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FINAL REPORT

EAST RANGE MINERALS LAND-USE COMMITTEE

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MINNESOTA DEPARTMENT OF NATURAL RESOURCES

DIVISION OF MINERALS

1983

FINAL REPORT

EAST RANGE MINERALS LAND-USE COMMITTEE

**Minnesota Department of Natural Resources
Division of Minerals**

1983

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INTRODUCTION

At the eastern end of the Mesabi Iron Range, between the cities of Babbitt and Hoyt Lakes, copper-nickel resources of the Duluth Gabbro Complex abut and overlie the taconite reserves of the Biwabik Iron Formation. Located within this approximately 18-mile-long strip of land there are three active taconite mines operated by two mining companies. In addition, at least two taconite and three copper, nickel, and titanium resource areas with future mining potential exist. The East Range Area (see fig. 1) also contains significant timber, recreational, wildlife, water, and scenic resources that are valued by the public as well as by the state's recreational and timber industries.

Development of the taconite and copper-nickel resources within the East Range would require extensive land for mining, stockpiling, tailings disposal, and associated mining facilities. Such new mining activities could result in conflicts among the area's land and mineral developers, land users, local governmental units, and regulatory agencies, who have different land development needs and plans.

In anticipation of potential development problems in the East Range area, representatives of the mining industry, local and county governments, and state and federal agencies (listed below) formed the East Range Minerals Land-Use Committee (ERMLUC). By creating a forum

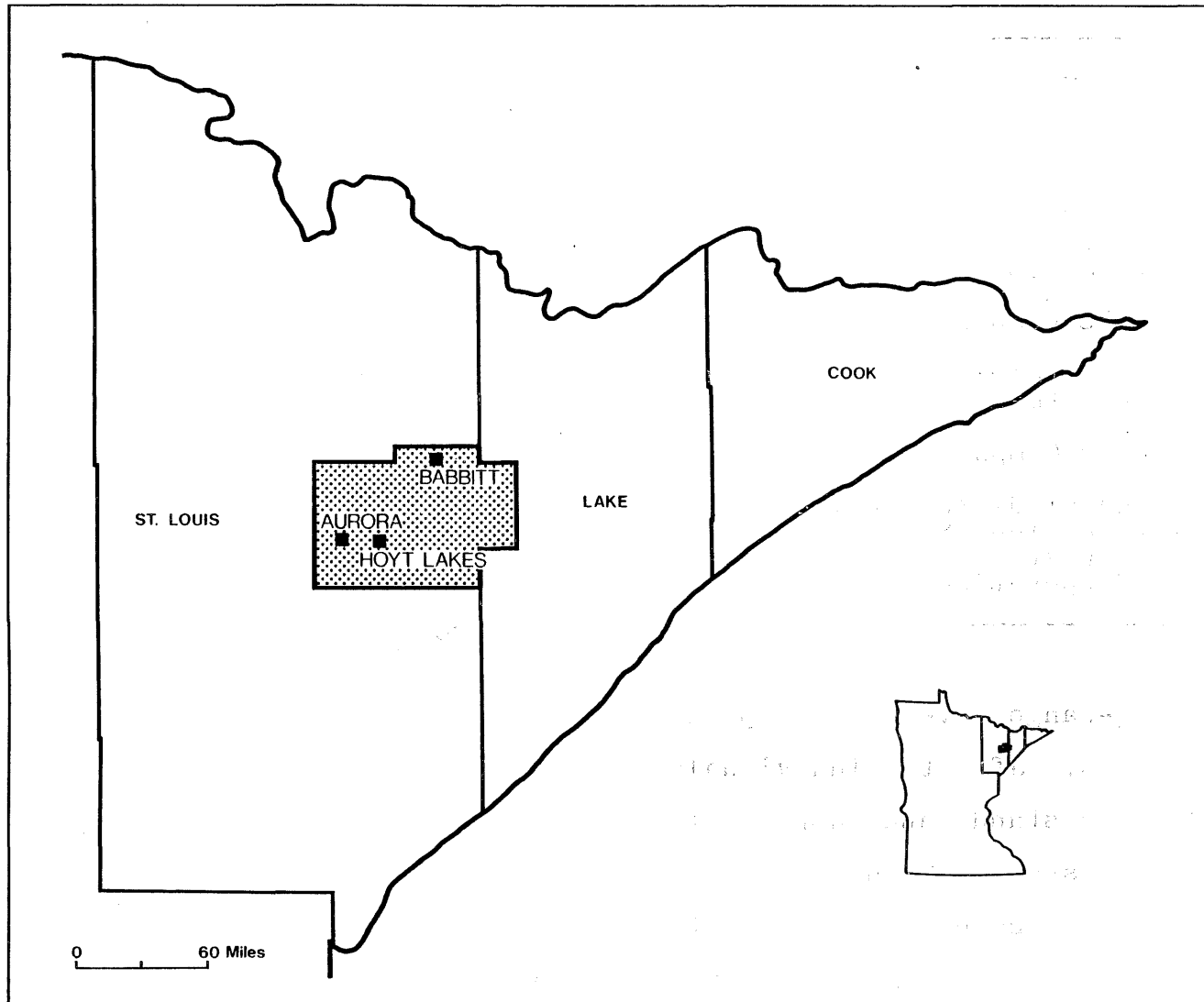


Fig. 1. East Range study area

East Range Minerals Land-Use
Committee Members

AMAX of Minnesota, Inc. (now
Kennecott Minerals Company)
American Shield Corporation
City of Babbitt
City of Hoyt Lakes
Erie Mining Company
Exxon Minerals Company
Lake County
Longyear Group (Meridan Engineering)
Minnesota Department of Natural
Resources
Reserve Mining Company
St. Louis County
U.S. Fish and Wildlife Service
U.S. Forest Service (Superior
National Forest)
U.S. Steel Corporation

to discuss long-range development plans and public needs, affected individuals can better understand and appreciate competing interests. With such an understanding, it should be easier to reach a compromise on specific land-use conflicts that arise when competing land development needs exist in a small area

such as the East Range.

The first meeting of the ERMLU Committee was held in August 1980. In subsequent meetings the committee established two goals. These were:

- (1) to identify mining and public land requirements for the area and provide this information to units of government involved in land-use planning; and
- (2) to identify areas of conflict among the mining companies and conflicts between the mining companies' and the public's land requirements.

Since the minerals in an area are not as readily visible as other resources, they have not always received adequate consideration during land-use planning. Yet, they often represent substantial

wealth to a region. Thus, in establishing the first goal, the committee's purpose was to provide the best available mining potential and mineral resource information for ongoing land-use planning. This information will allow minerals to be considered with other natural resources such as wildlife, recreation, timber, and water.

In establishing the second goal, it was not the intention of the committee to resolve the conflicting land-use needs identified. This was neither feasible nor desirable for two reasons. First, there were differences in the detail, timing, and feasibility of the development plans submitted by the mining representatives. For example, Exxon's proposal (page 28) is associated with the discovery phase of mining whereas

AMAX's and Reserve's proposals are associated with the predevelopment and operational phases of mining respectively (pages 20 and 32). Since some of the mining plans are very speculative, it would not be practical at this time to resolve conflicts that may not exist in subsequent mining plans. Second, it was felt that conflicts identified are most appropriately resolved between the affected parties during the planning of land development. Information contained in this report can be used by the parties in helping to resolve specific land-use conflicts.

To accomplish the goals of the committee, it was necessary for participants to identify their organizations' anticipated land requirements for approximately the next 50 years. Once identified,

these areas were mapped, and overlapping land requirements were identified. The tools used to accomplish this mapping project were two computerized resource inventory and analysis systems, IRIS (Iron Range Information System) and MINESITE, developed by the Minnesota Department of Natural Resources, Division of Minerals. IRIS is a detailed inventory of natural resources on the Mesabi Iron Range. MINESITE is a similar inventory for the copper-nickel resource area. The majority of the East Range Study Area falls within one or the other of these inventory systems. By combining these two systems and entering the land requirements of the committee members, tables and maps were produced to illustrate land requirements and areas of conflict.

Two types of computer-generated maps are included in this report: a greytone set in the appendix and a colored set in the text. The greytone maps, at a scale of approximately one inch = one mile, provide detailed information on mining and other land-use proposals in the study area. Included with each map is an interpretive legend. The terms used in the legend are defined as follows:

Symbol: The department's computer mapping system uses an assortment of geometric patterns (symbols) to represent map features. Each map symbol represents approximately 2.5 acres, or 1 hectare, of land.

Description: Describes the map feature each symbol represents.

Data Level: For a given map, each symbol is assigned a number called a data level. This number is used for bookkeeping and computer manipulation. It also provides an easy way to discuss a map since each of its symbols has a number by which it can be identified.

Frequency: The number of 2.5 acre (hectare) cells on the map that are represented by a particular symbol (data level).

Percent: Percent of the map that is represented by a particular symbol (data level).

Acres: Number of acres on the map that are represented by a particular symbol (data level).

The colored maps contained in the text of the report correspond to the maps of the appendix but contain less detail. Because of the limited number of colors available, not every greytone symbol could be assigned a corresponding color. Therefore, some greytone symbols (data levels) were combined and assigned a single color. For example, the greytone Mineral Potential map (A-1) distinguishes between areas with 0.50% or greater copper mineralization and areas that contain near-surface copper mineralization that is greater than 0.25% but less than 0.50% copper. However, the colored Mineral Potential Map (page 11) combines these two types of mineralization and identifies them only as zones containing .25% or greater

copper. Thus, the colored maps, while easier to read, do not provide as much detail as the greytone maps. In some instances the greytone maps contain too much information to be simplified, and corresponding colored maps are not included.

For a general understanding of land-use issues in the East Range Area the reader can use the colored maps found in the text. For a more detailed understanding, the reader is referred to the maps in the appendix.

MINERALIZATION AND OWNERSHIP

Mineral Potential

The Mineral Potential maps (map on page 11 and map A-1 in the appendix), prepared by the DNR, present resource data on taconite, copper-nickel, and titanium. The resource analysis is based on three computer models that have been described by Brice.¹ The maps provide an overview of mineral resources in the study area and are based on the best available information.

The taconite resource information presented includes the Biwabik Iron Formation (BIF), the northern and southern ultimate pit limits as defined by

¹Brice, William C. 1981. An analysis technique for mineral resource planning. PhD Thesis, University of Minnesota.

Marsden², and the existing mine pits.

The taconite resource area is large (approximately 35 square miles) and can accommodate substantial future mining. South of the BIF, drilling has disclosed a large copper-nickel resource and a smaller titanium resource. Areas of most potential and possible potential copper-nickel resources are identified.

In addition to resource information, the maps show a three-mile buffer zone around the known resources. The three-mile buffer identifies those lands that could be in highest demand for mine

²Marsden, R. W. October 1977. Iron ore reserves of the Mesabi Range, Minnesota -- a minerals availability system report. U.S. Bureau of Mines, Denver.

facility use. For example, waste stockpiles, because of haulage costs, should be as close to the mines as possible.

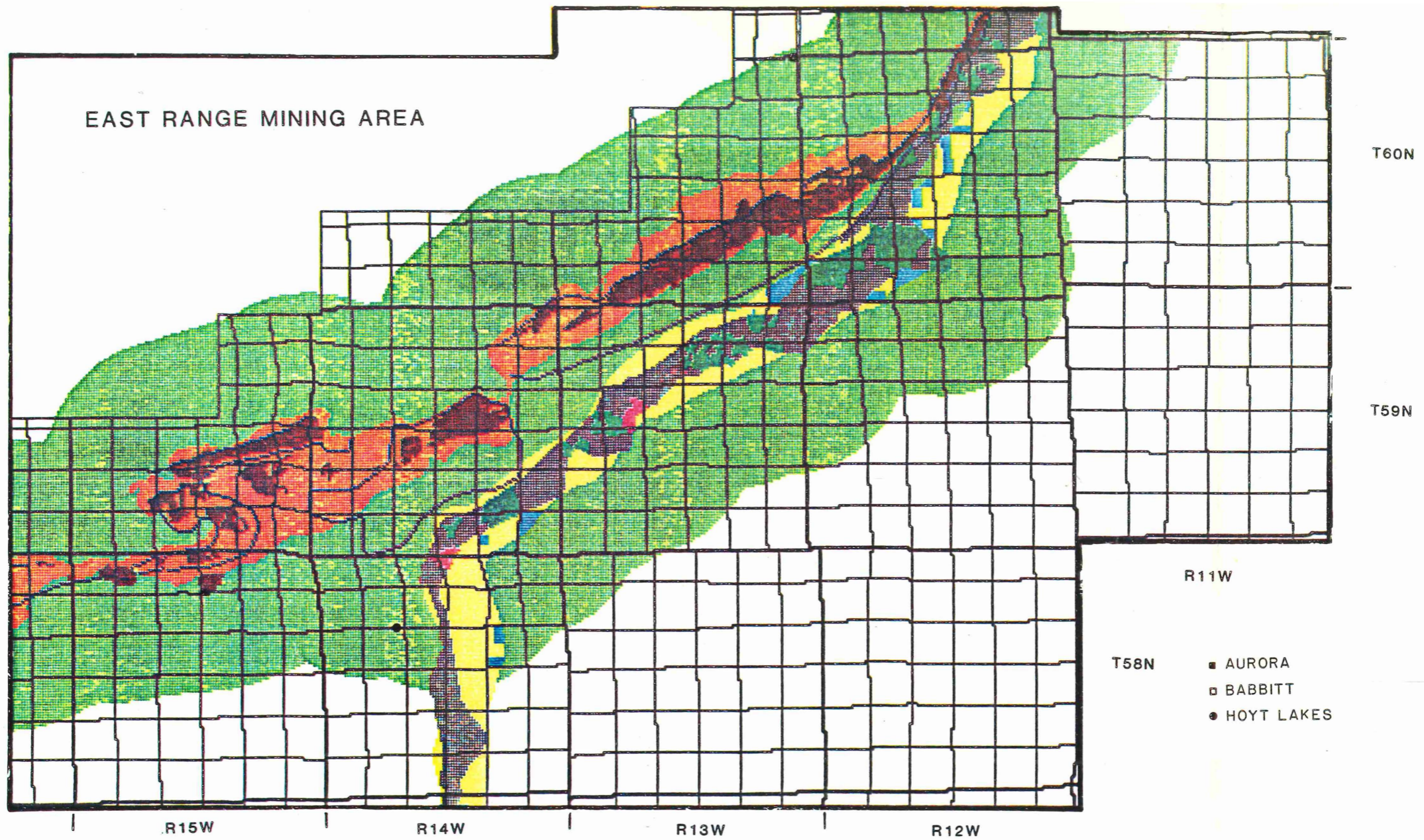
The greytone map (A-1) distinguishes between the near-surface copper-nickel and higher-grade copper-nickel resources plus the titanium resources as identified by drilling.³ Potential also exists for additional copper-nickel resources within areas that have not been drilled. This potential is based on a maximum depth of 3,000 feet (to the base of the Duluth Complex) and geologic and leasing data and is identified on the map as most, major, and possible under-

