Appendix M

Cumulative Wetland Effects Analysis

Cumulative Wetland Effect Analysis
East Reserve Mining Project

Prepared for Ispat Inland Mining Company

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BARR

4700 West 77th Street
Minneapolis, MN 55435-4803
Phone: (952) 832-2600
Fax: (952) 832-2601

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East Reserve Mine
Ispat Inland Mining Company

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1.0 Introduction

Barr Engineering Company has prepared this Cumulative Wetland Effects Analysis on behalf of Ispat Inland Mining Company for its proposed East Reserve Mine project as requested by the U.S. Army Corps of Engineers to meet the requirements of the National Environmental Policy Act (NEPA). The Council on Environmental Quality's regulations for implementing the NEPA defines cumulative effects as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions (40 CFR § 1508.7).

While the Minnesota Wetland Conservation Act and Section 404 of the Clean Water Act provide programs for evaluating the project-specific wetland impacts, the NEPA provides the context and carries the mandate to analyze the cumulative effects of federal actions (here the Section 404 permit authorization). The consideration of past, present and reasonable foreseeable future actions provide a context for assessing the cumulative impacts on the wetland resources.

This analysis includes the evaluation of the no action alternative as the baseline against which to evaluate the cumulative effects on wetland resources. This baseline will be compared to the wetland resources available in the past as well as expected to be present in the reasonably foreseeable future. The proposed mine development project (Figure 1), along with the future actions within the study area, will be evaluated to determine the potential for cumulative effects on wetland resources. The resources evaluated in this study include wetlands and deepwater habitats that provide many of the same functions throughout the study area.

Several of the primary functions performed by wetlands are directly related to watershed processes; therefore, the analysis will be performed on a watershed basis. The proposed mining activities and associated haul road will impact wetlands located in the Embarrass River watershed and Pike River subwatershed in St. Louis County, Minnesota.

2.0 Study Area

The majority of the proposed wetland impacts for the East Reserve Mine project will be located in the Embarrass River watershed (116 acres). There are only 7 acres of proposed wetland impact in the Vermilion River watershed, specifically the Pike River subwatershed. Therefore, the focus of this study will be on the Embarrass River watershed and the Pike River subwatershed.

2.1 Embarrass River Watershed

The Embarrass River watershed covers approximately 180 square miles extending from Gilbert to Babbitt (Figure 1). The Minnesota Department of Natural Resources (MnDNR) Census of the Land (1996) identifies the primary land uses in the watershed as water, wetlands, forests and brushland. Other land uses include hay, pasture, grassland, cultivated areas, mining and urban areas.

The urban areas in the watershed include Babbitt in the northeastern corner with scattered areas of housing along the major highways to the west and south of the city. The cities of Biwabik (including the Giants Ridge Ski area), McKinley and Gilbert are located in the southwestern corner of the watershed. These urban areas are generally experiencing limited growth and development adjacent to the already developed portions of the city. The primary areas of city growth in the watershed are in the Giants Ridge area of Biwabik and around the lakes.

The major highways that connect the cities within the area include State Highway 135, County Highway 416 and County Highway 21. Water resources (other than wetlands) in the watershed include:

- Several water-filled, abandoned mine pits;
- Two large, created wetlands that developed in the LTV Steel Mining Company's reclaimed tailings basin;
- Twelve named lakes in the south area including Embarrass, Gill, Hay, Leaf, Round, Sabin, Salt and Wine;
- Sixteen named lakes in the north area including Beaver, Cranberry, Falls, Fishing, Fiver, Hay (2), Hekkilla, Holter, Island, Kaunonen, Little Birch, Moose, Mud, Putnam and Spring Mine;
- Many small shallow lakes scattered throughout the watershed; and
- Many unnamed stream and rivers.

Historic activities within the study areas that have affected wetland resources are primarily mining activities, urban development and road construction. These activities began in the early 1900s and are the primary source of impact to wetlands in the study area. The majority of the study area has experienced limited disturbance due to previously mentioned activities and therefore limited loss of wetlands.

2.2 Pike River Subwatershed

The Pike River subwatershed encompasses approximately 38 square miles of land abutting the southwest side of the Embarrass River watershed, generally located east of the city of Virginia (Figure 1). The MnDNR Census of the Land (1996) identifies the primary land uses in the watershed as water, wetlands, forests and brushland. There are small areas of hay, pasture and grassland in the north and south ends of the subwatershed. There are mining areas located in the southeastern area of the subwatershed just east of the city of Virginia.

