tributaries, but does not include groundwater diversions or withdrawal. For this reason, our interpretation of the 1986 federal law is that it does not apply to the proposed mine.

**Proposed Mining Rule Revisions:** Proposed revisions to Chapter NR 132 (*Metallic Mineral Mining*, Wis. Admin. Code), would require a mining permit holder to establish an irrevocable trust fund to guarantee the availability of funds for necessary remedial actions. The proposed rule specifies appropriate uses of the fund and the mechanisms by which the fund is established, reviewed, and adjusted.

Proposed revisions to Chapter NR 182 (*Metallic Mining Wastes*, Wis. Admin. Code), would impose the groundwater quality provisions of Chapter NR 140 (*Groundwater Quality*, Wis. Admin. Code), to mining sites. Facilities on mining sites would be required to be designed and operated to achieve compliance with all the provisions specified in Chapter NR 140 (Wis. Admin. Code). Several key elements from the existing Chapter NR 182 (Wis. Admin. Code), which will supplement the provisions of Chapter NR 140 (Wis. Admin. Code), are proposed to be retained. These include provisions that require predictive modeling prior to project approval, preparation of a contingency plan on how to react to unforeseen impacts, and assessment of any statistically significant deviation from baseline groundwater quality detected during project monitoring.

The Natural Resources Board has authorized five public hearings on the proposed revisions to the mining rules. Hearings will be held in Eau Claire on May 19, Rhinelander on May 20, Shawano on May 21, Milwaukee on May 23, and in Madison on May 30.

## IMPORTANT PROJECT AND REGULATORY INFORMATION

**Description of the Proposed Mining Project:** The Crandon Mining Company has proposed construction of a large industrial facility to mine zinc, copper and lead, along with silver and gold, from a deep underground mine. In addition to the mine, there would be ore concentrating facilities, an above-ground waste (tailings) disposal facility, a water treatment plant, a buried pipeline to the Wisconsin River for discharging treated wastewater, and additional facilities. In total, the project would directly affect nearly 600 acres at the proposed project site, seven miles south of Crandon. There are no smelting or refining facilities in Wisconsin, thus the zinc, copper, and lead concentrates produced at the facility would be transported by rail to other states or countries for further processing.

The project proposal is to mine about 55 million tons of ore over approximately 28 years of operation. Construction would require about three years, and reclamation of the site would take an additional four years after mining ended.

During development of the underground passageways and ore removal, groundwater would seep into the mine and have to be pumped out. The continuous mine pumping would lower the groundwater levels around the mine and could affect the levels of local lakes and streams. The mining company, under the Department's review and approval, would be responsible for implementing a surface water mitigation plan for the project that would assure protection of the

public rights (e.g., boating, fishing, swimming, protection of aquatic and wildlife habitat) in those surface waters.

**Mining Waste Disposal:** Mining wastes include the finely ground tailings (the waste left after the valuable minerals are removed), waste rock, and water treatment plant solids, which are proposed for permanent disposal in the tailings management area. In total, nearly 24 million tons of waste would be placed in the facility and a nearly equal amount would be backfilled in the underground mine. The tailings management area would consist of four cells, each between 45-71 acres in size, and each with a multiple liner system on the bottom and sides to minimize leakage to the groundwater. A leachate (liquid) collection system on the bottom and the sides (just above the liner) also would help minimize liquid loss through the liner. The waste disposal cells would be filled and reclaimed sequentially as mining proceeded. The multiple liner system would incorporate compacted native soil, a manufactured bentonite clay layer and a flexible plastic membrane. A reclamation cap consisting of the same soil, bentonite and plastic membrane components, plus a drainage layer, would cover each cell after closure to minimize the amounts of water and oxygen reaching the wastes. The reclamation goal, through the use of the reclamation cap, is to limit over the long term the amount of water and oxygen reaching the wastes in order to reduce pollutants reaching the groundwater.

