

SELECTED DEVELOPMENTS IN WISCONSIN'S MINERAL INDUSTRY IN 1996 AND 1997

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1998

The years 1996 and 1997 were marked by extensive activity affecting the metallic and nonmetallic mining industries in Wisconsin. For metallic mineral development, the cessation of mining at the Flambeau Mine, the ongoing permitting evaluation for the Crandon Mine proposal, the reduced levels of mineral exploration and leasing, and the public debate over several legislative initiatives (including a proposed mining "moratorium" bill) were the principal activities. For nonmetallic mineral resources, the development of revised, negotiated administrative rules related to the reclamation of nonmetallic mines, and the adoption of revised statutory language to authorize the enactment of these rules, were the principal activities.

WISCONSIN NONFUEL MINERAL PRODUCTION

Table 1 shows the value of nonfuel mineral production in Wisconsin for the years 1995, 1996, and 1997. Although the data for 1997 are preliminary, it appears that the values for 1996 and 1997 ranked as the third and fourth highest annual production values in the state's history. In 1996 and 1997 strong growth in the value of production for crushed stone and construction sand and gravel compensated, in part, for the general decline in value of metal produced from the Flambeau Mine. Value of production for other mineral commodities—silica sand, industrial sand, gemstones, peat, lime, and dimension stone—was relatively constant in 1996 and 1997.

Table 1. Nonfuel raw mineral production in Wisconsin¹. (Quantity in thousand metric tons and value in thousand dollars, unless otherwise specified. Source: U.S. Geological Survey.)

Mineral	1995		1996		1997 ²	
	Quantity	Value	Quantity	Value	Quantity	Value
Gemstones	NA ³	65	NA	505	NA	927
Lime	568	33,900	551	32,000	557	32,400
Sand and gravel						
Construction	32,200	102,000	32,600	105,000	33,500	111,000
Industrial	1,670	33,300	1,660	32,300	1,730	34,400
Stone						
Crushed	26,000	108,000	26,000	113,000	29,000	128,000
Dimension (metric tons)	128,000	14,500	143,000	16,600	144,000	16,700
Combined value of copper, gold, peat, silica stone, and silver	— ⁴	124,000	—	96,800	—	65,200
TOTAL VALUE	—	416,000		396,000	—	389,000

¹ Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Data are rounded to three significant digits; may not add to totals shown.

² Preliminary data only.

³ Data not available.

⁴ Not applicable.

METALLIC MINERAL DEVELOPMENTS

Flambeau Mine closes in 1997

The Flambeau Mine, operated by Flambeau Mining Company, a subsidiary of Kennecott Corporation, ceased production of volcanogenic massive-sulfide ore from the small open-pit mine located in Rusk County, south of the city of Ladysmith, in the spring of 1997 (fig. 1) (*Skills Mining Review*, 1997).

Total production from the property since its opening in May 1993 was 1,894,000 short tons, averaging 8.9 percent copper and 0.10 ounces per ton (opt) of gold. Three different ores were produced—400,000 tons of direct smelting copper ore (averaging more than 20% copper metal), 150,000 tons of gold-bearing gossan ore (averaging more than 0.25 opt gold), and a copper-rich milling ore (averaging approximately 9% copper metal). The direct smelting ore and the gossan were processed at Noranda's Horne smelter in Rouyn, Quebec; the copper milling ore was sent to Falconbridge's Kidd Creek smelter in Timmins, Ontario. The Flambeau Mining Company estimates that copper-bearing resources totaling 2 million to 3 million tons and averaging 2 to 3 percent copper remain. Average daily employment at the Flambeau Mine over the four years of operation was about 70 persons. In accordance with the Local Agreement, at least 75 percent of these employees were from the local Rusk County area.

Reclamation of the site has begun; the ultimate objective is to return the site to its approximately original condition. The open pit has been backfilled with waste rock, which was mixed with crushed dolomite to help prevent acid-generation in the waste. Topsoil saved during preparation of the site for mining has been placed on the land surface, and vegetation restoration is underway. Buildings constructed on the mine site are still in place, and discussions with local officials regarding alternative uses of these buildings and other potential uses of the site are continuing.