Cities that border or extend into the subwatershed include Virginia, Gilbert, McKinley and Biwabik. There is minimal urban development in other areas of the watershed.

The major highways that connect the cities within the area include State Highway 105 and County Highway 21. Water resources (other than wetlands) in the subwatershed include:

- Two named lakes, Hay and Rice, in the central area;
- Several small shallow lakes scattered throughout the area; and
- An unnamed stream/river system that flows out of the subwatershed at the northwest corner.

Historic activities within the study areas that have affected wetland resources are primarily mining activities, urban development and road construction. These activities began in the early 1900s and are the primary source of impact to wetlands in the study area. The majority of the study area has experienced limited disturbance due to previously mentioned activities and therefore limited loss of wetlands.

3.0 Study Methods

The extent of the wetland resources were estimated using the following methodology for three specific time periods that included pre-settlement, existing and future conditions. This analysis was used to determine the impact of all projects (past, present and future) on the wetlands located in the Embarrass River watershed and the Pike River subwatershed.

3.1 Pre-Settlement Wetland Resources

The wetland area estimated for the pre-settlement time period was developed using historical mapping and the National Wetlands Inventory (NWI). The process was completed in four steps, as follows:

1. Estimate the area of pre-settlement wetlands within the study area using historical wetland mapping (Trygg maps) based on the original government land survey notes (Trygg, 1966).
2. Compare the Trygg maps with the NWI.
3. Determine a relationship between the Trygg maps and the NWI for use as an adjustment factor to estimate the acreage of wetlands in areas that have experienced significant human impact.
4. Estimate the total acres of pre-settlement wetlands. The Trygg maps were used to identify wetlands in areas with significant human impact. The NWI was used to identify wetlands in areas with insignificant human impact.

The Trygg maps were developed by J. William Trygg (1966) utilizing data from the original Government Land Surveys along with other historical surveys and sources (http://www.trygglandoffice.com/maps.html). These historical maps included water features that were identified in the original land surveys such as marshes, bottoms, swamps, lakes or ponds, and rivers. These water features were digitized from the Trygg maps for 23 townships within and near the Embarrass River watershed and the Pike River subwatershed. The historical mapping information was used to estimate the extent of the pre-settlement wetlands.

A relationship was developed between the “wetlands” and water features shown on the Trygg maps and the NWI wetlands to account for the differences in map scale and human disturbance. Because the scale of the Trygg maps is relatively small (1:250,000), it is assumed to be less accurate than a larger scale and more detailed map such as the NWI (1:24,000). There are 23 townships that

encompass the project area, with some portions of these townships located outside of the watershed areas. A comparison of wetlands areas between the Trygg "wetlands" and the NWI wetlands was performed for the 23 townships. A summary of this comparison for each of the townships is shown in Table 1.

The difference in wetland area between the Trygg and NWI maps ranged from -44 percent to +70 percent, with an average difference of -6 percent. The -6 percent explains that, on the average, the Trygg maps have 6 percent less wetland area in the 23 townships compared to the NWI. Other than map scale, another reason for the range of difference may be due to human impacts on wetlands between the time of the original land survey and compilation of the NWI map in the 1970s, and differences in the purpose and methods utilized in each mapping effort.

The land cover (or land use) categories were estimated for each of the 23 townships to identify townships which have experienced limited human impact on wetlands. The MnDNR Census of the Land (1996) landcover GIS layer was used to estimate the impacted areas (http://deli.dnr.state.mn.us/metadata.html?id=L390002840604). In this data set, the land cover was divided into the following classes: bog/marsh/fen, brushland, cultivated land*, forested, hay/pasture/grassland*, mining*, urban and rural development* and water. Land cover classes with an asterisk were the classes assumed to be associated with human impacts. Therefore, the total area of these four land cover classes was calculated for each township and then divided by the total area of the township, as summarized in Table 1. The percent of human impacted land ranged from 0.5 percent to 41.3 percent within the 23 townships that were evaluated, with a total of 13.8 percent of the evaluated area impacted by human disturbances.