ground or open-pit copper-nickel resource.⁴

⁴Brice.

³Listerud, W. and D. Meineke. 1977. Mineral resources of a portion of the Duluth Complex and adjacent rocks in St. Louis and Lake counties, northeastern Minnesota. Report 93. Minnesota Dept. of Natural Resources, Division of Minerals, Hibbing, Minn.

EAST RANGE MINING AREA



MINERAL POTENTIAL

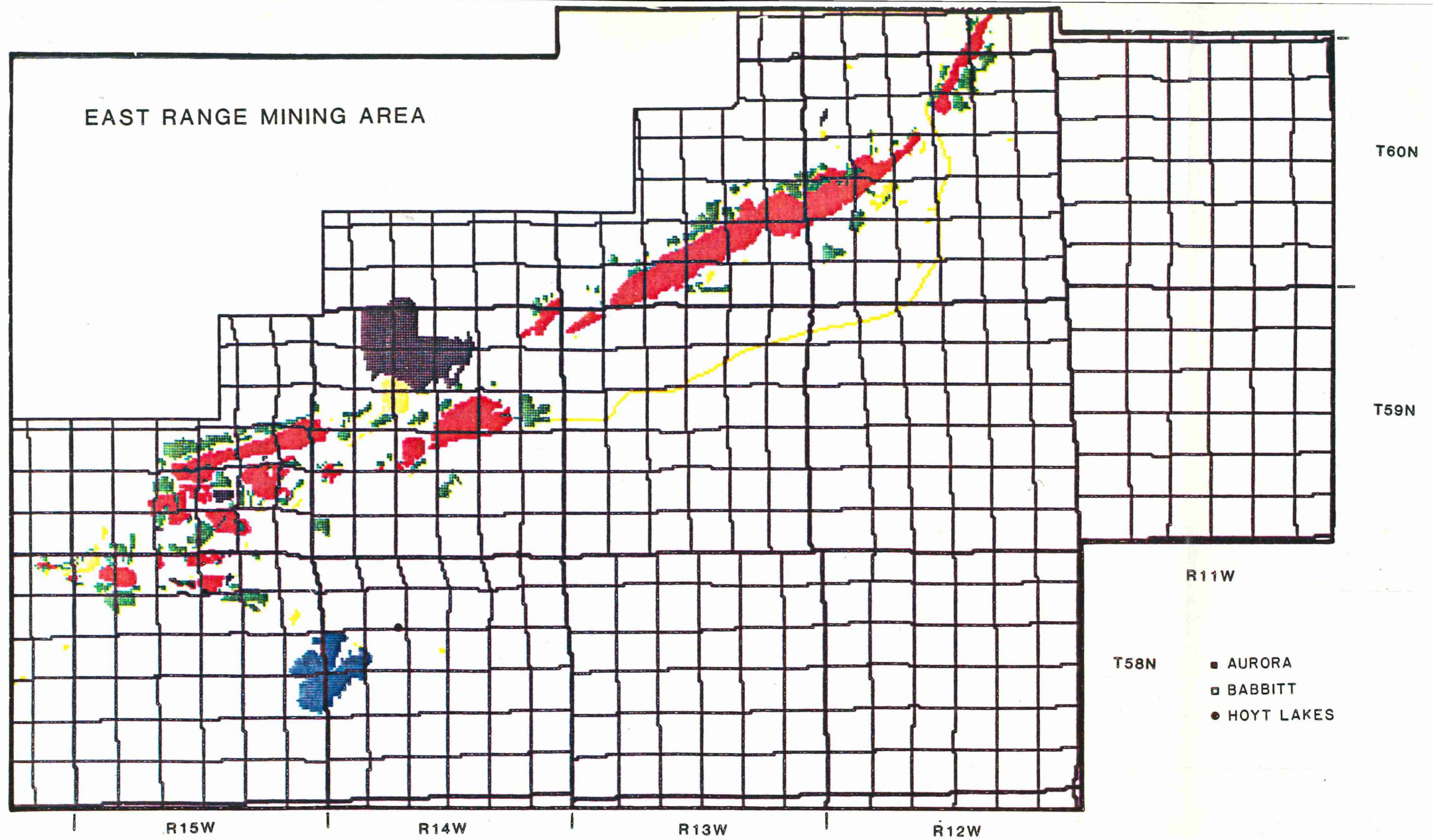
SYMBOL	COUNT	PERCENT	ACRES	LEGEND	
■	0	76812	53.8	192030.0	NO DATA
■	1	3993	2.8	9982.5	NON-MINERALIZED POLYGOON
■	2	1526	1.1	3815.0	.25 CU OR GREATER
■	3	121	0.1	302.5	10 PERCENT TIO2 OR GREATER
■	4	469	0.3	1157.5	MOST POTENTIAL CU-NI

SYMBOL	COUNT	PERCENT	ACRES	LEGEND	
■	5	3731	2.6	9327.5	POSSIBLE POTENTIAL CU-NI
■	6	2803	2.0	7007.5	EXISTING OPEN PIT TACONITE
■	7	6140	4.3	15350.0	BIWABIK IRON FORMATION
■	8	991	0.7	2477.5	MARSDEN'S PIT LIMIT
■	9	46278	32.4	115697.5	3 MILE BUFFER

Existing Mining

The maps of existing mining facilities (facing page and A-2) show that the area between Hoyt Lakes and Babbitt supports an intensive mining industry. Auxiliary mining facilities cluster themselves near the resource because of the high costs of transporting rock, ore, and overburden, putting a premium on land surrounding known mineral reserves or resources. The colored map on the facing page identifies auxiliary mining lands as well as reservoirs, pits, stockpiles, tailings basins, and caved areas. The greytone map in the appendix (A-2) provides more detailed information on auxiliary mining lands and stockpiles.

EAST RANGE MINING AREA



EXISTING MINING

	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	135679	95.0	339197.5	NO DATA
	1	559	0.4	1397.5	AUXILIARY MINING
	2	551	0.4	1377.5	RESERVOIR
	3	3000	2.1	7500.0	OPEN PIT
	4	2011	1.4	5027.5	STOCK PILE
	5	1043	0.7	2607.5	TAILINGS BASIN
	6	16	0.0	40.0	CAVED AREA

- AURORA
- BABBITT
- HOYT LAKES

Surface Ownership

The map in the appendix (A-3) shows the diverse ownership pattern in the study area. Surface owners include the mining industry, timber companies, the federal government, the counties, and the State of Minnesota. Control of surface lands is essential to mining as well as to other types of development.

When a developer does not control the surface rights, a land exchange, purchase, or lease is usually required. With federal or state lands a land exchange is usually required because of legal restraints on the sale or lease of land. County lands are often sold, although they also may be exchanged. The process of developing a land package can be complicated and lengthy because the needs of each individual must be

protected in the transaction.

Mineral Ownership

Control of mineral rights through ownership or lease is a prerequisite to mining. In the study area there is a complex mixture of private ownership along with significant holdings by the mining industry, the State of Minnesota, and the federal government (see A-4). The state's minerals include those on county tax-forfeited land, which are owned by the state in trust for the counties.

In many instances the mineral rights are severed from the surface rights, which results in different surface and mineral owners. This further complicates ownership patterns. Separate ownership can result in a use of the surface in such a

manner that it precludes the development of the minerals beneath. For example, stockpiling on lands with open-pit mining reserves may preclude development of the resource because of the added cost of stockpile removal in the future when mining could occur. This situation has led to the practice of stockpiling similar or better quality materials over underlying resources when stockpiling on resources is unavoidable.

LAND-USE NEEDS

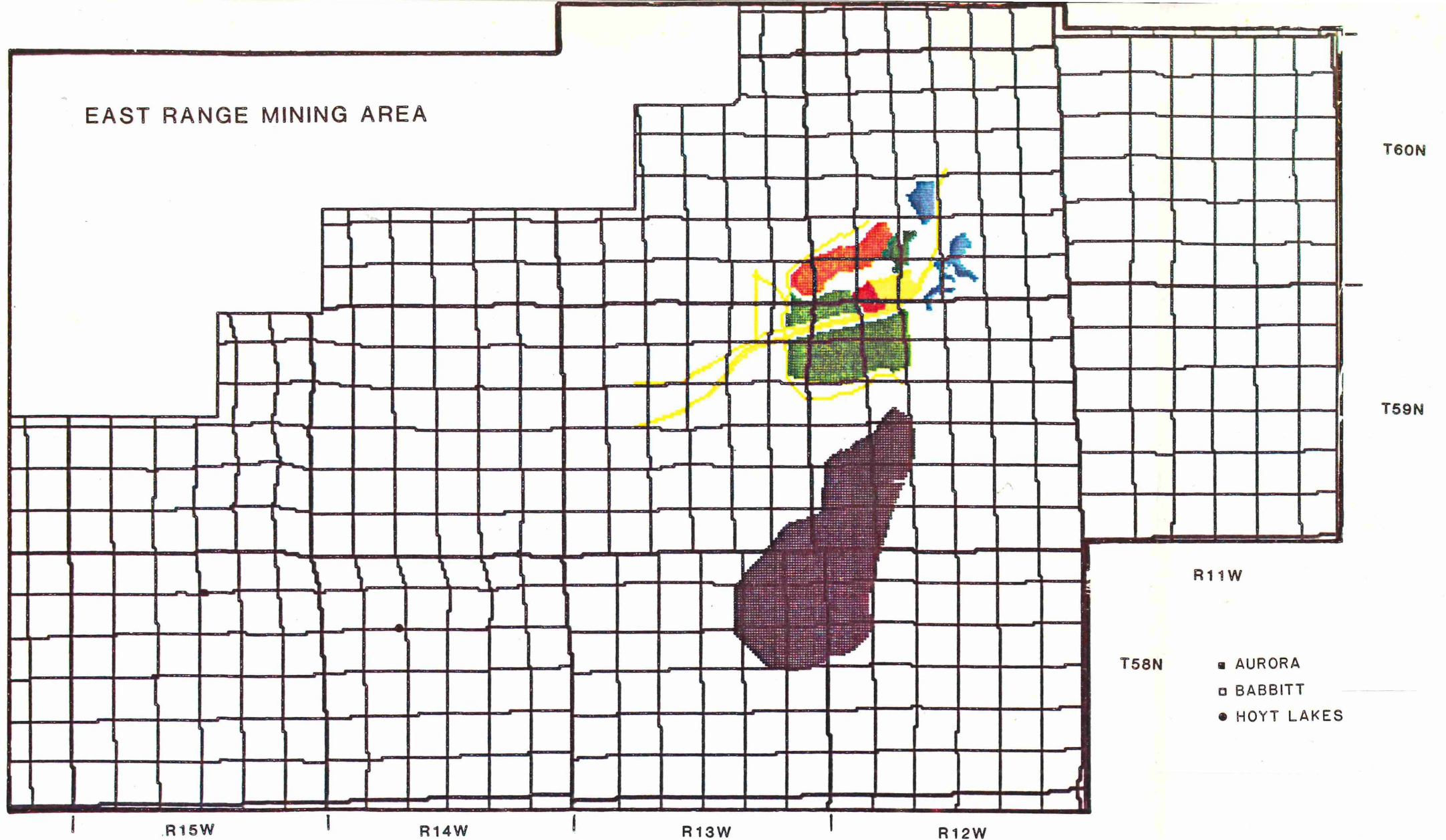
Mining Company Maps

The following maps were generated from information submitted by the mining companies represented on the East Range Minerals Land-Use Committee. Although there are differences in detail, feasibility, and timing of the development plans, the maps are useful in obtaining an understanding of future mining land needs in the study area.