Net proceeds tax payments by Flambeau Mining Company

In 1996, Flambeau Mining Company paid \$6.4 million in mining net proceeds taxes for the 1995 tax year.¹ In addition, Flambeau Mining Company made payments based on Flambeau Mine's net proceeds totaling \$419,000 directly to three local units of government, in accordance with a Local Agreement. These additional payments raised the Flambeau Mining Company's total net proceeds tax-related payments to \$6.828 million. In 1997, Flambeau Mining Company paid a total of \$1.718 million, including \$1.071 million directly to the state of Wisconsin and an additional \$647,000 to the three local units of government, as required by the Local Agreement (table 2).

Crandon zinc-copper mine proposal

The Crandon Project is a proposed 5,500-ton per day underground mine for development of primarily zinc and copper metal from a 55-million ton volcanogenic massive-sulfide orebody, located 3 miles south of the city of Crandon in Forest County. This deposit was discovered in 1975 by Exxon Coal and Minerals Company. Permitting activities for the initial Crandon Mine proposal were suspended in late 1986, but were resumed for the current proposal in the early 1990s. The current proposal was developed by the Crandon Mining Company, a 50-50 partnership between Exxon Minerals Co. and Rio Algom Ltd.

Crandon Mining Company continued to pursue necessary permitting activities and completion of the company's Environmental Impact Report for the Wisconsin Department of Natural Resources (DNR) during 1996 and 1997. Much of the work focused on the evaluation of potential impacts of the project on the local groundwater and surface-water systems in the immediate area of the proposed underground mine.

The role of federal agencies in evaluating the Crandon Mine proposal received additional attention in 1996 and 1997. The U.S. Army Corps of

¹ Sixty percent of the net proceeds tax payment is paid directly to the Mining Investment and Local Impact Fund—50 percent for programs of financial support to communities impacted by metallic mineral development activity and 10 percent to a project reserve fund. The Mining Impact Fund is managed by a gubernatorial-appointed board responsible for distribution of funds in accordance with the statutes and administrative rule, Tax 13; the project reserve fund is used to assist communities adversely affected by mine closings. The remaining 40 percent of the net proceeds tax payment supports a mining damage claims fund (4%) and the state treasury (36%).

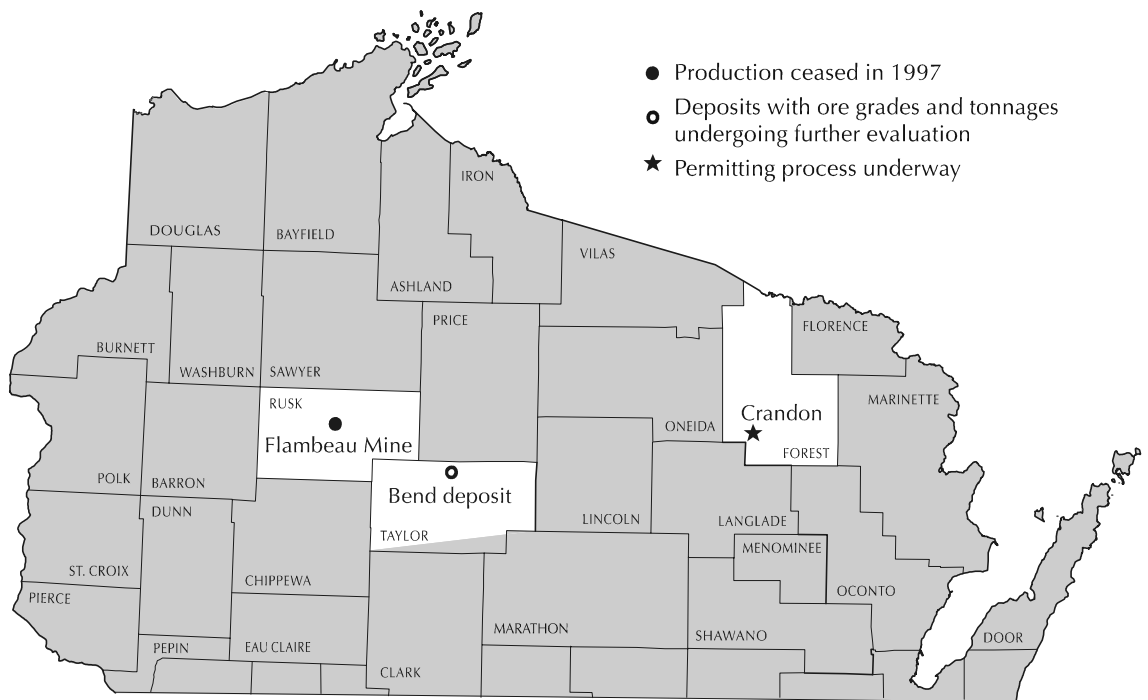


Figure 1. Sites of major metallic mineral projects in Wisconsin.