Eight of the 23 townships had wetland impacts that were less than five percent. It is assumed that due to the minimal amount of impact in these eight townships, the NWI mapping in these townships is representative of pre-settlement wetland conditions. Therefore, the data for these eight townships were used to develop a relationship between the NWI and Trygg wetlands. The total wetland acreage for the two data sets was compiled and the ratio of NWI to Trygg wetlands was calculated as an adjustment factor of 1.13 for these townships (Table 2). The adjustment factor explains that there were 12.8 percent fewer (-12.8%) wetlands identified in the area using the Trygg maps compared to the NWI maps. This adjustment factor was used to adjust the area of wetlands depicted on the Trygg maps to the standards and scales of the NWI.

Before the final calculation of the predevelopment wetlands was completed, additional data were used along with the MnDNR Census of the Land (as discussed above), to describe the impacted areas. Three additional layers of data were used to determine human impacted areas, which included:

1. MnDOT road layer for St. Louis County - all roads identified within the two watersheds were buffered at 33 feet on each side of center (for a total width of 66 feet).
2. MnDOT railroad layer for Minnesota - all railroads identified within the two watersheds were buffered at 15 feet on each side of center (for a total width of 30 feet).
3. MnDNR mining features layer (2003) - all areas located within the mining feature areas were assumed to be impacted.

The GIS was used to create an impacted wetland area layer containing a polygon with the boundaries of the four data sets as described above. The NWI wetlands located within the boundaries of this polygon were removed from this layer using a GIS clipping tool. The wetlands digitized from the Trygg maps were overlaid on the impacted wetland area layer to represent the pre-settlement wetland conditions. The areas of the Trygg wetlands within the clipped layer were multiplied by the adjustment factor of 1.13 to calculate the acreage of historic wetlands correlated to the NWI. Therefore, the total historic wetland resources within the study area were a compilation of the following:

1. NWI wetland mapping in relatively undeveloped areas; and
2. Trygg wetland mapping adjusted to the NWI in historically impacted areas.

3.2 Existing Wetland Resources

Wetland areas estimated for the existing conditions were developed by compiling the following data:

1. The wetland delineations completed by Barr, which includes the Ispat Inland Wetland Delineation (2004), the Dewatering Routes Wetland Delineation (2005) and a supplemental delineation in 2006 to identify wetlands east of County Road 715 (Pike River Drive).
2. The extent of mine pit water bodies was developed using a combination of MnDNR Public Land Inventory maps and interpretation of the 2003 FSA aerial photography. The extent of open water observed on the 2003 FSA aerial photography was used for pits not covered by the Public Land Inventory maps.
3. The NWI was used to identify wetlands in all areas not covered in items 1, 2 and 3 above.

A “composite” wetlands layer was developed by deleting all of the NWI wetlands from the areas in which more detailed mapping has been completed. These wetlands were replaced with the delineated wetlands, the mine pit water bodies, and the PolyMet tailings basin wetlands as discussed above. The NWI wetlands were also removed from the extent of the active Laurentian Mine Pit (no wetlands were assumed to be present within the extent of this mine).

3.3 Projected Future Wetland Resources

Wetland areas estimated for the future conditions were developed by using the existing conditions wetland mapping and deleting the projected future impacts from the map. Projected impacts included the East Reserve project and other reasonably foreseeable future projects including the St. Louis County highway projects and the MnDOT bridge project.

4.0 Cumulative Effects Analysis Results

4.1 Pre-settlement Conditions

Pre-settlement conditions within the study area were identified through comparison of historic and recent land use maps, evaluation of past mining activities compiled by the MnDNR, and discussions with city officials.

4.1.1 Embarrass River Watershed

The pre-settlement conditions assumed there had been no impact to wetlands. A total of 40,563 acres of pre-settlement wetlands were identified in the watershed (Figure 2; Table 3), comprising 35.2 percent of the land area.

4.1.2 Pike River Subwatershed

The pre-settlement conditions assumed there was no impact to wetlands. A total of 8,732 acres of pre-settlement wetlands identified in the watershed (Figure 2; Table 3), comprising 35.9 percent of the land area.

4.2 Existing Conditions

Existing conditions were determined from evaluation of recent aerial photographs, field wetland delineations in select areas, the NWI and existing land use mapping resources.

4.2.1 Embarrass River Watershed

A total of 39,473 acres of existing wetlands and water bodies were identified in the 115,120 acre watershed (Figure 3; Table 3), comprising 34.3 percent of the land area. There has been a decrease of approximately 1,090 acres of wetland, or a 0.9 percent decrease in watershed land area covered by wetlands from pre-settlement conditions (Table 5). The change in wetland acreage has resulted primarily from mining projects, agriculture, development of municipalities, and construction of transportation infrastructure such as roads and railroads.