AMAX

The maps on the facing page and in the appendix (A-5) are a conceptual layout of the 40-year land requirements for a possible operation envisioned to produce 100,000 tons of copper annually. The operation consists of an open-pit mine (1,000 acres), an underground mine, a concentrator, and a smelter, as well as the infrastructure required to support such an operation. Locations are represented diagrammatically and in some instances (such as the tailings disposal area) do not represent the preferred alternative. Approximately 15,000 acres of land would be required for the major facilities and waste storage areas. Additional land would be required for power, highways, and railway-spur corridors. The total area that would be

involved at the end of the operation would be about 25,000 acres.



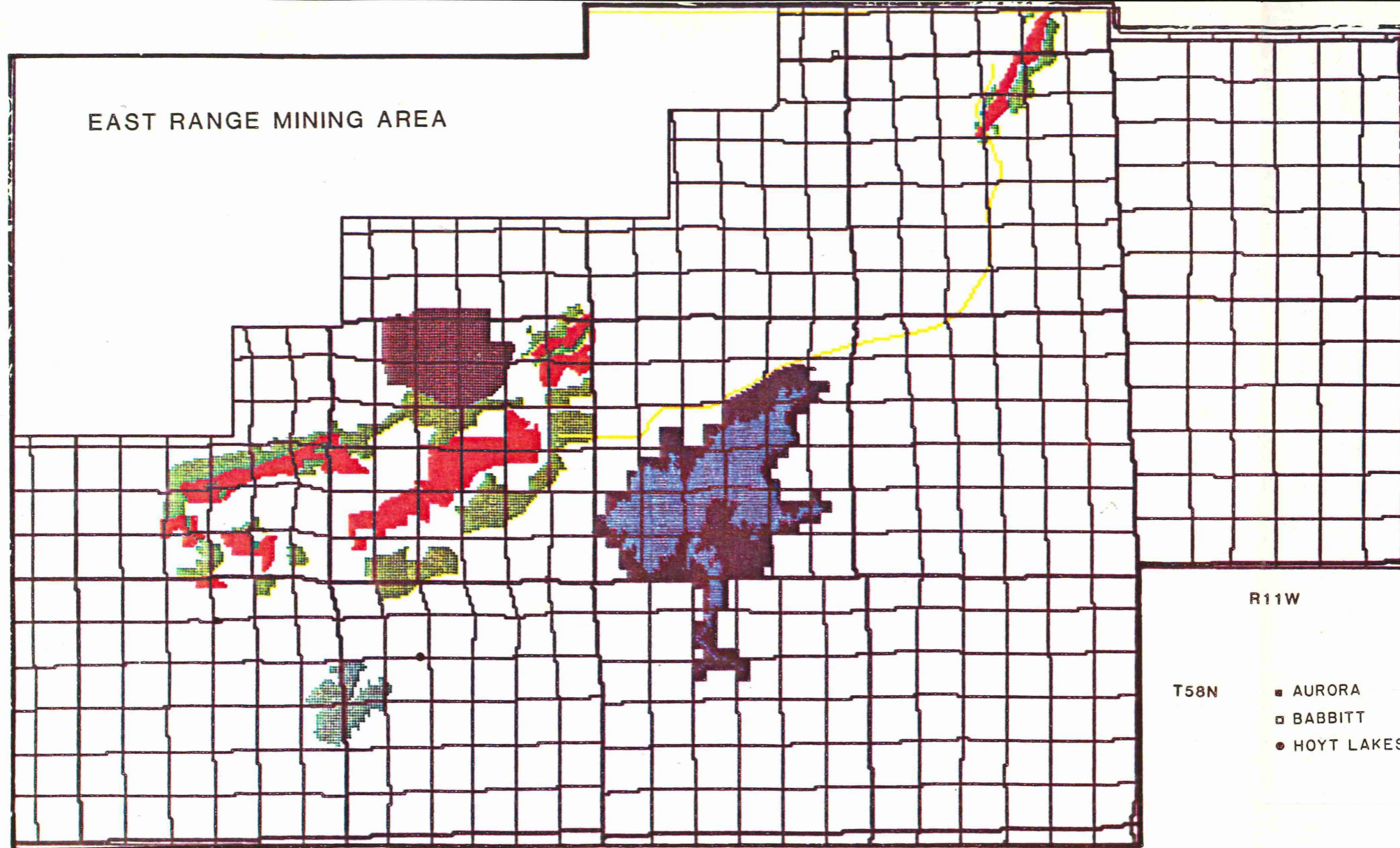
ANAX PROJECT (CU-NI)

	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	196449	95.5	341122.5	NO DATA
	1	427	0.3	1067.5	OPEN PIT MINE
	2	103	0.1	257.5	UNDERGROUND MINE
	3	306	0.2	765.0	RESERVOIR
	5	1167	0.8	2917.5	WASTE DUMP
	6	74	0.1	185.0	SLAG DUMP
	7	3661	2.6	9152.5	TAILINGS AREA
	8	672	0.5	1680.0	AUXILIARY FACILITY

Erie Mining Company

The maps on the facing page and in the appendix (A-6) depict the mining, stockpile, and tailings storage areas necessary for the continuing operation of Erie Mining Company through the next forty years. Also shown is a proposed reservoir on the Partridge River. This reservoir would provide process water for Erie's mining operation in the future.

EAST RANGE MINING AREA



T60N

T59N

R11W

T58N

- AURORA
- BABBITT
- HOYT LAKES

R15W

R14W

R13W

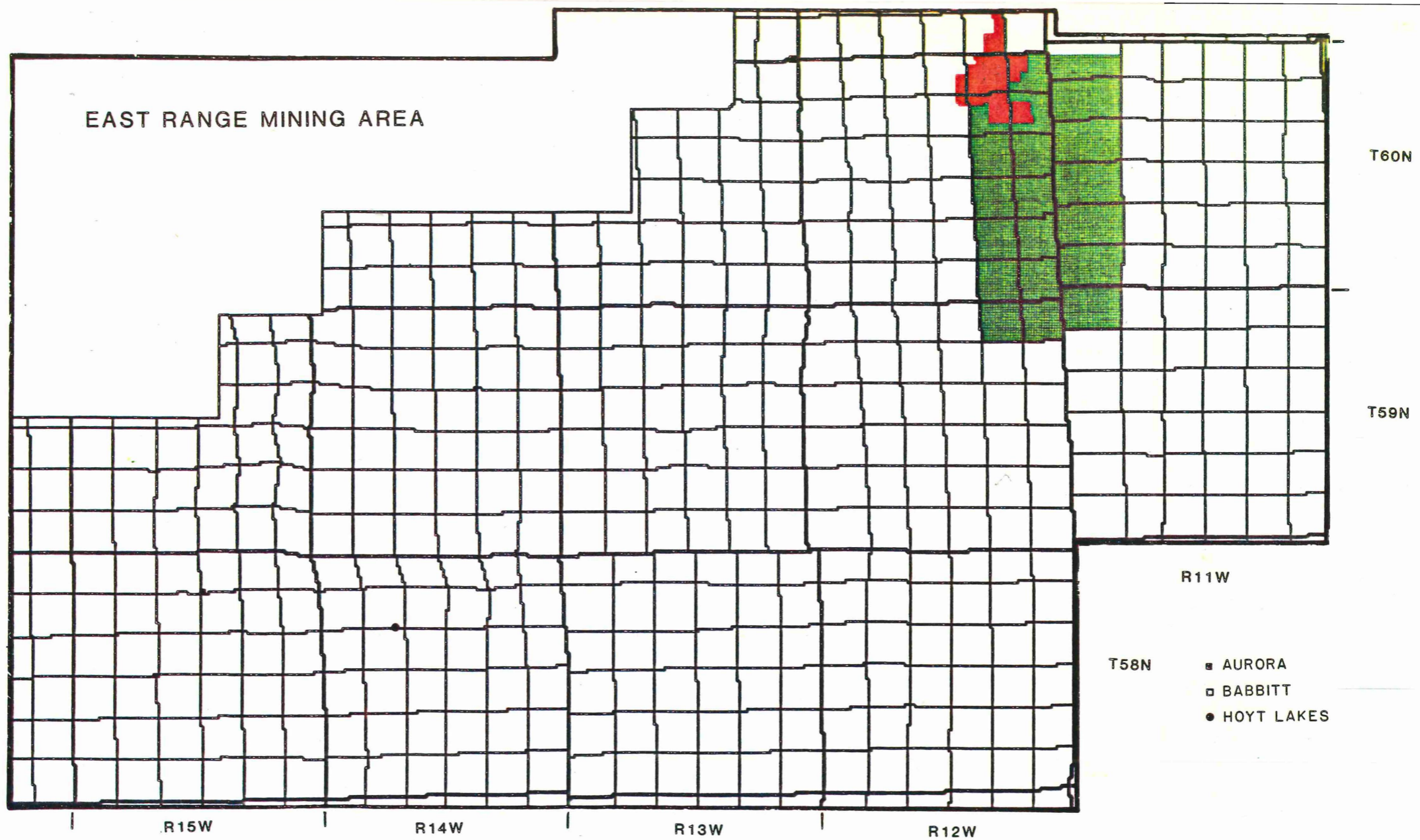
R12W

ERIE (TACONITE)

	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	131443	92.0	328607.5	NO DATA
■	1	2058	1.4	5170.0	ORE BODY
■	2	1369	1.0	3422.5	TAILINGS BASIN
■	3	2935	2.1	7337.5	STOCKPILE AREA
■	4	241	0.2	602.5	BUNKA ROAD
■	5	550	0.4	1375.0	EXISTING RESERVOIR
■	21	2051	1.4	5127.5	PROPOSED RESERVOIR
■	22	2202	1.5	5505.0	100 YEAR HIGH WATER MARK

Exxon

Exxon's maps (facing page and A-7) show the exploration area where Exxon holds mineral leases as well as potential areas for waste and lean-ore stockpiles and tailings disposal should a mining operation be developed. The project is still in the early stages of exploration, and Exxon currently has no plans to develop a mining operation. Should a mining operation be developed, Exxon expects that it could be similar to the AMAX operations to the southwest.



EXXON PROJECT (CU-NI)

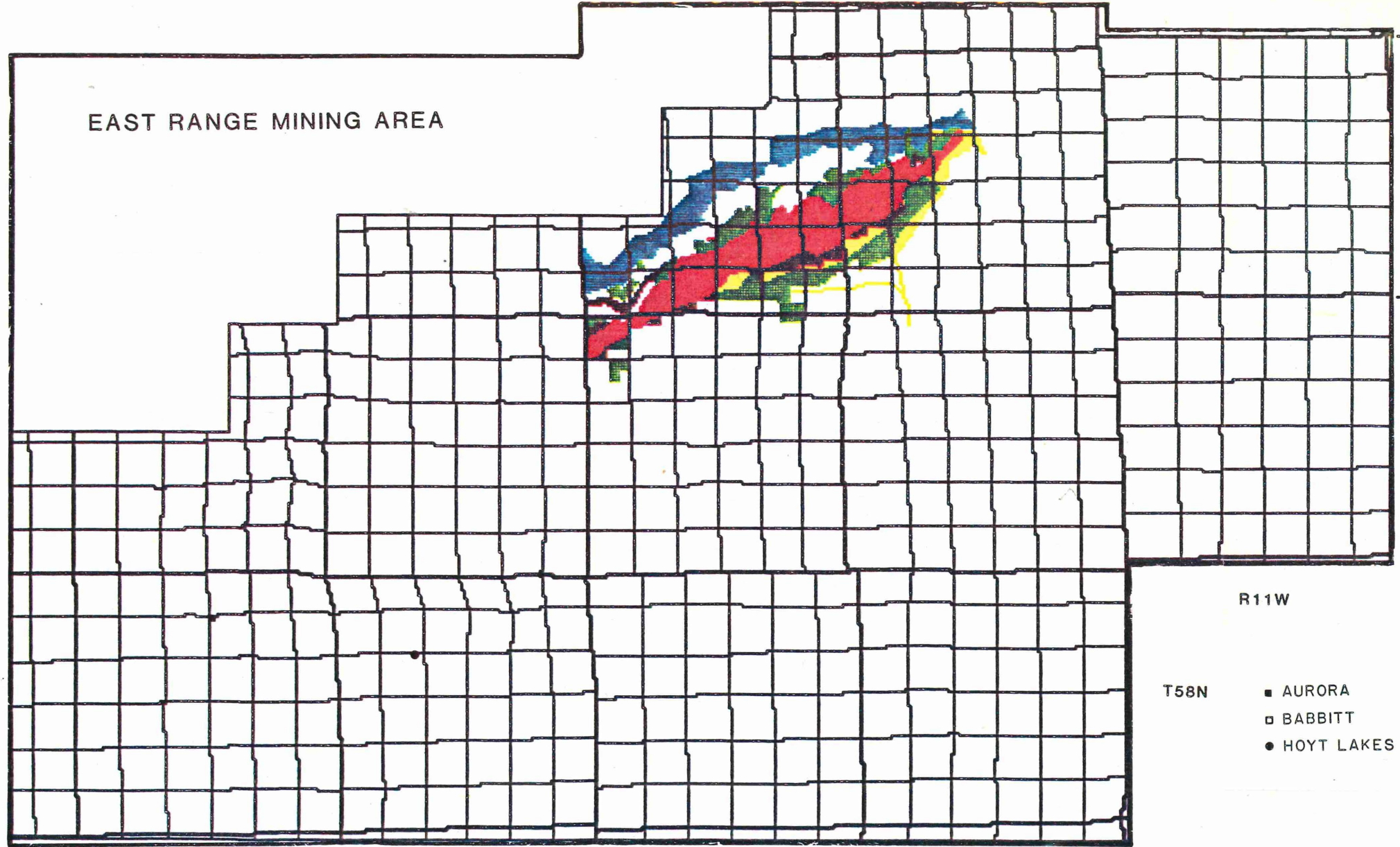
	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	136373	85.5	340932.5	
■	5	648	0.5	1620.0	MINING AREA
■	7	5838	4.1	14595.0	AUXILIARY LAND