Engineers is preparing a Federal Environmental Impact Statement about the project to support the decision of the Corps concerning a permit for proposed wetland dredging and filling—a permit that would be needed if the mining project were to proceed. The U.S. Environmental Protection Agency, as a result of the federal government’s trust responsibilities related to Native American groups in the vicinity of the proposed mine, continued to play a role in the evaluation of the po-

tential impacts of the proposed mine project on the Upper Wolf River, Swamp Creek, and Pickerel Creek watersheds.

Significant public discussion regarding the mine proposal also continued with much of the public attention focused on the proposed 38-mile-long mine-wastewater pipeline and the proposed discharge of the treated wastewater into the Wisconsin River, the construction of a tailings management area to contain 44 million tons of

Table 2. Payments related to Flambeau Mine, 1996 and 1997. (Values in millions of dollars. Source: Flambeau Mining Company via Kennecott Energy Company.)

	State of Wisconsin	Rusk County	City of Ladysmith	Town of Grant	TOTAL
1996 Flambeau Mine net proceeds tax payment	\$6.409				\$6.409
1996 required direct payments by state of Wisconsin to local units of government	(\$0.842)	\$0.536	\$0.153	\$0.153	
Additional payments by FMC in 1996 per Local Agreement		\$0.267	\$0.076	\$0.076	\$0.419
1996 TOTAL	\$5.567	\$0.803	\$0.229	\$0.229	\$6.828
1997 Flambeau Mine net proceeds tax payment	\$1.071				\$1.071
1997 required direct payments by state of Wisconsin to local units of government	(\$0.641)	\$0.329	\$0.156	\$0.156	
Additional payments by FMC in 1997 per Local Agreement		\$0.491	\$0.078	\$0.078	\$0.647
1997 TOTAL	\$0.430	\$0.820	\$0.234	\$0.234	\$1.718

Table 3. Mineral leasing activity in 1996 and 1997, in acres, by county¹.

County	1996		1997	
	Leased	Released	Leased	Released
Clark	778.8		565.25	
Eau Claire	40.0			
Forest	3,377.5	480.0	40.0	1,693.2
Florence	1,320.0	1,360.0		1,400.0
Jackson	1,574.3		1,686.9	
La Crosse	1,545.0			
Lafayette	600.0			600.0
Lincoln	3,136.17		40.0	719.32
Marinette				160.0 ²
Oconto				80.0
Oneida		2,419.0		
Outagamie				54.56
Taylor		160.0		
Trempealeau	801.0			
TOTAL	12,394.02	4,419.00	2,252.15	4,707.08

¹ Other counties surveyed for 1996 and 1997 leasing activity include Chippewa, Iron, Kewaunee, Langlade, Marathon, Price, Rusk, and Vilas. No recorded mineral leasing activity occurred in these counties during these years.

² Diamond exploration lease between Ashton Mining Co. and the county of Marinette.

sulfidic tailings, and the transfer of groundwater from the Great Lakes watershed to the Mississippi River watershed as a result of discharge of treated mine wastewater into the Wisconsin River. To further respond to public interest in the proposed mine, the DNR held a series of eight meetings in northern Wisconsin and prepared question-and-answer documents for each meeting.

In 1996 and 1997, Crandon Mining Company continued to develop and sign local agreements with the local governmental bodies in the area. To date, local agreements have been signed with the towns of Nashville and Lincoln, the city of Crandon, and Forest County. Efforts to pursue agreements with Oneida County and the town of Crescent regarding the development and routing of the proposed wastewater pipeline from the mine were on hold at the end of 1997.

In early 1998, as this report was being prepared, the Crandon Mining Company partnership between Exxon Minerals Company and Rio Algom, Ltd. was terminated by the sale of Exxon's interests in the partnership to Rio Algom. Subsequently, Rio Algom formed the Nicolet Minerals Company to continue the permitting and environ-

mental assessment activities related to the Crandon Mine proposal.