Mining activities are primarily located in the central to southern end of the watershed. Past mining operations in the southern portion of the watershed have also created mine pit lakes. The LTV Steel Mining operation created two deepwater basins within the reclaimed tailings basin after the operation

ceased in 2001. These basins are currently permitted waste disposal systems; therefore future activities in these basins are not considered as jurisdictional impacts to deepwater habitat and are not included in this analysis. There are agricultural activities located throughout the watershed. These activities include hayland, pasture and some cultivated cropland which have affected wetlands. In total, about 17.5 percent of the Embarrass River watershed has been impacted by human disturbance (Figure 3).

There are four cities located within the watershed and activities within those cities have affected historic wetland resources. In addition, there was development of recreational areas including the Giants Ridge Ski Resort and homes in the Sabin and Wine Lakes area. Other supporting infrastructure includes roadways, bridges and culverts, and railroads in the watershed.

4.2.2 Pike River Subwatershed

A total of 8,798 acres of existing wetlands were identified in the watershed (Figure 3; Table 3), comprising 36.2 percent of the land area. This represents an increase of approximately 66 acres of wetland, or a 0.3 percent increase in watershed land area covered by wetlands from pre-settlement conditions (Table 5). The increase in wetland acreage is primarily due to the differences in wetland mapping methods between the Trygg and NWI datasets and a beaver impoundment in the area of the East Reserve Mine project haul road.

Mining activities have been primarily located in the southeastern end of the subwatershed, however, only 6.5 percent of the Pike River subwatershed has been impacted by human disturbance (Figure 3). Agricultural activities are very limited in the subwatershed. There are four cities located within or adjacent to the subwatershed. Other supporting infrastructure includes roadways, bridges and culverts, and railroads in the watershed.

4.3 Foreseeable Future Conditions

Various agencies were contacted to identify foreseeable future actions within the study area. The time period for identifying reasonably foreseeable future actions is 20 years. This 20-year time period was based on the projected life span of the proposed project, which includes 16 years of mining plus 4 years of reclamation.

Public officials were contacted within each city to obtain estimates of future development as follows:

1. City of Biwabik (contact: Terry Lowell and Marty Halverson) – the Giants Ridge Ski Area was recently incorporated into the City of Biwabik. It is anticipated that development will occur in this ski area, however the extent of future projects is unknown. Areas around the original central area of Biwabik and the area around the Sabin and Wine Lakes is expected to have continued development, however, the extent is unknown.
2. City of Gilbert (contact: Erik Wedge) – There is currently development in the city that does not impact wetlands. In addition, there are no known future projects at this time that will impact wetlands.
3. City of McKinnley (contact: City Hall) – There was no response to phone calls and voice mails left at the City office. It is assumed that there will be no future development that will impact wetlands.
4. City of Babbitt (contact: Pete Pastika) – There is anticipated future development likely in the next 10 years but nothing is planned at this time.

County and state public transportation departments were contacted to obtain information about future projects in the watershed (Table 4). The St. Louis County Public Works (contact: Wayne Bergstedt, Virginia, MN) identified three projects, including:

1. A proposed route development between Babbitt and Hoyt Lakes. Construction is anticipated to begin in 2012-2016 if the funding is obtained. This project is approximately 20-30 miles in length and will impact approximately 17 acres in the watershed.
2. State Highway 21 will be resurfaced with no wetland impacts anticipated.
3. County State Aid Highway 138 from Biwabik to Giants Ridge Road, approximately 5 miles, will be reconstructed. There is an anticipated impact of 3 to 5 acres of wetlands for this project.
4. The MnDOT is considering work on a bridge on State Highway 135 over the Pike River. It is anticipated that approximately 0.2 acres of wetland impacts will result from the project.

The MnDOT (contact: Brian Larson, Duluth) identified one other project that would impact the watershed, however only the general corridor has been identified for the reroute. This project will not impact wetlands in the watershed.