**Permits Needed:** The major State permits, approvals, and licenses required for the proposed mine are listed below:

- Mining Permit - includes the mining plan, environmental monitoring plan, the reclamation plan, risk assessment and contingency plan;
- Tailings Management Feasibility Determination, Plan of Operation Approval, and Solid Waste Operating License;
- Air Quality Permit;
- Surface Water Discharge (WPDES) Permit (proposed for Wisconsin River);
- High-capacity Well Plan Approval (for mine pumping);
- Wastewater Treatment Plant Plan Approval;
- Industrial Storm-water Runoff Permit (for construction);
- Chapter 30 (Navigable Waters) Permits - for stream crossings and discharge structures (if needed);
- Withdrawal of County Forest Land;
- Potable Water Supply Plan Approval;
- Additional permits and approvals may be required for the surface water mitigation plan, designed to maintain lake levels and stream flows that could be affected by the mine pumping. The plan has not been fully developed.
- Approval by the Public Service Commission for the electric transmission line and natural gas pipeline to serve the project.

The local units of government in the project area that have zoning and land use regulatory authority for the proposed mine must issue approvals before the Department could issue a mining

permit. Two local units of government, the Town of Nashville and Forest County, have signed local agreements implementing local approval.

The US Army Corps of Engineers is preparing a Federal Environmental Impact Statement on the proposal and has permitting authority for the proposed wetland dredging and filling. The Corps also has a responsibility to protect the resources on Native American lands. In addition, the Army Corps requires wetland mitigation to compensate for the wetlands that would be lost on the project site during development. To comply with that requirement, the Crandon Mining Company has proposed to re-establish wetlands on drained agricultural lands located on the Shawano and Oconto County border.

**Significant Environmental Concerns:** The following list includes the most significant environmental concerns associated with the proposed project that have been identified by the public. These issues, along with many more, will be fully evaluated in our Environmental Impact Statement:

- The potential for "acid rock" drainage from the mining wastes and mobilization of heavy metals in the acid leachate
- Groundwater contamination as the result of acid rock drainage from the mine or tailings disposal facility
- Destruction (during the life of the project) of nearly 600 acres of habitat plus additional acreage of secondary impacts
- Inter-basin transfer of water from the Great Lakes basin to the Mississippi basin
- Surface water impacts to the Wolf River and its tributaries, as well as to the Wisconsin River
- Groundwater drawdown due to mine pumping and resulting surface water and water well impacts
- Impacts to the adjacent Sokaogon Chippewa Reservation, including Rice Lake and its wild rice crop
- Impacts of mercury in groundwater and surface waters
- Social and economic changes to the project area
- Construction and tailings area fugitive dust
- Impacts of particulate deposition on soils, lakes, streams, and nearby residences
- Regional tourism impacts
- Noise impacts
- Potential chemical or concentrate spills

**Mining Information Sheets:** The Department's mining information sheets recently have been updated. These updated information sheets are available from Department offices in Rhinelander and Madison. These are prepared by the Department of Natural Resources to explain how mining in Wisconsin is regulated and to explore other aspects of metallic mining. Copies of the following nine mining information sheets are available:

- Potential Mining Development in Northern Wisconsin
- Cumulative Impacts of Mining Development in Northern Wisconsin
- How a Mine is Permitted
- Protecting Groundwater at Mining Sites
- Local Decisions in Mining Projects
- Wisconsin's Net Proceeds Tax on Mining and Distribution of Funds to Municipalities
- Reclamation and Long-Term Care Requirements for Mine Sites in Wisconsin
- Responses to Public Concerns with Wisconsin's Laws Governing Mining
- How the Department of Natural Resources Regulates Mining

We also have copies of "Public Concerns Regarding the Proposed Crandon Mine Discharge into the Wisconsin River." This is a compilation of citizen questions and Department responses from a May 1996 public meeting in Tomahawk.

The most comprehensive explanation of mining regulation is found in *An Overview of Metallic Mineral Regulation in Wisconsin* by Thomas Evans. It was published as Special Report 13 (revised in 1996) by the Wisconsin Geological & Natural History Survey, Madison, and can be ordered by calling (608) 263-7839.

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