BHP Minerals activities

BHP Minerals International, Inc. conducted exploration programs in Lincoln and Forest Counties in 1996 and 1997. Of particular note was BHP's evaluation of target(s) in the Bishop Lake area of the town of Nashville, Forest County. Permission to conduct the exploration had been denied by the Town Board, pursuant to authority it claimed under town ordinances related to exploration for metallic minerals. BHP appealed the denial of the exploration permit to the Board of Adjustments, asserting that the denial was outside the proper exercise of town authority as defined in the ordinance in question. The BHP won its appeal and the exploration permit was subsequently issued.

In December 1997, BHP announced the closing of its exploration offices in Rhinelander, Wisconsin. Review of leases extant at the time indicates that the company is moving to release lands currently under lease.

Noranda terminates lease on Lynne site

In August 1997, Noranda Exploration Inc. filed notice of its intent to release its rights to 2,419 acres of county-owned land in the town of Lynne in west-central Oneida County. The land had been under lease following Noranda's successful bids on four sections of land in the Oneida County competitive metallic mineral lease sale held in May 1989. In January 1990, Noranda had announced the discovery of a zinc-rich mineral deposit on this land.

METALLIC MINERAL LEASING AND EXPLORATION ACTIVITY

Tables 3, 4, 5, and 6 include data for 1996 and 1997 related to mineral leasing and metallic mineral exploration (drilling).

Mineral leasing and exploration, 1996

The major mineral leasing effort in 1996 was the leasing of more than 4,000 acres of private mineral rights in west-central Wisconsin by the Flambeau Mining Company (table 3). The focus on this part of the state was the result of new airborne electromagnetic survey data collected by the Flambeau Mining Company. These leases were to be supplemented by the leasing of public lands,

Table 4. Summary of metallic mineral exploration in Wisconsin, 1993–97. (Source: Wisconsin Department of Natural Resources.)

	1993	1994	1995	1996	1997
Companies licensed to drill ¹	8	9	10	9	9
Newly licensed companies	2	2	1	0	0
Companies conducting drilling programs	4	5	3	3	3
Counties with drilling activity	5	8	5	8	3
Total holes drilled	18	26	30	14	10
(development drilling) ²	(10)	(14)	(14)	(1)	(1)
Total footage drilled	10,492	34,499	28,809	10,330	7,983
(development drilling)	(4,493)	(23,426)	(6,505)	(691)	(1,098)
Total bedrock footage	7,405	31,653	25,635	8,278	6,988
(development drilling)	(3,543)	(21,658)	(5,836)	(542)	(985)

¹ An exploration license for metallic minerals may be obtained at any time, but expires July 1st. These totals include companies licensed for all or part of the indicated calendar year.

² Numbers in parentheses refer to drilling at known mineral deposits, also known as development drilling. Totals include figures shown for development drilling.

particularly in Jackson, Clark, and Eau Claire Counties. However, the county boards in all three counties rejected lease offers by the company during the year.

Other activity of note includes 1,440 acres of mineral rights sold to Crandon Mining Company by Connor Forest Industries (which previously had held royalty interests in the Crandon deposit) and the leasing of more than 6,000 acres of mineral interests by BHP in Lincoln, Forest, and Florence Counties.

Exploration activity for 1996 was low—only 14 drillholes in eight counties (table 4). One hole was drilled on the Bend copper–gold volcanogenic massive-sulfide deposit in Taylor County.

Mineral exploration and leasing, 1997

Leasing of minerals in 1997 declined sharply overall, although leasing of private land in Jackson County by Flambeau Mining Company was significant. The major activity was the releasing of much of the acreage previously held by BHP in Forest, Lincoln, and Florence Counties (table 5).

Exploration activity in 1997 dropped to only 10 drillholes; 8 of those were centered on targets in the town of Butler in Clark County. As in 1996, one drillhole was constructed on the Bend deposit in Taylor County.