The Ispat Inland East Reserve Mine project is expected to directly impact 87 acres of wetlands within the Embarrass River watershed and 7 acres within the Pike River watershed. A study of the potential

for indirect wetland impacts through the loss of hydrology indicates the potential to impact an additional 29 acres of wetlands within the Embarrass River watershed. In contrast to the direct and indirect loss of wetlands, the project will have a net benefit on water resources. Upon reclamation of the project site, the 475 acres of mine pits will be allowed to fill with water. It is expected that approximately 275 acres of deepwater habitat will develop within the mine pits.

4.3.1 Embarrass River Watershed

There are 39,610 acres of wetlands and water bodies predicted to be present in the foreseeable future in the watershed (Figure 4; Table 3), comprising 34.4 percent of the land area. This represents an increase of 137 acres more wetland and deepwater habitats than in existing conditions, which is an increase of 0.1 percent of the watershed land area and a decrease of 0.8 percent of the pre-settlement watershed land area covered by wetlands (Table 5). The wetland impacted by the East Reserve Mine project will be mitigated outside of the study area and therefore, this acreage is not included in the future analysis for this report.

Changes in wetland acreage will be caused primarily by the projected impacts to 112 acres of wetland for the East Reserve project (Table 4). In addition, there are projected to be 22 acres of wetland impacts for transportation projects (Figure 4). Upon completion of the East Reserve Mine project, there will be an additional 275 acres of deepwater habitat established when the mine pits refill with water. There are no known agricultural or municipal projects for the foreseeable future in the watershed.

4.3.2 Pike River Subwatershed

There are 8,790 acres of wetlands predicted to be present in the foreseeable future in the watershed (Figure 4; Table 3), comprising 36.1 percent of the land area. This is a decrease of less than 0.1 percent from existing conditions and an increase of 0.2 percent from pre-settlement conditions (Table 5).

The East Reserve project proposes to impact about 7 acres of wetlands in the subwatershed. The MnDOT identified a potential bridge crossing that will impact less than one acre of wetland (Figure 4). The St. Louis County Public Works Department did not identify any future impacts in the subwatershed. There are no known agricultural or municipal projects for the foreseeable future in the watershed.

4.4 No Action Alternative

The no action alternative assumes that the proposed East Reserve Mine project will not occur in the future. The projected future wetland impacts in the Embarrass River watershed and the Pike River subwatershed under this scenario will be caused by the PolyMet project and transportation projects.

In the Embarrass River watershed, without the East Reserve Mine project impact of 116 acres, there will be a total of 39,451 acres of wetlands in the future (Table 4). This represents a decrease of 22 acres of wetland, or a 1.0 percent and 0.2 percent decrease in wetland acreage from existing and pre-settlement conditions, respectively (Table 5). While the wetland impact would be decreased by 116 acres, the no action alternative will not result in the establishment of the 275 acres of deepwater habitat that would be created after the East Reserve Mine project ends.

In the Pike River subwatershed, without the East Reserve Mine project impact of 7 acres, there will be 8,797 acres of wetlands in the future (Table 4). This represents a decrease of less than 1 acre of wetland, or less than a 0.1 percent decrease in wetland acreage from existing conditions and a 0.3 percent increase from pre-settlement conditions (Table 5).

5.0 Conclusions

The analysis completed for this study indicated that more than 99 percent of the existing wetlands in the study area will be present in the foreseeable future with or without the East Reserve Mining project (Table 5). So, while human development has impacted about 24 percent of the study area, this impact has resulted in a loss of less than one percent of the watershed area covered by wetlands. The Embarrass River watershed and the Pike River subwatershed are unique in contrast to the historical loss of wetlands in the United States.

Between the 1780s and the 1980s, the lower 48 states have lost about 53 percent of the pre-settlement wetland habitat (http://www.epa.gov). Minnesota and Wisconsin have lost 42 and 50 percent of their original wetlands, respectively. The prairie pothole region of Minnesota, which has been extensively farmed and drained, only has approximately 10 percent of the original wetlands remaining on the landscape (T. Dahl, USFWS, *Status and Trends of Wetlands in the Conterminous United States 1998-2004*, Washington DC). The northeastern wetlands of Minnesota are unique in that the loss of wetlands has remained relatively small in comparison to the remainder of the state.

The impacts to wetlands in the Embarrass River watershed and Pike River subwatershed result from the East Reserve Mine project and transportation (Table 4). The largest impacts are due to the projected loss of 123 acres of wetland associated with the East Reserve mining activities and haul road. However, even these impacts are small in comparison to the current amount of wetland acreage, which is more than 34 percent of the total land in the study area (Table 3).