Reserve Mining Company

The maps (facing page and A-8) identify areas to be tentatively reserved for ore mining and waste-material stockpiles and those areas to be excluded from these activities. The areas reserved for mining of ore (data levels 1 and 2) include all present and potential ore reserves within the lands presently controlled by Reserve. The areas reserved for waste material (data level 3) include lands either presently controlled or to be acquired. The areas excluded from mining and waste-material disposal will be used for lean-ore and save-rock storage, pillars protecting various mine facilities (data level 5), and protection of the scenic vista from the north (data level 6). Excluded areas also include lands considered too remote for economical mining use, which

additionally serve as a buffer between the mine and the City of Babbitt.

EAST RANGE MINING AREA



R15W

R14W

R13W

R12W

R11W

T60N

T59N

T58N

- AURORA
- BABBITT
- HOYT LAKES

RESERVE MINING (TACONITE)

	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	137412	98.2	349530.0	NO DATA
■	1	1884	1.3	4710.0	CRE BODY
■	2	329	0.2	822.5	POTENTIAL RESOURCE
■	3	1351	0.9	3377.5	STOCKPILE AREA
■	4	27	0.0	67.5	POTENTIAL RESOURCE UNDER PROPOSED STOCKPILE
■	5	338	0.3	997.5	AUXILIARY LAND
■	6	1390	1.0	3475.0	NORTHERN EXCLUSION AREA

U.S. Steel Corporation

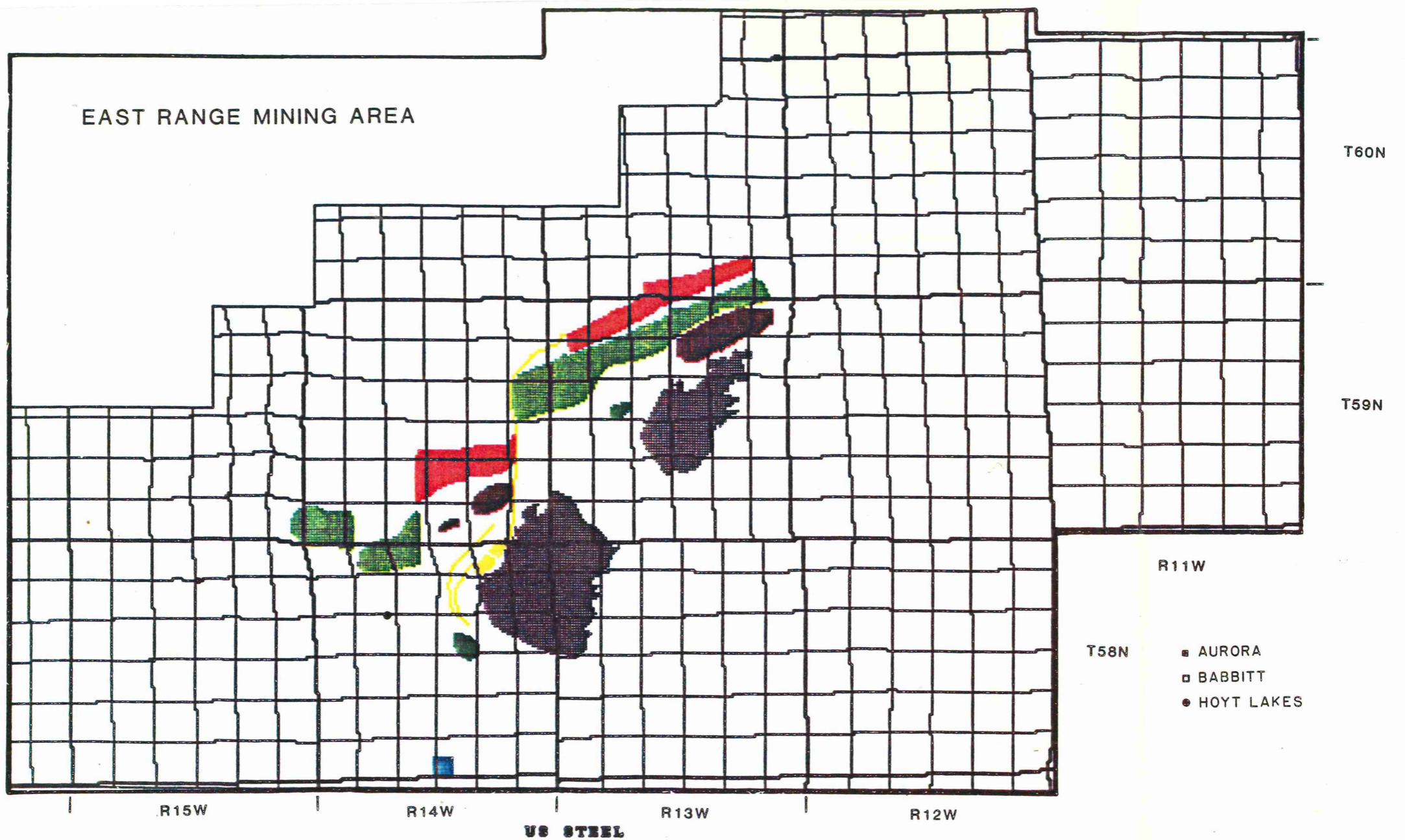
The map on the following page identifies various taconite and base metal resources that may have potential for development in the future. The map in the appendix (A-9) provides more information on these resources by identifying them as conditional, unexplored, or unexplored anomalies. None of these resources are proven reserves, and all would require additional exploration as well as a more favorable economic climate before development decisions could be made.

The map should be considered a conceptual model developed as a compromise between principles of preservation of potential mineral resources, efficient waste disposal, and maximum use of existing topographic features and trans-

portation facilities. Since U.S. Steel Corporation's planning for mineral development in these areas has not been carried far enough forward to determine the limits set, broad generalizations have been borrowed from other studies to fill in areas where corporate data are inadequate. The ultimate stripping limit⁵ proposed by Marsden⁵ represents the southern limit of open pit taconite resources and therefore defines a northern limit for proposed rock dump sites and other facilities. Generally, the first mile south and east of the gabbro contact with the surface has also been excluded from proposed rock dumps and tailings ponds to prevent burial of potential open pit copper-nickel resources.

⁵Marsden, 1977.

Two possible tailings disposal areas were identified. Area 1 would be most suitable for base metal development while Area 2 could be used for both taconite and base metal tailings. The proposed stockpiles identified could serve both the taconite and base metal resources. The plant locations were sited on the basis of existing railroad lines and represent hypothetical sites for both taconite and base metal milling facilities.



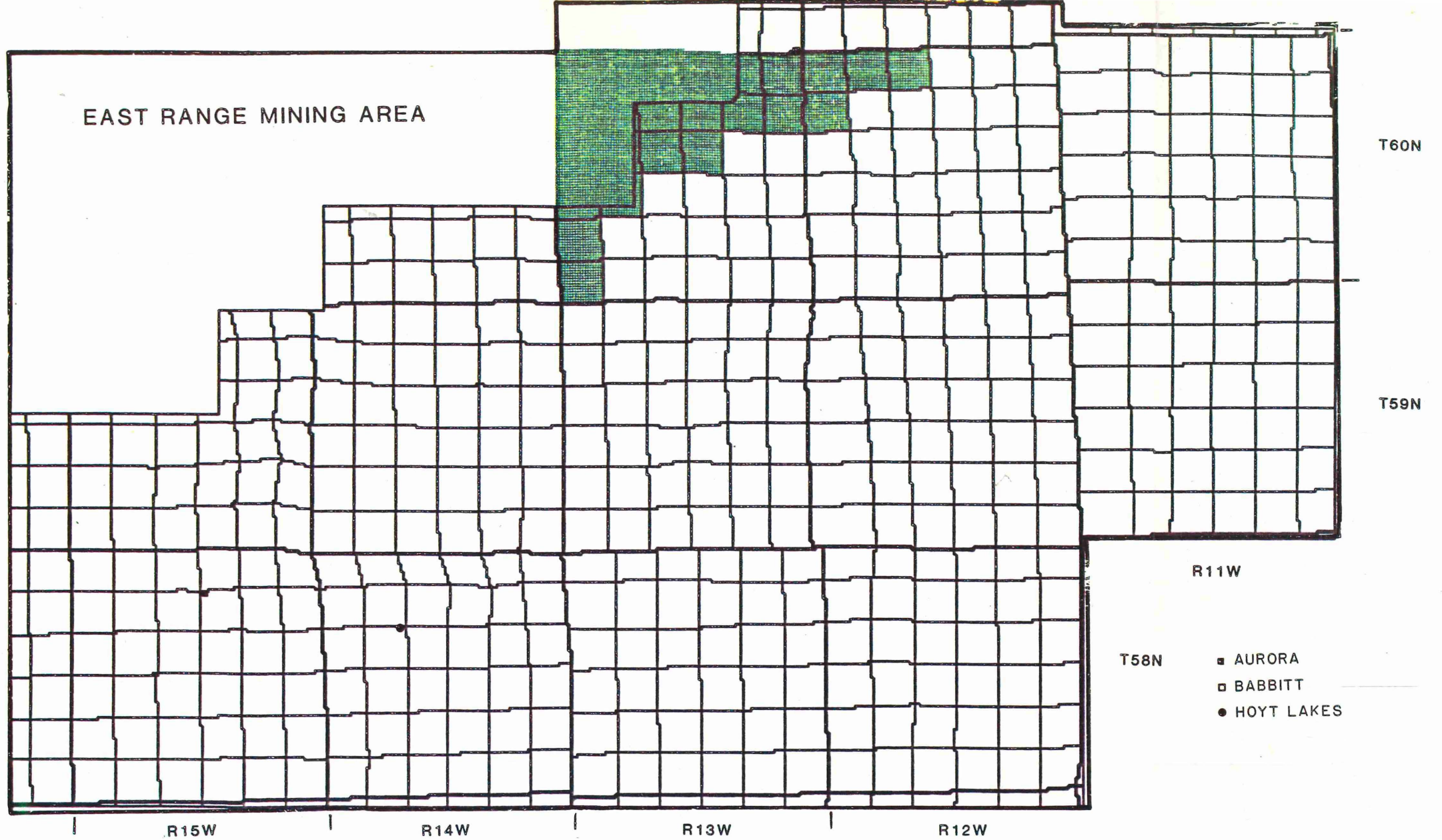
SYMBOL	COUNT	PERCENT	ACRES	LEGEND
○	135428	94.8	338570.0	NO DATA
■	1	0.8	2777.8	TACONITE RESOURCE
■	2	0.4	1490.0	CU-NI RESOURCE
■	3	0.1	297.8	TITANIUM RESOURCE
■	4	0.0	180.0	CU-NI/TITANIUM RESOURCE
■	5	2.3	8282.8	POSSIBLE TAILINGS AREA
■	6	1.4	5037.8	POSSIBLE STOCKPILE AREA
■	7	0.2	552.8	AUXILIARY FACILITY

Local Units of Government and Agency Maps

The following maps were prepared from information submitted by local units of government and state and federal agencies. Their level of planning is substantially more detailed and often based on existing zoning or regulations. Thus their maps represent a fairly accurate description of the land-use concerns of these organizations.

City of Babbitt

The exclusion area submitted by the City of Babbitt, (see map on the facing page and map A-10) represents a buffer zone the village wants maintained between itself and mining activities.



CITY OF BABBITT

	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	136670	95.7	341675.0	
■	1	6189	4.3	15472.5	EXCLUSION AREA

City of Hoyt Lakes

The map on the facing page and map A-11 show the corporate boundary of the City of Hoyt Lakes including lands zoned for mining (data level 2) and conservation (data level 1). Map A-11 also shows the "100 mile swamp" from which three streams flow into Colby Lake, the current source of potable water for the city, and provides more detail on local zoning for single and multiple family dwellings.