Activity on federal lands in Wisconsin in 1996 and 1997

Sharpe Resources Corporation and Royal Standard Minerals, Incorporated are successors to the pref-

erence right lease application filed in January 1991 by Cyprus Gold Exploration Co. This lease application relates to the Bend deposit, a volcanogenic massive-sulfide deposit containing quantities of copper and gold. The Bend was discovered in the Chequamegon National Forest near Perkinstown in Taylor County in 1985. In addition to the permit related to the Bend preference right lease application, five other prospecting permits in the vicinity are currently active and an additional six prospecting permit applications have been made.

In addition to prospecting permits related to the Bend deposit, three other prospecting permits are currently active on federal mineral holdings in Wisconsin, including two in Forest County and one in Florence County (Nicolet National Forest). Two prospecting permit applications were filed in 1997 on other federal mineral holdings in the Chequamegon National Forest in Price County.

ACTIONS WITH POLICY IMPLICATIONS

Activity of the Wisconsin Legislature

Legislative activity in 1996. In 1996, two laws affecting metallic mineral development were enacted. The 1995 Wisconsin Act 227 resulted in the renumbering of several Wisconsin statutes related to environmental protection, particularly within former Chapter 144, Wis. Stats. No changes of substance were authorized in Act 227, and the laws affecting metallic mineral development were renumbered and restructured into a new Chapter

Table 5. Metallic mineral exploration in 1996 and 1997, by county and company.

		1996		1997	
		Drillholes	Length (ft)	Drillholes	Length (ft)
Company	BHP Minerals	3	4,133	1	682
	Flambeau Mining Co.	8	3,680	8	6,203
	Sharpe Resources Corp.	3	2,517	1	1,098
TOTAL		14	10,330	10	7,983
County	Clark	2	1,406	8	6,203
	Forest	2	2,118	1	682
	Jackson	2	886	0	0
	Lafayette	2	690	0	0
	Lincoln	1	2,015	0	0
	Price	2	1,826	0	0
	Taylor	1	691	1	1,098
	Trempealeau	2	698	0	0
TOTAL		14	10,330	10	7,983

293. The 1995 Wisconsin Act 311 modified the duration of time required to maintain proof of financial responsibility for long-term care of a mining waste facility. Under Act 311, an owner of a mining-waste facility may apply at any time 40 years after the closing of the facility for departmental approval to terminate the need to maintain proof of financial responsibility for long-term care. Such application would constitute a formal notice and initiate a process that could lead to a formal hearing on the application.

Legislative activity in 1997. In 1997, significant public debate and legislative activity focused on Senate Bill 3, which was characterized by supporters and opponents alike as the mining moratorium bill. It would create an additional condition related to the issuance or rejection of a metallic mineral operating permit, such that a permit applicant must demonstrate that a similar mine has operated for at least 10 years and a similar mine has been reclaimed for at least 10 years without causing environmental pollution. The bill stimulated considerable controversy and was the focus of several meetings and hearings and extensive media/editorial coverage. The bill was eventually amended, passed, and sent to the Governor for action in early 1998.

Other legislation awaiting action at the end of 1997 included 1) Assembly Bill 22 (prohibiting the discharge of wastewater from the mining of an orebody containing metals and sulfide minerals into the Wisconsin River or any of its tributaries);

2) Assembly Bill 123 (relating to groundwater standards for mining activities and mining-waste facilities and specifically making metallic mining operations subject to the state's more general groundwater law); 3) Assembly Bill 236 (providing for two additional findings by DNR regarding a mining-permit decision related to the existence of proven technology to ensure the mine will comply with Wisconsin's environmental standards and that the mine as proposed will use that technology); 4) Senate Bill 342 (relating to a variety of requirements, most notably affecting the application of existing Local Agreement statues to local governments potentially affected by a proposed mine); 5) Assembly Bill 447 (relating to details of the enforcement of certain environmental laws regulating metal mining and water pollution); 6) Assembly Bill 488 (relating to the collection of fees for proposed prospecting and mining operations and the timing of such collection of fees); 7) Assembly Bill 586 (affecting several additional requirements for the consideration of a metallic mining permit application), and 8) Assembly Bill 643 (restricting the conditions under which the DNR may consider the construction of a pipeline for transporting mine discharge within the right-of-way of highways). None of these bills, with the possible exception of AB 488, was likely to receive favorable consideration.