Wetlands in the study area are similar in type and function to wetlands found throughout this portion of northern Minnesota. Most wetlands in the study area are a combination of different types including shrub carr/alder thicket (Type 6), wet meadow (Type 2), black spruce and open bog (Type 8) and shallow marsh (Type 3). Wetlands generally provide functions including water quality improvement, wildlife habitat and water storage.

The 123 acres of wetlands that will be impacted by the East Reserve Mine project are typically located in disturbed areas where erosion, altered land use (roads, berms, excavations, etc.), and proximity to human activity have already degraded the quality of the wetlands. As a result, these wetlands currently have decreased functions and values.

Overall, these wetland functions have not been disrupted in the study area because the mining activities have been confined to specific locales where the wetlands are already degraded. With minimal activity in the remainder of the study area, there are few stressors on the majority of the wetlands and therefore, no significant reduction in the size or configuration of habitat. With plentiful high quality wetlands in the study area, mining activities will not cause habitat fragmentation or a loss of functions and values.

The East Reserve Mine project will also create 275 additional acres of primarily deepwater habitats when the mine pits will fill with water. The deepwater habitats serve a different function than most wetlands currently in the study area. Under the No Action scenario, these deepwater habitats will not be created, so the future wetlands and deepwater habitats under this scenario will be less than with the East Reserve Mine project. These deepwater areas will create new wildlife habitat which should result in an increase in biodiversity for the area. In addition, water will still be retained on the landscape and infiltrate through the soil and bedrock landscape resulting in similar functions as the original wetlands.

Wetlands in the Embarrass River watershed comprised 35.2 percent of the land area for the pre-settlement conditions and 34.4 percent of the land area for the foreseeable future with the East Reserve Mine project (Table 3). Wetlands in the Pike River subwatershed comprised 35.9 percent of the land area for the pre-settlement conditions and 36.1 percent of the land area for the foreseeable future with the East Reserve Mine project (Table 3). Overall, for the two areas, the wetlands comprised 35.3 percent of the land area for the pre-settlement conditions and 34.7 percent of the land area for the foreseeable future with the East Reserve Mine project (Table 3).

The impacts to the wetland resources in the Embarrass River watershed and Pike River subwatershed should be considered as insignificant when compared to the overall loss of wetlands in Minnesota. The impacted wetland acres will be mitigated outside of the project area; however, the East Reserve Mine will create additional wetlands and deepwater habitats. This results in an overall gain of the water resource in Minnesota.

The pre-settlement wetlands comprised 35.3 percent of the Embarrass River watershed and the Pike River subwatershed (Table 3). Currently, wetlands in the project area comprise about 34.6 percent of the total land area for this study (Table 3). Future wetland impacts are considered to be minimal since the study area will still have more than 34.6 percent of the land area covered by wetlands with or without the East Reserve Mine project (Table 3). Placing this project in the context of the region and the state, the cumulative effects of the future projects on the study area are considered to be insignificant.

Tables

Table 1. Existing conditions comparison by township of total area of wetlands from the NWI and Trygg mapping.