EAST RANGE MINING AREA

T60N

T59N

R11W

T58N

- AURORA
- BABBITT
- HOYT LAKES

R15W

R14W

R13W

R12W

CITY OF HOYT LAKES

	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	127865	89.5	318662.5	NO DATA
	1	8990	6.3	22475.0	CONSERVATION
	2	5487	3.8	13742.5	MINING DISTRICT
	3	79	0.1	197.5	MULTIPLE FAMILY DWELLING
	4	25	0.0	62.5	INDUSTRIAL DISTRICT
	5	381	0.3	952.5	SINGLE FAMILY DWELLING
	6	22	0.0	55.0	BUSINESS

DNR Reclamation Siting

Map A-12 in the appendix delineates exclusion and avoidance areas for mining as contained in the state's rules for mineland reclamation. Exclusion areas are lands on which no mining shall be allowed "unless the commissioner determines that a state or national emergency exists which would require the exploitation of the mineral resources within such areas" (6 MCAR 1.0402). In the East Range Study area many of the exclusion areas identified are either trout streams (data level 1), Shipstead-Newton-Nolan waters (data level 4), lakes greater than 80 acres (data level 9), or combinations of these data levels. Exclusion areas are surrounded by buffer zones corresponding to the setback requirements of the rules and are assigned separate data levels, which

identify the total area excluded from mining activities. For example, the buffer zone for Shipstead-Newton-Nolan waters is assigned data level 6. There are also some areas excluded from mining because they are public buildings, cemeteries, or occupied homes (data level 12) or public roads (data level 22).

Avoidance areas for mining are lands where mining will not be allowed when a feasible or prudent alternative site exists. Avoidance areas in the East Range Study area consist only of lakes and streams and do not include buffer zones.

The map also identifies natural resource conflict areas. These are natural resource sites that should be avoided when

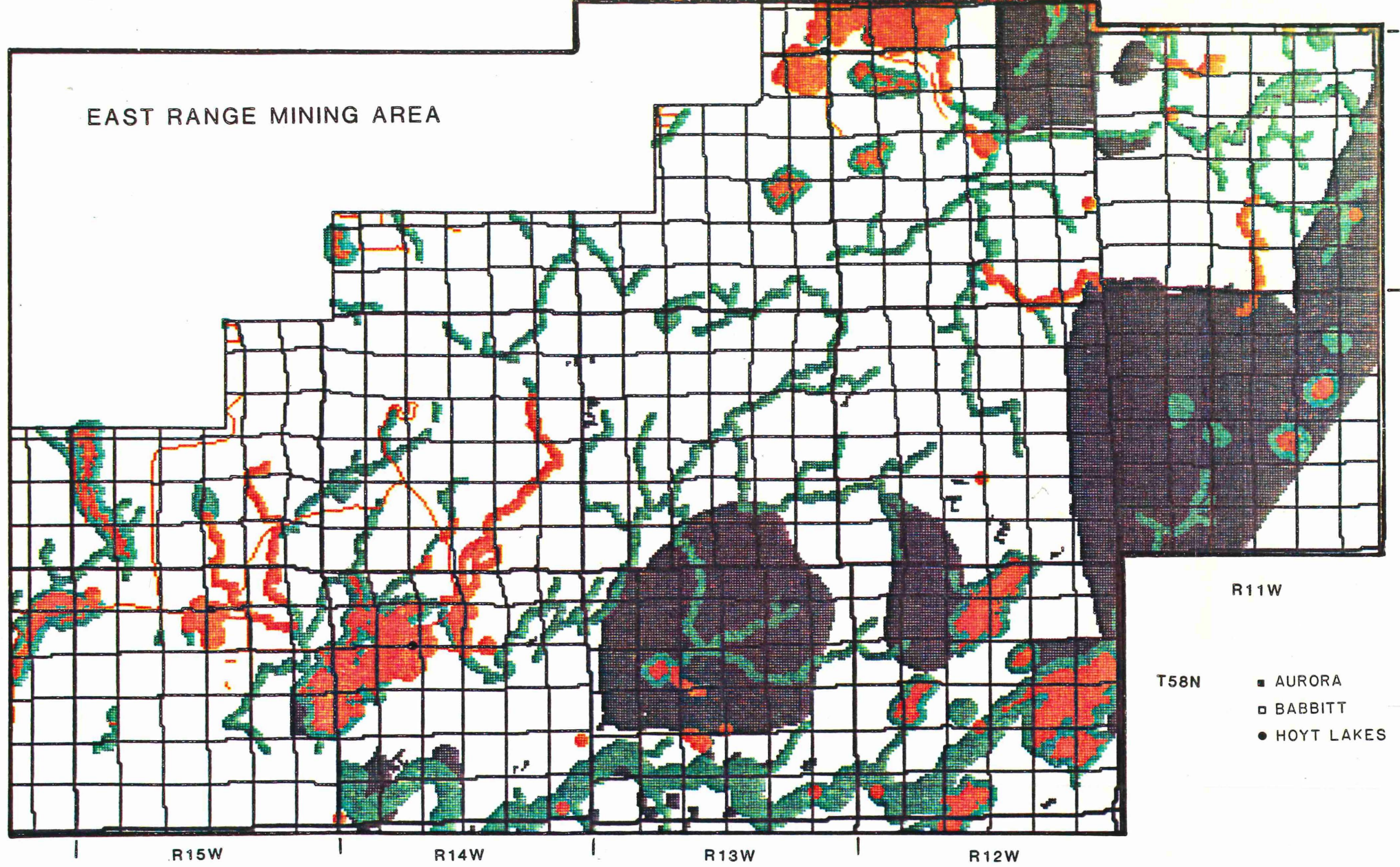
there is flexibility in site selection for mining facilities (e.g., stockpiles, tailings basins, plants).

The state's rules for mineland reclamation are applicable only to mining of natural ore and taconite. Therefore, the exclusion, avoidance, and natural resource areas identified are applicable only to the taconite mining plans, not to the copper-nickel plans. The department will be writing rules for copper-nickel mining in the future, and it is likely that these rules will contain the same or similar exclusion, avoidance, and natural resource conflict area restrictions on mining.

The colored map on the facing page and map A-13 in the appendix are simplified versions of A-12. All exclusion areas

have been combined and assigned one data level (level 1). Similarly, avoidance areas and natural resource conflict areas have been combined and assigned data levels 3 and 2, respectively.

EAST RANGE MINING AREA



EXCLUSION AREA (COMBINED MAP)

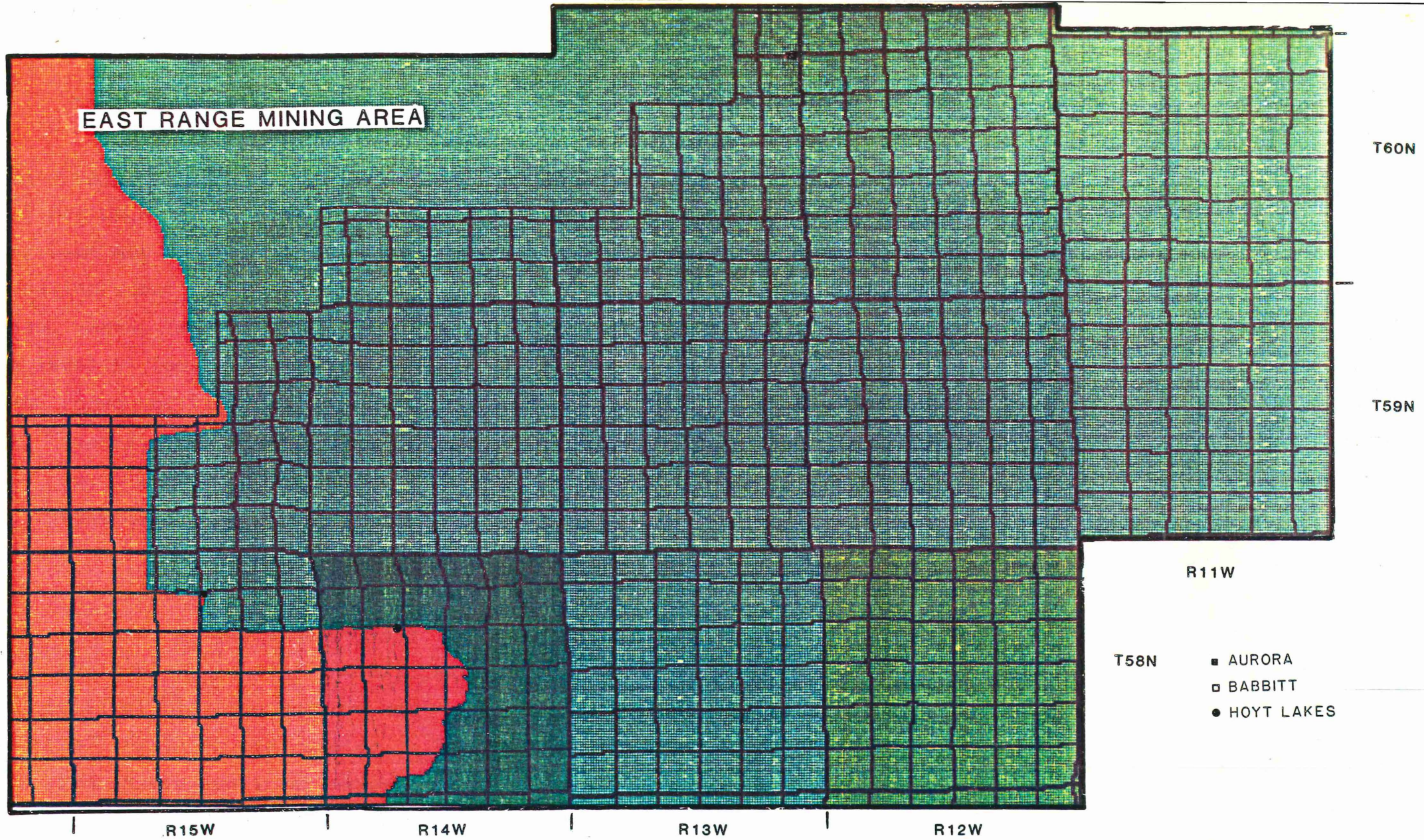
	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	97724	68.4	244310.0	NO DATA
■	1	8196	5.7	20490.0	EXCLUSIONS FOR RULES AND REGS
■	2	17425	12.2	43562.5	AVOIDANCE AREA
■	3	19514	13.7	48785.0	NATURAL CONFLICT AREA

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife maps (facing page and A-14) outline areas of important habitat for the gray wolf and bald eagle. Both species are afforded high levels of protection under the Endangered Species Act of 1973, as amended, administered by the U.S. Fish and Wildlife Service. Gray wolf management zones 2 and 4 occur within the study area. Zone 2 comprises Critical Habitat for the wolf, while zone 4 is considered peripheral habitat. Areas identified as bald eagle nesting habitats contain confirmed or suspected nest sites.

Federally licensed, permitted, and financially supported activities (to include land exchanges) constitute federal "actions" within the context of The

Endangered Species Act. Sections 7(a) and (b) of the Act require federal agencies to consult with the U.S. Fish and Wildlife Service when those agencies determine their actions "may affect" listed species or their Critical Habitat.



US DEPT OF THE INTERIOR - FISH AND WILDLIFE SERVICE

SYMBOL	COUNT	PERCENT	ACRES	LEGEND	
■	1	103088	72.2	257715.0	ZONE 2 - DESIGNATED CRITICAL HABITAT FOR THE WOLF
■	2	20716	14.5	51790.0	ZONE 4 - DESIGNATED WOLF HABITAT
■	3	3081	2.1	7652.5	AREA OF SUSPECTED EAGLE NESTS + ZONE 4
■	4	9870	6.9	24675.0	AREA OF KNOWN EAGLE NESTS + ZONE 2
■	5	6128	4.3	15315.0	AREA OF SUSPECTED EAGLE NESTS + ZONE 2

Superior National Forest

The Superior National Forest maps (following page and A-15) were prepared from information submitted by the U.S. Forest Service. Seven Beaver Recreational Area (data level 5) consists of approximately 32,640 acres of intermixed federal, state, county, and private lands. Road access is limited to points at Skibo Mill, Stone Lake, and Forest Road 418. Reserve's railroad crosses the area and provides restricted access to its center. Other access is primarily by the St. Louis River (canoe) and Big Lake Trail (hiking) in the summer and by snowmobile trails in the winter. The area's remoteness and seven lakes make it suited for dispersed recreational activities such as camping, canoeing, hiking, skiing, and snowmobiling. Several campsites (user-established) are

located along the St. Louis River, Big Lake, Long Lake, and Round Lake. Portages have been constructed along the St. Louis River to provide canoe access into Seven Beavers, Round, and Long lakes. Proposed management is to develop the dispersed recreational activities. Plans include building ten campsites (1981), reconstructing Big Lake Trail (1982-83), and constructing an access at Skibo Mill Landing (1984-85-86).