Senate Resolution 3 was introduced late in 1997 and would require the Attorney General to appear as a party-in-interest in any administrative

or judicial proceeding related to a proposed metal mine. The resolution would direct certain activity of the Attorney General pursuant to Section 165.25, Wis. Stats. Senate Resolution 3, if adopted, would have the effect of recreating the Office of the Public Intervenor, in concept if not in name. The Office of the Public Intervenor had been eliminated in the previous biennial budget adopted by the Legislature in mid-1994.

Activity in the Executive Branch

Wisconsin Science Advisory Council created. In April 1977, Governor Thompson signed Executive Order 309 creating the Wisconsin Science Advisory Council. The council's responsibilities include evaluation of technologies proposed by potential metallic mining operators for the reduction or elimination of environmental impacts for proposed metallic mining projects in Wisconsin. The five-member council serves as an advisory body to the Secretary of the DNR. The Council makes recommendations regarding proposed technologies and identifies technologies effective in reducing or eliminating environmental degradation. Their recommendations must be incorporated into mining-related environmental impact statement preparation and permit decisions of the DNR.

Administrative rules development. In response to a July 1996 petition from several Wisconsin legislators, the DNR initiated a process leading to proposed modifications of two chapters of administrative rules regulating metallic mineral development in Wisconsin.

A proposed modification of NR 132 was the creation of an irrevocable trust fund to be financed by a mining operator. The proposal would provide for funds to cover certain remedial actions and preventative measures taken to avoid adverse environmental consequences related to a proposed mining operation. The money in the trust fund can be used for such purposes only if the mining operator is 1) not under a legal obligation to pay for the actions or preventative measures separately, 2) is not already funded under other obligations of the mine operator, or 3) the mine operator is financially incapable of paying for such costs even though legally obligated to do so. The size and funding of the irrevocable trust would be created on the basis of testimony

Table 6. Metallic mineral exploration licensees, 1996 and 1997¹. (Source: Wisconsin Department of Natural Resources.)

License number ²	Company
28	BHP Minerals International, Inc.
30	Flambeau Mining Company
33	Phelps Dodge Exploration East, Inc.
34 ³	Cominco American Resources, Inc.
36	Cyprus Amax Minerals Corporation
37	Crandon Mining Company
38	Kennecott Exploration Company
39 ⁴	Sharpe Resources Corporation
40	Zavco Inc.

¹ Companies listed were licensed to explore for metallic minerals in Wisconsin for 1996 and 1997, except as noted below.

² License numbers not listed represent licenses issued previously to companies that did not renew their licenses for any part of the 1996 or 1997 calendar years.

³ Sharpe Resources was not licensed for the period 7/1/96 through 6/30/97.

⁴ Cominco American did not renew its license for the last half of 1997.

provided at the Master Hearing. At the end of 1997, the proposed NR 132 rule changes had been reviewed by the Legislature and additional modification (providing for a "floor" or base amount related to the amount of waste material created by the proposed mine) were being considered.

A proposed modification to NR 182 addressed the petitioners' request for a re-evaluation of the approach used to determine impacts of metallic mines and related metallic mine waste facilities on groundwater. The 1,200-foot compliance boundary, defining a design management zone, was retained, but a 150-foot "mandatory intervention boundary" was created, which would define a monitoring boundary at which DNR action on potential exceedances of groundwater standards is automatically required. This proposed rule change was under Legislative review at the end of 1997 and was expected to receive approval early in 1998.

The DNR reconstituted the Metallic Mining Council, a nine-member advisory group to the DNR representing the mining industry, environmental groups, Native American interests, and the scientific community for assistance in developing and evaluating the proposed changes to NR 132 and NR 182. The council met several times in

1997 and was generally supportive of the proposed changes. These changes were approved by the Natural Resources Board of the DNR and passed along to the Legislature for further review and comment.

Mining Investment and Local Impact

Fund Board. The Mining Investment and Local Impact Fund Board within the Wisconsin Department of Revenue met in 1996 and 1997 to consider issues and applications related to the distribution to local communities of funds collected under Wisconsin's net proceeds tax on metallic mining operations.