Township (T) Range (R)	Total Township Area (acres)	NWI Mapping Wetland Areas by Township (acres)					Trygg Mapping Wetland Areas by Township (acres)						Difference between Total Trygg minus Total NWI Wetlands	Percent Difference	Estimate of Impacted Area[1]	
		Lacustrine	Palustrine	Riverine	TOTAL Wetland Area	Percent Wetland	Marsh	Swamp	Lake	River	TOTAL Wetland Area	Percent Wetland			Area of Impacted Land Cover (acres)	Percent Impacted
T61 R14	22,506	1,284	7,250	0	8,534	37.9%	54	8,482	1,132	0	9,668	43.0%	1,134	11.73%	111	0.5%
T59 R13	22,259	30	9,641	53	9,724	43.7%	0	11,884	61	0	11,945	53.7%	2,221	18.59%	312	1.4%
T61 R12	22,531	4,330	3,381	31	7,743	34.4%	0	2,676	3,728	39	6,442	28.6%	-1,300	-20.18%	455	2.0%
T59 R16	23,393	124	9,310	2	9,436	40.3%	0	6,903	180	0	7,082	30.3%	-2,354	-33.24%	509	2.2%
T61 R13	22,494	3,440	5,382	13	8,835	39.3%	0	3,969	2,924	192	7,085	31.5%	-1,750	-24.70%	720	3.2%
T61 R16	23,315	505	6,945	126	7,577	32.5%	98	3,751	434	622	4,906	21.0%	-2,671	-54.46%	750	3.2%
T61 R15	22,810	125	7,367	9	7,500	32.9%	5	8,175	108	0	8,289	36.3%	789	9.51%	773	3.4%
T58 R14	21,584	1,008	7,357	290	8,655	40.1%	0	3,577	567	731	4,875	22.6%	-3,780	-77.54%	763	3.5%
T60 R17	21,258	1,958	8,887	47	10,892	51.2%	0	8,516	1,825	127	10,468	49.2%	-425	-4.06%	1,505	7.1%
T60 R14	22,594	165	9,615	0	9,780	43.3%	0	11,697	15	0	11,712	51.8%	1,932	16.50%	1,925	8.5%
T57 R16	23,301	517	7,988	0	8,505	36.5%	0	4,941	558	783	6,282	27.0%	-2,223	-35.38%	2,614	11.2%
T60 R16	21,823	10	7,495	93	7,598	34.8%	104	4,849	52	651	5,657	25.9%	-1,941	-34.32%	2,909	13.3%
T60 R12	23,248	189	6,646	27	6,861	29.5%	0	5,297	0	0	5,297	22.8%	-1,564	-29.52%	3,439	14.8%
T60 R15	21,039	0	8,032	24	8,057	38.3%	127	7,699	0	205	8,031	38.2%	-26	-0.33%	3,262	15.5%
T58 R15	22,836	884	5,502	127	6,513	28.5%	0	2,219	447	969	3,636	15.9%	-2,877	-79.12%	3,616	15.8%
T59 R17	22,368	105	5,573	6	5,684	25.4%	0	3,249	0	194	3,443	15.4%	-2,241	-65.10%	3,930	17.6%
T59 R15	21,868	700	4,029	8	4,737	21.7%	0	4,822	1,028	241	6,090	27.8%	1,353	22.22%	4,026	18.4%
T57 R17	23,027	1,821	6,423	2	8,247	35.8%	0	11,737	2,121	134	13,992	60.8%	5,746	41.06%	4,873	21.2%
T60 R13	22,747	270	4,946	0	5,216	22.9%	201	6,727	222	0	7,150	31.4%	1,935	27.06%	5,117	22.5%
T58 R16	23,241	1,621	4,936	4	6,562	28.2%	0	3,714	2,043	23	5,780	24.9%	-782	-13.53%	6,171	26.6%
T59 R14	22,881	1,408	4,318	0	5,726	25.0%	0	6,540	0	0	6,540	28.6%	815	12.46%	6,923	30.3%
T57 R15	23,073	614	6,642	0	7,255	31.4%	0	4,704	378	0	5,081	22.0%	-2,174	-42.78%	7,592	32.9%
T58 R17	22,416	717	1,822	0	2,539	11.3%	0	2,247	56	0	2,303	10.3%	-237	-10.27%	9,268	41.3%
TOTAL	518,787	21,826	149,498	862	172,186	33.2%	590	138,400	17,877	4,910	161,777	31.2%	-10,409	-6.43%	71,640	13.8%

[1]Urban and rural development, cultivated land, hay/pasture/grassland, and mining land covers from *Minnesota Land Use and Cover - A 1990's Census of the Land* (MnDNR).

Table 2. Existing conditions comparison by township of total area of wetlands from the NWI and Trygg mapping for the townships with landuse impacts less than five percent.