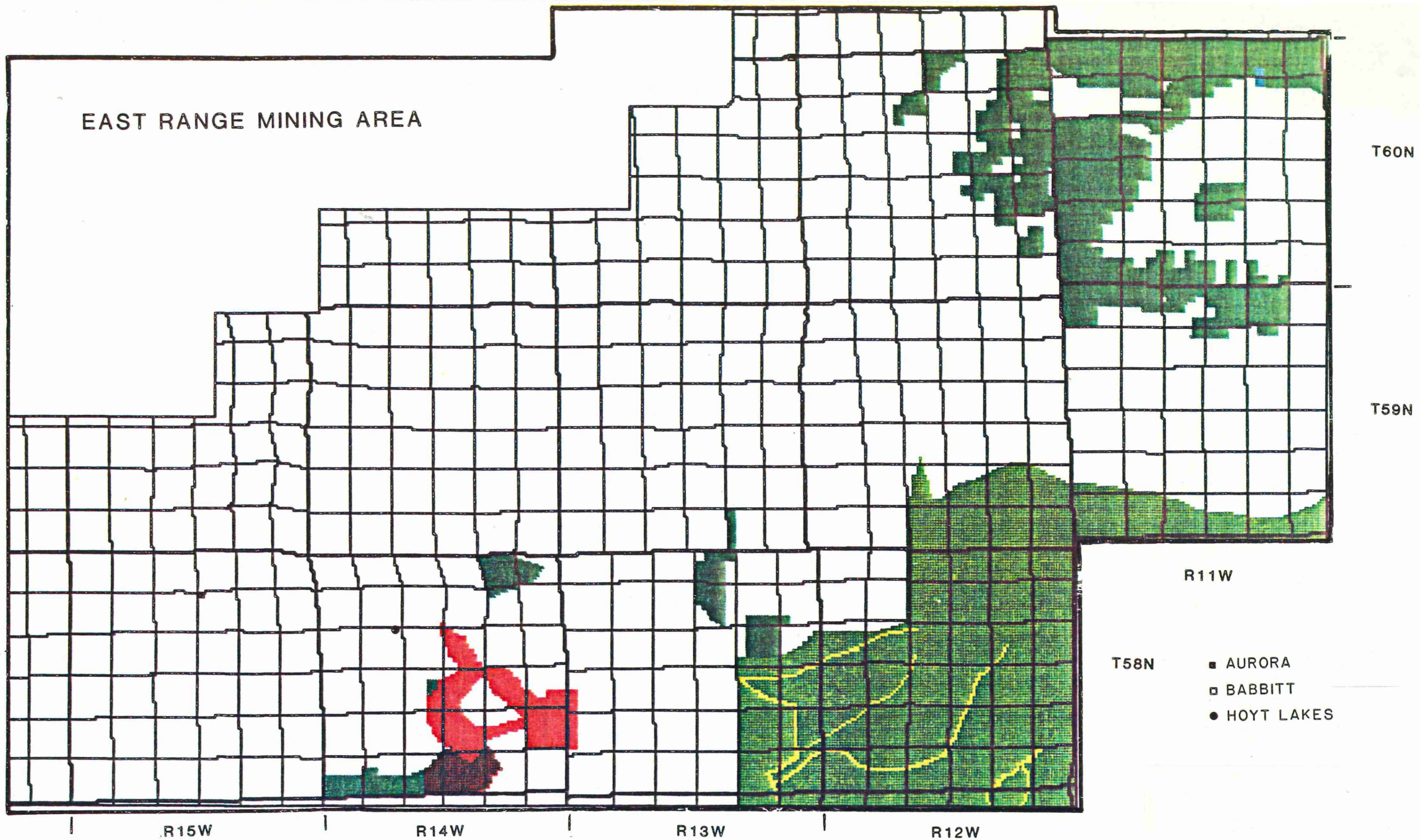
The Bird Lake Ski Trail System (data level 3) is approximately ten miles of cross-country ski trails constructed around Bird Lake. Future plans include connecting the trails to the Hoyt Lakes vicinity along Forest Road 569. Bird Lake picnic grounds (three picnic sites and toilet facilities) serves as the

trail head.

The St. Louis River Hunter Walking Trail (data level 4) is a system of old logging roads and newly constructed loop trails maintained for walking access to hunt ruffed grouse. No vehicles are permitted. The area, which has a good variety of aspen age classes and vegetative diversity, is considered excellent ruffed grouse habitat and is managed primarily for this species.

The Softwood Timber Producing Area (data level 1) contains the majority of the district's potential for intensified softwood timber production. These areas have a high site index and are currently forested with pine or spruce pole timber, or have recently been reforested to pine or spruce. Existing red pine

stands have recently been thinned for the first time or are on the Five-Year Sale Plan for thinning.



EAST RANGE MINING AREA

T60N

T59N

R11W

T58N

- AURORA
- BABBITT
- HOYT LAKES

R15W

R14W

R13W

R12W

SUPERIOR NATIONAL FOREST

	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	117831	82.5	294577.5	NO DATA
■	1	8238	6.5	23097.5	SOFTWOOD TIMBER HIGH POTENTIAL
■	2	441	0.3	1102.5	TRAIL
■	3	1318	0.9	3295.0	CROSS COUNTRY SKI TRAIL
■	4	390	0.3	975.0	WILDLIFE/HUNTER WALKING TRAIL - GROUSE MANAGEMENT AREA
■	5	13608	9.5	34020.0	SEVEN BEAVER RECREATION BOUNDARY
■	6	32	0.0	80.0	DISPERSED RECREATION SITE

RESULTS

Existing and Potential Mining

Table 1 shows existing and potential mining in the study area. The numbers indicate that there could be approximately a fivefold increase in

lands needed for mining. Such an increase in mineral development would be likely to result in conflicting demands on some lands in the study area.

TABLE 1
Existing and Potential Mining
East Range Study Area, Northeastern Minnesota

	Existing Mining (acres)	Potential Mining (acres)	Total (acres)
AMAX	-	15,022	15,022
Erie	8,713	14,054	22,767
Exxon	-	15,727	15,727
Reserve	4,626	4,353	8,979
U.S. Steel	-	12,326	12,326
More than one company	610	5,670	6,280
Total (acres) (sq.mi.)	13,949 22	67,152 105	81,101 127

Comparison of Mining Proposals

Tables 2 through 6 tabulate the overlaps between the mining companies' plans. Each of the five tables compares one company's mining proposal (listed across the top) with the mining proposals of

the remaining companies (listed down the left margin). Only those companies with facilities in conflict with the operation identified at the top of the table are tabulated.

TABLE 2
 AMAX's Proposal Versus Other Mining Proposals
 (acres)

	AMAX					
	Open Pit	Waste Dump	Slag Dump	Railroad	Highway	Powerline
Erie proposed reservoir					82	97
Reserve stockpile areas	77			92		37
railroad	65		27			
U.S. Steel conditional taconite resource-range 13						7
conditional Cu-Ni resource		37				
proposed stripping dump						20

TABLE 3
Erie's Proposal Versus Other Mining Proposals
(acres)

	ERIE		
	Stockpile	Proposed Reservoir	Proposed Reservoir 100-Year-High-Water Mark
Amax			
highway		82	
powerline		97	
Exxon			
mining land	381		
U.S. Steel			
conditional taconite resource-range 14	732		
titanium resources		92	
possible tailing area 1		655	2,019
possible tailing area 2		326	40
stripping dump	296		
proposed stripping dump	635		

TABLE 4
 Exxon's Proposal Versus Other Mining Proposals
 (acres)

EXXON	
Mining Land	
Erie stockpile	381

TABLE 5
 Reserve's Proposal Versus Other Mining Proposals
 (acres)

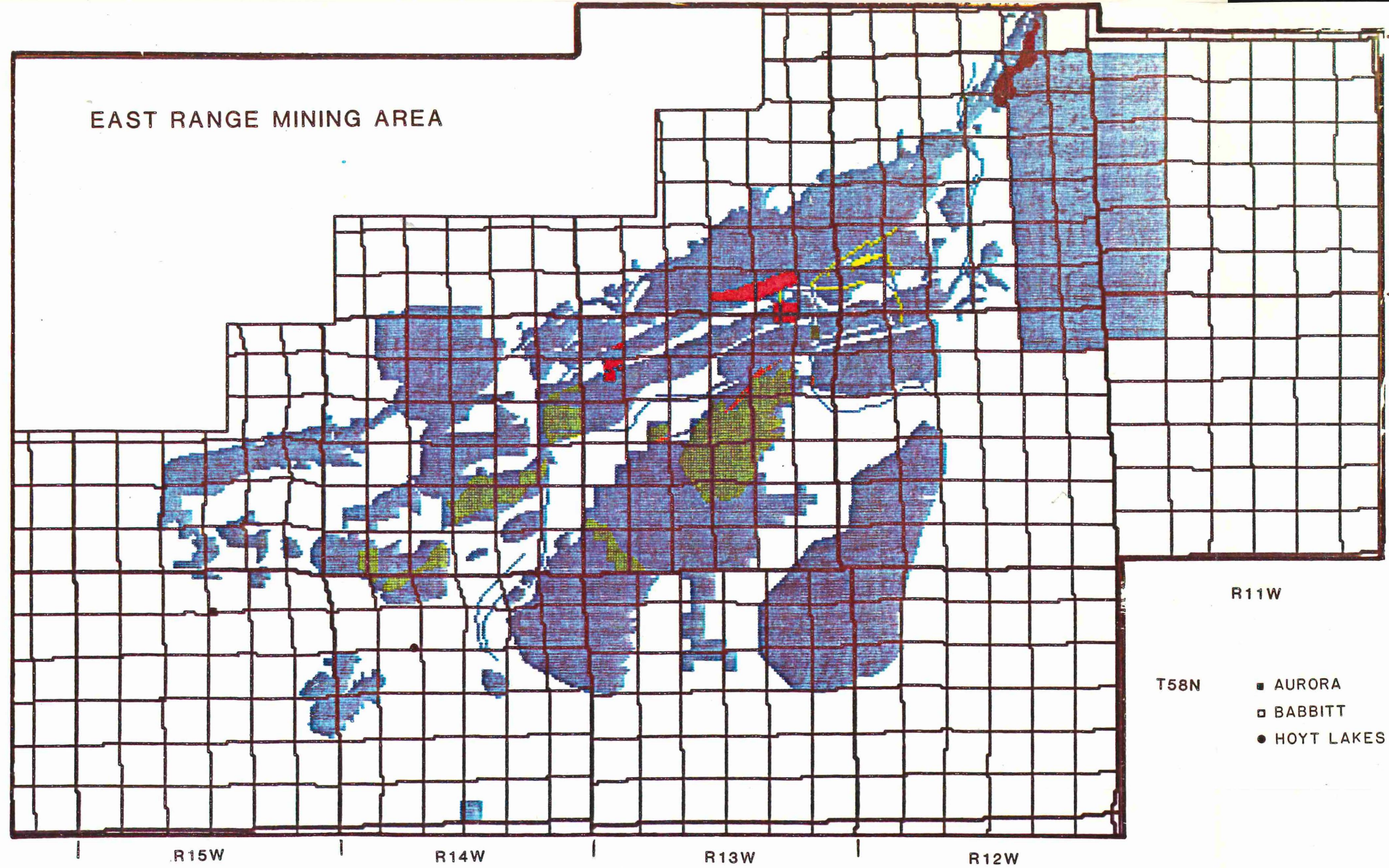
	RESERVE	
	Stockpile Areas	Railroad
Amax		
open pit	77	65
slag dump		27
railroad	92	
powerline	37	
U.S. Steel		
conditional taconite resource range 13	4,251	
proposed stripping dump	197	

TABLE 6
U.S. Steel's Proposal Versus Other Mining Proposals
(acres)

	U.S. STEEL							
	Conditional Taconite Resource Range 13	Conditional Taconite Resource Range 14	Conditional Cu-Ni Resource	Titanium Resources	Possible Tailing Areas		Stripping Dump	Proposed Stripping Dump
					1	2		
Amax waste dump powerline	7		37					20
Erie stockpile proposed reservoir 100-yr.-high-water mark		732		92	655	326	296	635
Reserve stockpile areas	4,251				2,019	40		

Map number A-16 is a composite of the five mining companies' maps. Although complex, the map is useful in that it provides detailed information on land-use conflicts identified in tables 2 through 6. It is possible to quickly determine the conflicts between proposed mining facilities by reviewing the description column of the map legend. In each instance where one symbol describes more than one data level, there is a mining conflict. For example, near the center of the map is Erie Mining Company's proposed reservoir (data level 5). The northeast and southwest portions of this reservoir are overlapped by two tailings basins (data level 35) proposed by U.S. Steel. Where these two data levels overlap (levels 5 and 35), a third data level is assigned (level 36).