In 1996, the Mining Board approved a \$4.672 million emergency grant request from the city of Ladysmith (\$1.8 million of this emergency grant was later rescinded.) Out of more than \$4 million in applications, the Mining Board granted \$1,065,330 to the city of Ladysmith (funds from the project reserve fund), \$473,100 to Rusk County (funds from the project reserve fund), \$160,000 to the city of Crandon, \$142,856 to Forest County, and \$27,000 to the city of Tomahawk (the latter three disbursements from the discretionary grant account). The Mining Board also approved a second emergency grant (\$750,000) to the city of Ladysmith.

In 1997, following payment of the 1996 net proceeds taxes by Flambeau Mining Company, the Mining Board had a balance of approximately \$548,000 in its Discretionary Grant account and \$228,000 in its Project Reserve Fund. From 12 applications involving 10 units of government, the Board voted to grant \$180,000 from the project reserve fund to the city of Ladysmith for costs related to Flambeau Mine site re-use, and from its discretionary grant account, \$16,500 to the city of Platteville, \$82,350 to Forest County, \$81,220 to the town of Nashville, and \$22,000 to the town of Lincoln.

Activity in the courts

In 1997, the District III Court of Appeals overturned a 1995 ruling in *Rusk County Citizen Action Group, Inc. v. Wisconsin Department of Natural Resources* that had sought judicial guidance on the DNR's authority to enact an administrative rule banning sulfide mining. (The DNR had previously argued that it lacked such authority, and this ruling by the Natural Resources Board was ap-

pealed to the Circuit Court of Rusk County, where the court ruled in favor of the petitioners.) The District III Court reversed the previous judgment citing the Metallic Mining Reclamation Act (now, Chapter 293, Wis. Stats.), which delineates departmental authority to regulate metallic mining through the establishment of standards and a permit process on a case-by-case basis. The Court held that petitioners' argument supporting authority for an outright ban of sulfide mining was inconsistent with the previously adopted Mining Act. Appeal of the District Court's decision to the State Supreme Court was denied, and the appeals court decision was allowed to stand.

NONMETALLIC MINERAL DEVELOPMENTS

Statewide regulation of nonmetallic mining reclamation

A statewide program to require reclamation of nonmetallic mining operations in Wisconsin, first mandated by action of the Legislature in 1994, moved closer to enactment in 1996 and 1997. A proposed administrative rule, NR 135, had been the subject of public hearings in 1995. Negative comments at these hearings and comments of other parties interested in or affected by the regulations led the DNR to withdraw and revise the rules and propose statutory changes necessary to implement the revised rules. The Technical Advisory Committee on Nonmetallic Mining Reclamation and the Nonmetallic Mining Council met jointly to develop the new rules and the required statutory revisions. The revised rule was subsequently developed and necessary statutory language changes adopted in the biennial budget bill. The same budget bill terminated the Nonmetallic Mining Council, but DNR maintained the technical advisory group to assist it in further developing the rules. At the end of 1997, the modified rule was essentially complete with only minor changes remaining before more formal review and approval by the Natural Resources Board of the DNR and a second round of public hearings.

Diamond exploration and leasing activity

Diamonds have been receiving attention in Wisconsin in recent years. Exploration for diamonds has resulted in limited leasing of land from pri-

vate and public owners and drilling of subsurface targets in northwestern and southeastern Wisconsin. Two holes were drilled in the town of Hubbard in Rusk County (T36N, R6W, sec. 29) by Kennecott Exploration. No further activity has been reported in northwestern Wisconsin.

The evaluation of targets in the town of Pleasant Prairie in Kenosha County (T1N, R22E, sec. 6) by Crystal Exploration, Inc. of Crystal Falls, Michigan resulted in the discovery of the Six-Pak ultramafic lamprophyre diatreme (Carlson and Adams, 1997). A diatreme is a vertically oriented rock body of volcanic origin composed of broken rock fragments formed from the explosive release of volcanic gases and associated magma upwards into shallower parts of the Earth's crust. Such bodies may occasionally contain minerals indicative of formation under high temperature and high pressures, such as diamonds. The Six-Pak diatreme contains numerous small diamonds, but not in

economic concentrations. No interest for further evaluation of these diamond resources in the area is known.

In 1997, a 160-acre tract of county forest land in Marinette County was released by Ashton Mining, a Canadian firm involved in the exploration for and development of diamond resources. The parcel had been leased in 1994 to Crystal Exploration, which later assigned the lease to Ashton.

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