Township (T) Range (R)	Total Township Area (acres)	NWI Mapping Wetland Areas by Township (acres)					Trygg Mapping Wetland Areas by Township (acres)						Difference between Total Trygg minus Total NWI Wetlands	Percent Difference	Estimate of Impacted Area[1]	
		Lacustrine	Palustrine	Riverine	TOTAL Wetland Area	Percent Wetland	Marsh	Swamp	Lake	River	TOTAL Wetland Area	Percent Wetland			Area of Impacted Land Cover (acres)	Percent Impacted
T61 R14	22,506	1,284	7,250	0	8,534	37.9%	54	8,482	1,132	0	9,668	43.0%	1,134	11.7%	111	0.5%
T59 R13	22,259	30	9,641	53	9,724	43.7%	0	11,884	61	0	11,945	53.7%	2,221	18.6%	312	1.4%
T61 R12	22,531	4,330	3,381	31	7,743	34.4%	0	2,676	3,728	39	6,442	28.6%	-1,300	-20.2%	455	2.0%
T59 R16	23,393	124	9,310	2	9,436	40.3%	0	6,903	180	0	7,082	30.3%	-2,354	-33.2%	509	2.2%
T61 R13	22,494	3,440	5,382	13	8,835	39.3%	0	3,969	2,924	192	7,085	31.5%	-1,750	-24.7%	720	3.2%
T61 R16	23,315	505	6,945	126	7,577	32.5%	98	3,751	434	622	4,906	21.0%	-2,671	-54.5%	750	3.2%
T61 R15	22,810	125	7,367	9	7,500	32.9%	5	8,175	108	0	8,289	36.3%	789	9.5%	773	3.4%
T58 R14	21,584	1,008	7,357	290	8,655	40.1%	0	3,577	567	731	4,875	22.6%	-3,780	-77.5%	763	3.5%
TOTAL	180,892	10,846	56,633	525	68,004	37.6%	157	49,418	9,133	1,584	60,292	33.3%	-7,712	-12.8%	4,393	2.4%

[1]Urban and rural development, cultivated land, hay/pasture/grassland, and mining land covers from *Minnesota Land Use and Cover - A 1990's Census of the Land* (MnDNR).

Table 3. Total area and wetland area (acres) for pre-settlement, existing and future conditions.

Study Area	Total Land Area (acres)	Wetland Area (acres)							
		Pre-settlement Conditions with adjustment[1]		Existing Conditions		Forseeable Future Conditions with East Reserve Mine Project		Forseeable Future Conditions without East Reserve Mine Project (No Action Alternative)	
		acres	% of Total Land Area	acres	% of Total Land Area	acres	% of Total Land Area	acres	% of Total Land Area
Embarrass River Watershed	115,119	40,563	35.2%	39,473	34.3%	39,610	34.4%	39,451	34.3%
Pike River Subwatershed	24,320	8,732	35.9%	8,798	36.2%	8,790	36.1%	8,797	36.2%
TOTAL	139,439	49,265	35.3%	48,271	34.6%	48,400	34.7%	48,248	34.6%

[1]The adjustment is based on the ratio of Trygg and NWI wetlands in townships where development impact was less than five percent of the township area. The adjustment ratio equals 1.13 (see Section 3.0 for methodology).

Table 4. Summary of future known wetland impacts for the study area[1].

Project	Pike River Subwatershed with East Reserve Mine Project (acres)	Pike River Subwatershed with No Action Alternative (acres)	Embarrass River Watershed with East Reserve Mine Project (acres)	Embarrass River Watershed with No Action Alternative (acres)
St. Louis County Highway Department	0	0	- 22	- 22
MnDOT Pike River Bridge Replacement	< -1	< -1	0	0
East Reserve Mine project	- 7	0	- 116	0
East Reserve Future Open Water Areas	0	0	+ 275	0
LTV Tailings Basin	0	0	0	0
TOTAL Decrease in Wetland Area (acres)	< - 8	< -1	+137	- 22

[1]The (-) represents a loss of wetland acres and the (+) represents a gain of wetland acres.

Table 5. Comparison of pre-settlement, existing and future conditions[1].

Study Area	Total Land Area (acres)	Wetland Area (acres)								
		Pre-settlement Conditions (acres)	Existing Conditions (acres)	% Change from Pre-settlement to Existing Conditions[2]	Foreseeable Future Conditions with East Reserve Mine Project	% Change from Pre-settlement to Future Conditions[2]	% Change from Existing to Future Conditions[2]	Foreseeable Future Conditions with No Action Alternative	% Change from Pre-settlement to Future Conditions[2]	% Change from Existing to Future Conditions[2]
Embarrass River Watershed	115,119	40,563	39,473	-0.9%	39,610	-0.8%	+0.1%	39,451	-1.0%	-0.02%
Pike River Subwatershed	24,320	8,732	8,798	+0.3%	8,790	+0.2%	-0.03%	8,797	+0.3%	-0.004%
TOTAL	139,439	49,295	48,271	-0.7%	48,400	-0.6%	+0.1%	48,248	-0.7%	-0.02%

[1]The (-) represents a loss of wetland acres and the (+) represents a gain of wetland acres.
[2]This number represents the change in percentage of watershed wetlands.