Map number A-17 is a simplification of map A-16. For this map all the facilities of an individual mining company were assigned the same data level. For example, AMAX's stockpiles, pits, tailings basins, reservoir, and other facilities are all assigned the same data level, which identifies them only as being part of AMAX's mining plan. The same procedure was followed for the other four mining companies. Conflicts are again identified by assigning a third data level where two data levels overlap. However, on this map it is not possible to determine if the overlap is between a stockpile and reservoir, for example, but only that a conflict exists between mining companies. The colored map on the facing page is a further simplification of map A-17. On this map only conflicts between mining proposals



EAST RANGE MINING AREA

T60N

T59N

R11W

T58N

- AURORA
- ◻ BABBITT
- HOYT LAKES

R15W

R14W

R13W

R12W

MINING CONFLICTS MAP

SYMBOL	COUNT	PERCENT	ACRES	LEGEND	SYMBOL	COUNT	PERCENT	ACRES	LEGEND		
	0	109863	77.0	274907.5	NO DATA						
■	1	30374	21.3	78935.0	NO CONFLICT	■	5	106	0.1	265.0	AMAX AND RESERVE
■	2	47	0.0	117.5	ERIE AND AMAX	■	6	267	0.2	667.5	US STEEL AND RESERVE
■	3	1926	1.3	4815.0	ERIE AND US STEEL	■	7	7	0.0	17.5	AMAX, US STEEL AND RESERVE
■	4	16	0.0	40.0	AMAX AND US STEEL	■	8	159	0.1	382.5	ERIE AND EXXON

are shown (data levels 2 thru 8). The remaining portion of the map (data level 1 or blue) represents areas where no mining conflicts exist.

**Comparison of Proposed Mining with
Regulatory Agencies' Plans**

Department of Natural Resources

Table 7 tabulates conflicts between the mining plans and the exclusion,

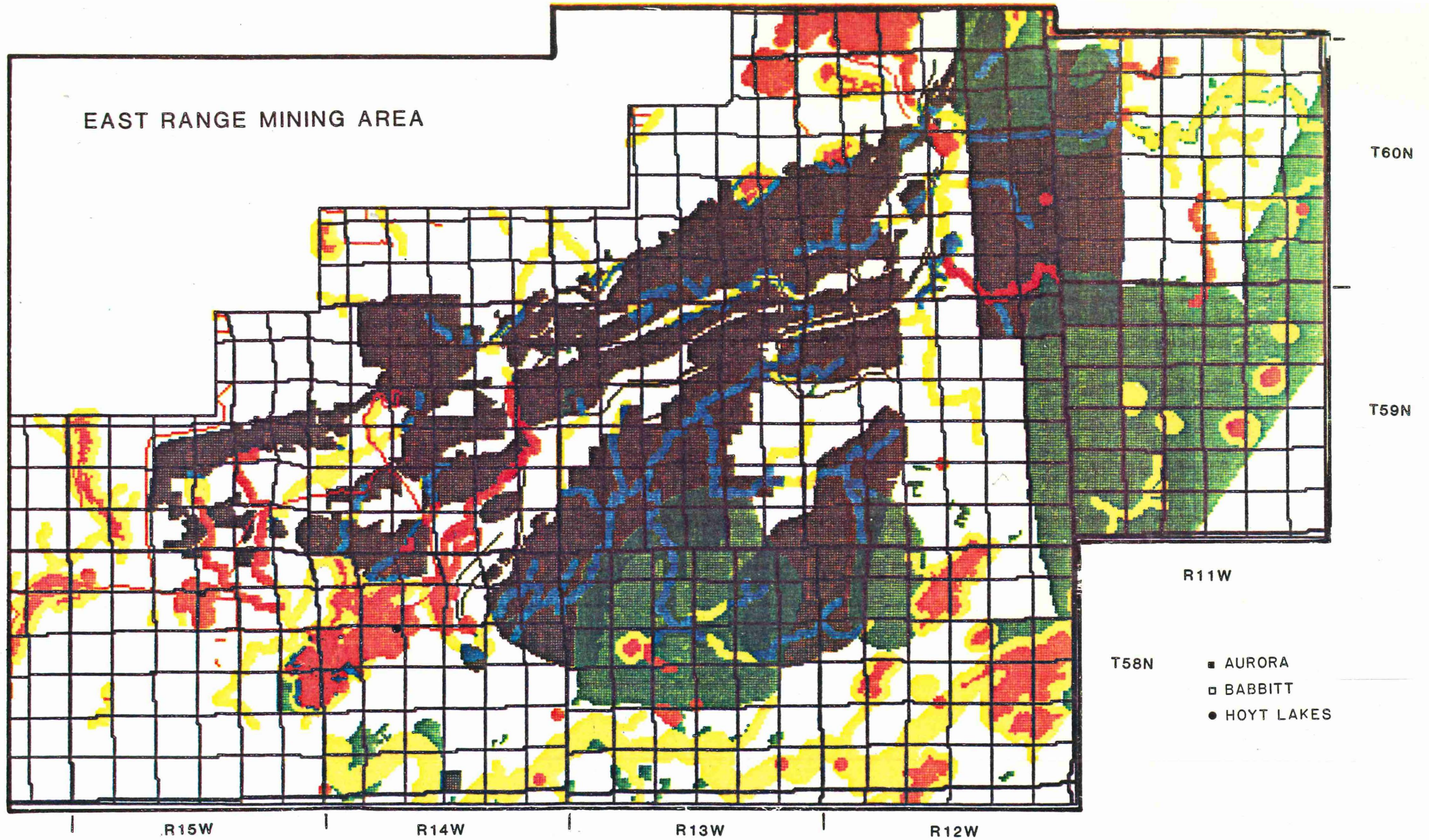
avoidance, and conflict areas designated in the state's Rules on Mineland Reclamation for iron ore and taconite. This information is also illustrated on the map on the facing page and on map A-18.

TABLE 7
DNR Reclamation Siting (simplified) Versus Mining Proposals*
(acres)

	RECLAMATION SITING			
	Exclusion Areas	Avoidance Areas (Lakes & Streams)	Conflict Areas (Natural Resource Sites)	Total
AMAX	92	2,572	2,898	5,562
Erie	207	2,811	2,216	5,234
Exxon	481	1,238	4,920	6,639
Reserve	37	555	-	592
U.S. Steel	261	2,099	1,245	3,605
More than one company	72	1,145	154	1,371
Total	1,150	10,420	11,433	23,003

*Does not include existing mining

EAST RANGE MINING AREA



MINING VS RECLAMATION RULES AND REGULATIONS

SYMBOL	COUNT	PERCENT	ACRES	LEGEND
0	75199	52.6	187847.5	NO DATA
1	22588	15.8	56462.5	MINING PROPOSALS
2	7192	5.0	17980.0	EXCLUSION AREA
3	1004	0.7	2510.0	MINING OVERLAP WITH EXCLUSION AREA
4	14769	10.3	36922.5	AVOIDANCE AREA
5	4745	3.3	11862.5	MINING OVERLAP WITH AVOIDANCE AREA
6	12863	9.0	32157.5	NATURAL CONFLICT AREA
7	4562	3.2	11405.0	MINING OVERLAP WITH NATURAL CONFLICT AREA

- T58N ■ AURORA
- BABBITT
- HOYT LAKES

U.S. Fish and Wildlife Service

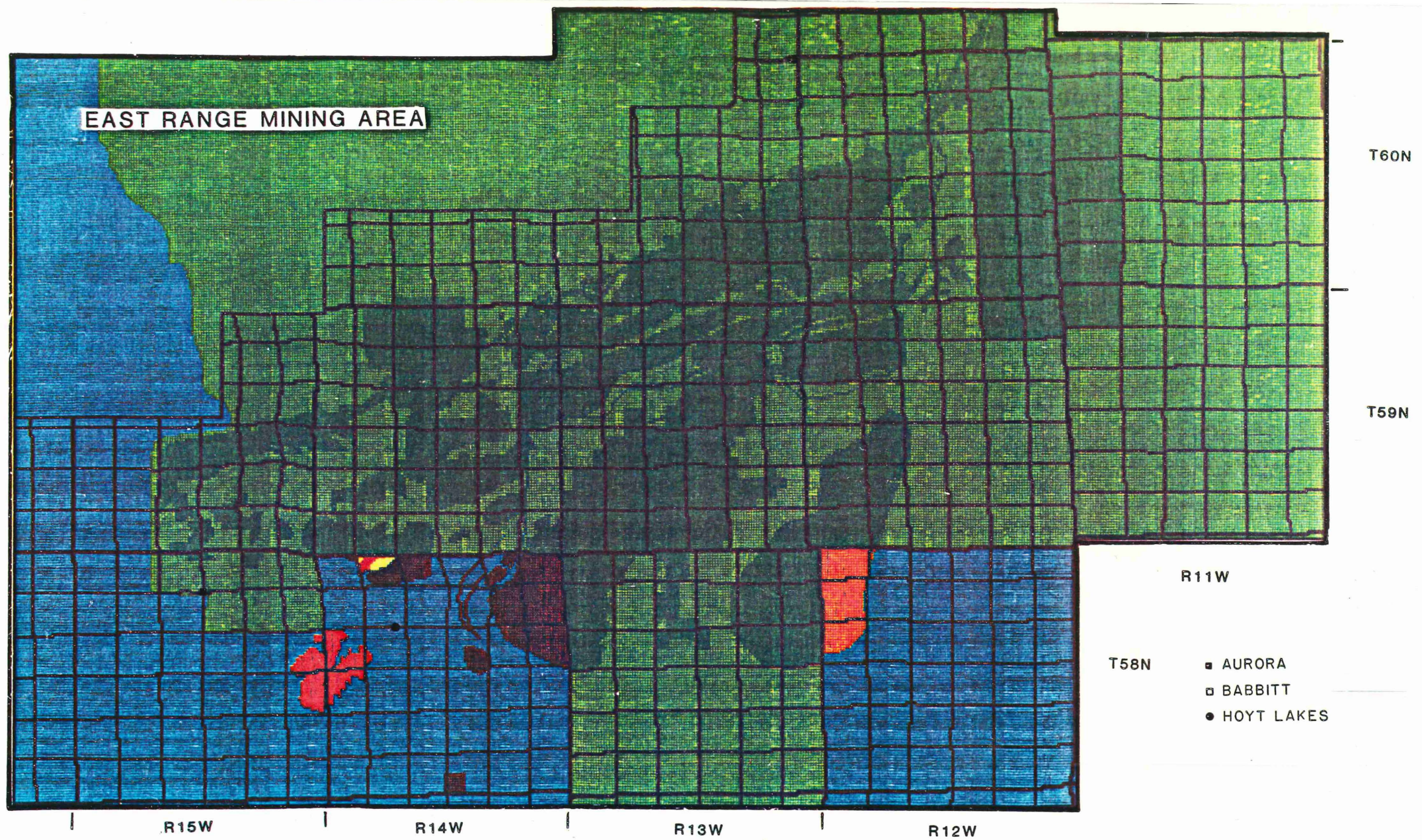
Table 8 identifies conflicts between mining proposals and wildlife habitat as identified by the U.S. Fish and Wildlife

Service. This information is illustrated on the map on the facing page and on map A-19.

TABLE 8
U.S. Fish and Wildlife Service's Plans Versus Mining Proposals*
(acres)

	U.S. FISH & WILDLIFE					
	Critical Habitat for Wolf (Zone 2)	Wolf Habitat (Zone 4)	Known Eagles Nest (Zone 2)	Suspected Eagles Nest (Zone 2)	Suspected Eagles Nest (Zone 4)	Total
AMAX	13,284	-	1,748	-	-	15,032
Erie	21,172	645	67	-	725	22,609
Exxon	15,757	-	-	-	-	15,757
Reserve	8,962	-	-	-	-	8,962
U.S. Steel	8,914	-	-	3,513	-	12,427
More than one company	6,148	-	-	132	-	6,280
Total	74,237	645	1,815	3,645	725	81,067

*Includes existing mining



EAST RANGE MINING AREA

T60N

T59N

R11W

- T58N ■ AURORA
- BABBITT
- HOYT LAKES

R15W

R14W

R13W

R12W

DEPARTMENT OF THE INTERIOR VS MINING PROPOSALS

SYMBOL	COUNT	PERCENT	ACRES	LEGEND	
■	0	72993	51.1	182392.5	ZONE 2 - WOLF HABITAT
■	1	30153	21.1	75382.5	MINING PROPOSALS AND ZONE 2 - WOLF HABITAT
■	2	37030	25.9	92575.0	EAGLE NESTS AND/OR ZONE 4 - WOLF HABITAT
■	3	577	0.4	1442.5	EAGLE NESTS AND/OR ZONE 4 - WOLF HABITAT AND ERIE
■	4	702	0.5	1755.0	EAGLE NESTS AND/OR ZONE 4 - WOLF HABITAT AND AMAX
■	5	1411	1.0	3527.5	EAGLE NESTS AND/OR ZONE 4 - WOLF HABITAT AND US STEEL
■	6	53	0.0	132.5	EAGLE NESTS AND/OR ZONE 4 - WOLF HABITAT, ERIE AND US STEEL

Superior National Forest

Table 9 identifies overlaps between mining proposals and existing or proposed land uses in the Superior National

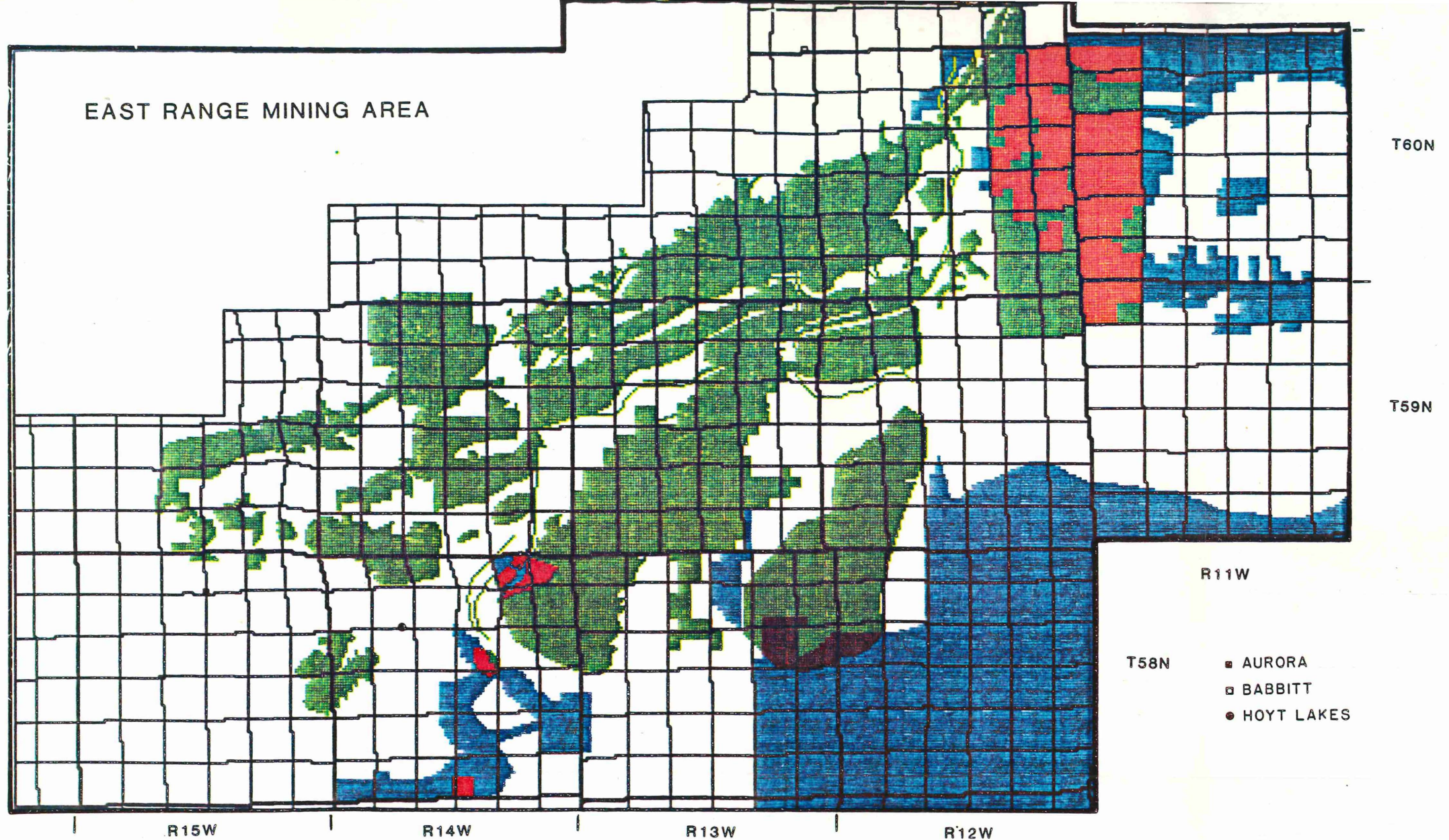
Forest. This information is illustrated on the map on the facing page and on A-20.

TABLE 9
Superior National Forest's Plans Versus Mining Proposals*
(acres)

	SUPERIOR NATIONAL FOREST				
	Softwood Timber	Ski Trails	Grouse Management Area	Seven Beaver Recreation Area	Total
AMAX	550	-	-	710	1,260
Erie	122	-	-	-	122
Exxon	9,579	-	-	-	9,579
Reserve	-	-	-	-	-
U.S. Steel	448	152	159	-	759
Total	10,699	152	159	710	11,720

*Includes existing mining

EAST RANGE MINING AREA



SUPERIOR NATIONAL FOREST VS MINING PROPOSALS

SYMBOL	COUNT	PERCENT	ACRES	LEGEND
0	88642	62.7	224105.0	NO DATA
1	28188	19.7	70472.5	MINING PROPOSALS
2	20321	14.2	50802.5	SUPERIOR NATIONAL FOREST
3	49	0.0	122.5	SUPERIOR AND ERIE
4	506	0.4	1265.0	SUPERIOR AND AMAX
5	305	0.2	762.5	SUPERIOR AND US STEEL
6	3847	2.7	9617.5	SUPERIOR AND EXXON

Comparison of Proposed Mining with Local Units of Government Plans

City of Babbitt

A table showing the conflicts between the City of Babbitt and the potential mining plans was not prepared since there was only one conflicting area, and this is easily identifiable on the map (data level 3 on following page). Babbitt's exclusion area generally corresponds to the exclusion area submitted by Reserve Mining Company and provides a buffer between the mining company and the village (data level 2 on map).

City of Hoyt Lakes

Table 10 identifies conflicts between the mining proposals and the land-use plan of the City of Hoyt Lakes. The information on this table is illustrated on the map on the following page and on

map A-21. The Partridge River Watershed is the source of potable water for Hoyt Lakes. The village is concerned that if too much mining development takes place in the watershed it will cause them significant water supply problems in the future.

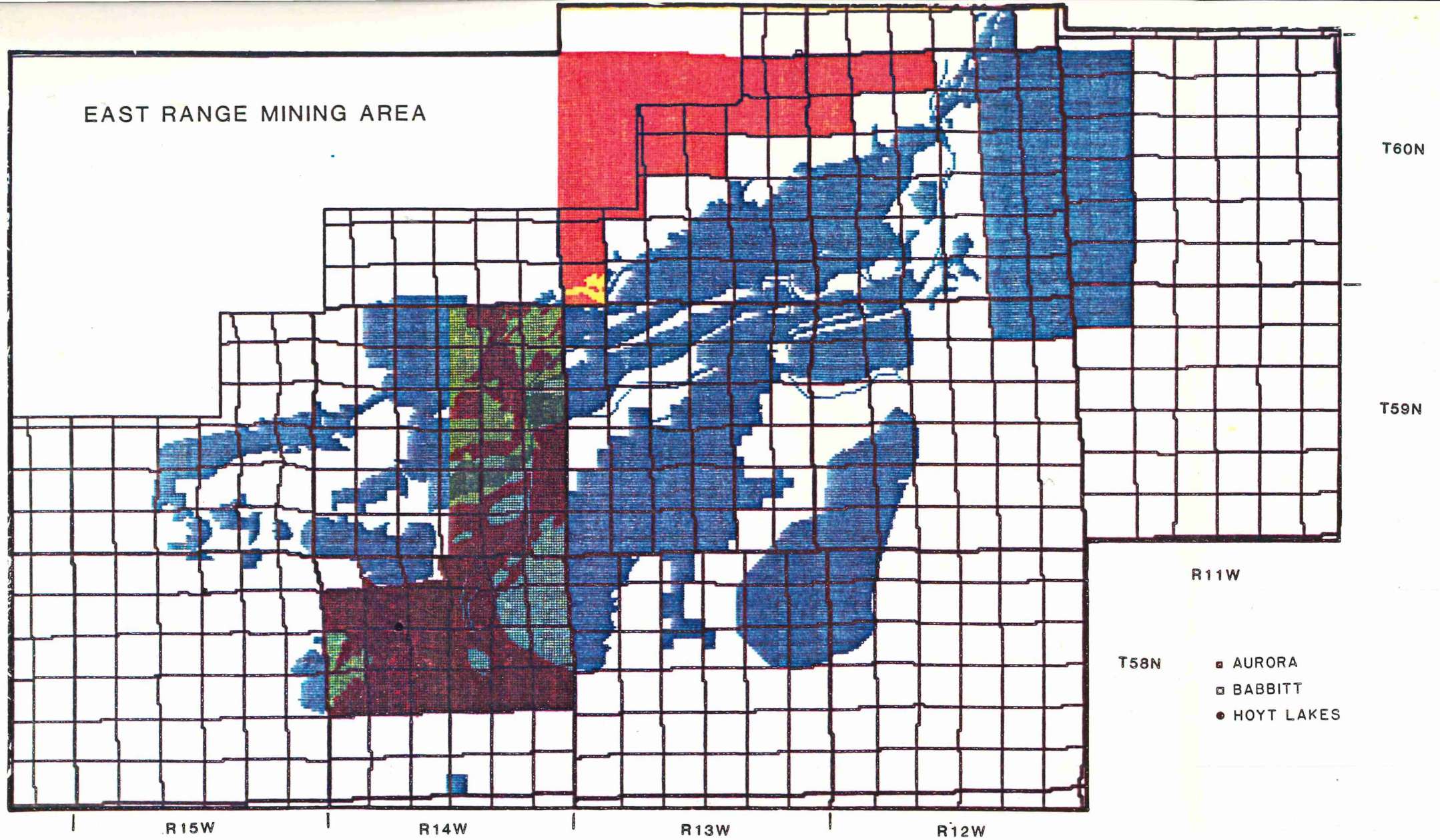
TABLE 10
Hoyt Lakes's Plans Versus Mining Proposals*
(acres)

	Partridge Watershed			Other Watersheds		Total
	Conservation District	Mining District	Remaining Watershed	Conservation District	Mining District	
AMAX	-	-	11,579	-	-	11,579
Erie	2,657	1,387	8,095	1,372	4,343	17,854
Reserve	-	-	4,455	-	-	4,455
U.S. Steel	4,283	1,320	6,641	-	10	12,254
More than one company	1,108	555	4,031	-	-	5,694
Total	8,048	3,262	34,801#	1,372	4,353	51,836

*includes existing mining

#Partridge River Watershed contains 88,751 acres

EAST RANGE MINING AREA



URBAN DEVELOPMENT VS MINING PROPOSALS

	SYMBOL	COUNT	PERCENT	ACRES	LEGEND
	0	98196	88.7	245465.0	NO DATA
■	1	28987	26.3	72467.5	MINING PROPOSALS
■	2	8109	4.3	15272.5	CITY OF BABBITT
■	3	80	0.1	200.0	BABBITT AND RESERVE
■	4	5668	4.0	14170.0	CITY OF HOYT LAKES
■	5	1818	1.1	4045.0	HOYT LAKES AND ERIE
■	6	1724	1.2	4310.0	HOYT LAKES AND US STEEL
■	7	487	0.3	1217.5	HOYT LAKES, ERIE AND US STEEL

SUMMARY

Tables 2 through 6 have identified a number of overlaps among the mining development plans. Two significant overlaps involve the resource, where proposed mining facilities overlap approximately 5,600 acres of potential mineral resource. In addition, there are a number of instances where more than one mining company has sited a facility on the same land. This type of overlap occurs on approximately 2,100 acres of land in the study area. Overlaps involving utility corridors (355 acres) are not as critical as others and can usually be resolved by selection of an alternative route.

There were a number of overlaps between the proposed mining plans and the siting

restrictions contained in the DNR's Rules on Mineland Reclamation for iron ore and taconite (see table 7). Mining facilities are proposed for over 1,000 acres of land excluded from mining. Additionally, a substantial acreage of land (22,000 acres) proposed for use by the mining companies is classified either as avoidance areas from mining or as natural resource conflict areas.

Tables 8 through 10 identified numerous overlaps between the potential mining plans and other land-use needs in the study area. A substantial portion (39%) of the Partridge River Watershed could be used for mining purposes. Such development would have to take into consideration the water needs of downstream

users, such as the City of Hoyt Lakes. Other natural resources in the area that could be greatly affected by mining include softwood timber (10,699 acres), recreational facilities and areas (1,000 acres), and wildlife habitat (81,000 acres).

CONCLUSION

In addition to the potential for several mining operations, there are numerous land-use demands involving a variety of natural resources in the East Range area. The access to mineral resources should not be obstructed by either mining wastes or other land uses that would inhibit mineral development. On the other hand, the development of the mineral resources must consider the non-mining land needs of the area. Since much of the mineral resource will be developed over a long time period, perhaps 100 years or more, effective planning will minimize both land-use conflicts and potential environmental impacts. The information contained in the East Range study is essential to the planning process and has already led to

the resolution of one land-use conflict. This report, in conjunction with cooperation among the members of the East Range committee, will hopefully lead to similar success in the future.

APPENDIX

1. Mineral Potential
2. Existing Mining
3. Surface Ownership
4. Mineral Ownership
5. Amax Project
6. Erie Mining
7. Exxon Project
8. Reserve Mining
9. U.S. Steel
10. City of Babbitt
11. Hoyt Lakes
12. Exclusion Map for Reclamation
13. Converted Exclusion Map for
Reclamation Rules and Regulations
14. U.S. Department of the Interior
Fish and Wildlife Service
15. Superior National Forest
16. Mining Proposals Combined
17. Mining Conflicts
18. Mining vs Reclamation Rules and
Regulations
19. U.S. Department of the Interior vs
Mining Proposals
20. Superior National Forest vs Mining
Proposals
21. Urban Development vs Mining
Proposals