

IX. Environmental Effects

This section examines the environmental impacts associated with the breach of the Silver Lake fuse plug. Silver Lake is a storage reservoir and one component of the Dead River Project (FERC No. 10855) operated by Upper Peninsula Power Company (UPPCO), a subsidiary of Wisconsin Public Service Corporation. Downstream from the Dead River Project is the Marquette Project (FERC No. 2589) operated by Marquette Board of Light and Power (MBLP). Both projects are located on the Dead River in Marquette County, Michigan.

The following assessment is the result of site visits, field interviews and newspaper/official web site accounts of the events. When available, quantifiable information of the impacts associated with the breach are presented; otherwise, a descriptive analysis is provided for the consequences of the event. It is recognized that the environmental impacts of flooding are varied and wide ranging. This report outlines the major environmental and socio-economic issues resulting from the flooding. The incident itself is described in detail in preceding sections of this report.

A. General Description of the Dead River Basin and Project Area¹

The Dead River drainage flows through the north-central portion of Michigan's Upper Peninsula. It is the largest tributary to Lake Superior in Marquette County. The Dead River flows in a southeasterly direction from its headwaters in the bog forests of western Marquette County. Leaving the bogs as a small stream, it transverses remote forests, and steep terrain before entering Silver Lake. Approximately 20 of the 35 miles of the main stem river are occupied by five impoundments created by the two licensed projects. Silver Lake is one development of the Dead River Project which comprises three separate developments or facilities. Silver Lake is a storage lake with no generating facilities. Table 1 lists the hydroelectric developments on the Dead River.

After approximately 5.4 miles of river, flows enter the Dead River Storage Basin which is impounded by Hoist dam. Hydro generation is associated with this development. There is approximately 0.4 miles of free flowing river, including the tailrace, between the Hoist powerhouse and the McClure reservoir.

¹ Modified from the Federal Energy Regulatory Commission's Final Environment Assessment issued August 5, 2002 for the Dead River and Marquette Projects. Also includes sources of information from the license applications from UPPCO, 1994 and MBLP, 1999.

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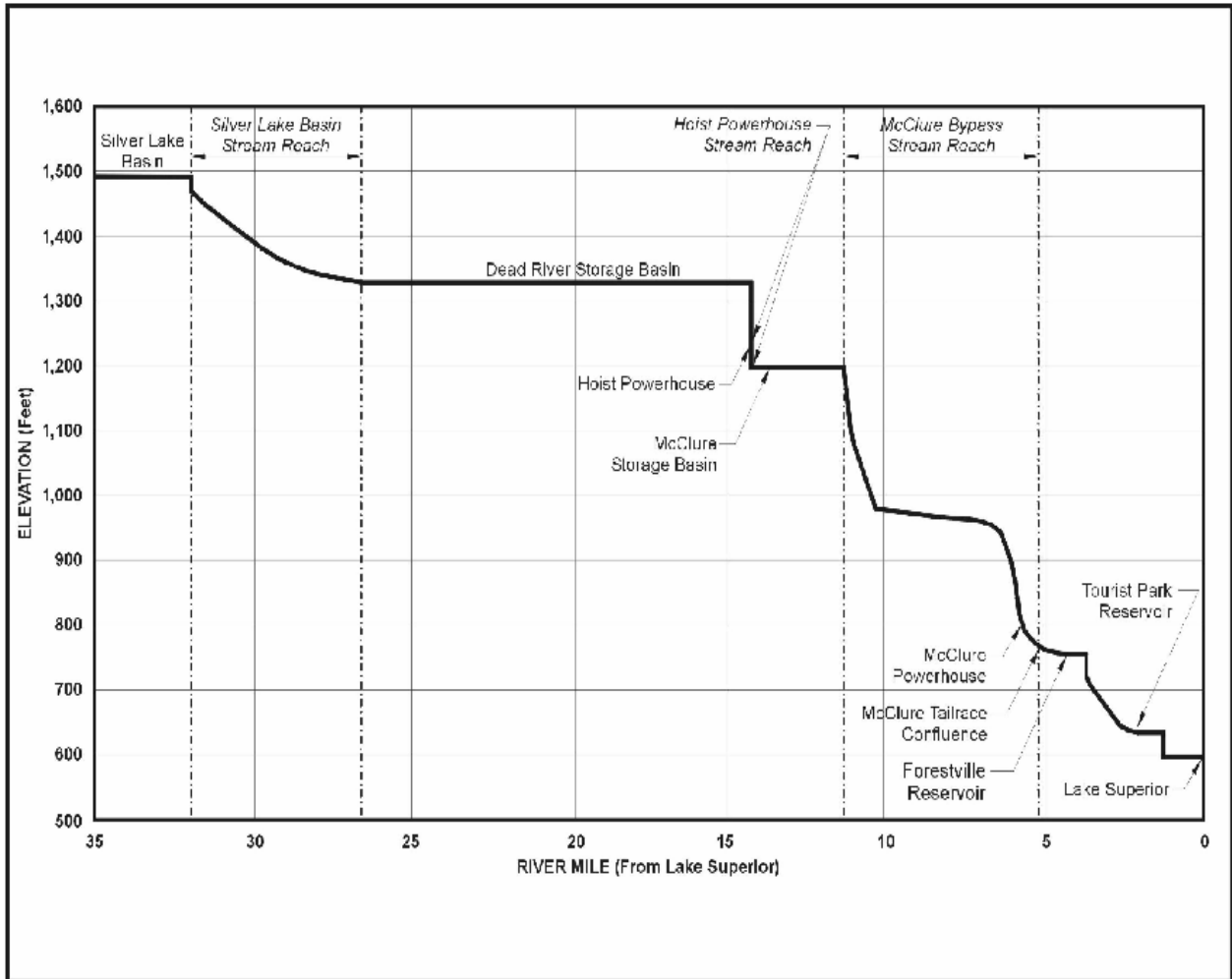
The McClure development includes a 13,302-foot-long penstock carrying flow to a powerhouse with two turbines. The length of the bypassed reach between the dam and where flows re-enter the Dead River below the powerhouse is approximately 6.1 miles.

Table 1. Hydroelectric developments on the Dead River.

Project/Development Name	FERC No.	Installed Capacity (kW)	Drainage Area (sq. mi.)	Surface Area (acres)	Approx RM at dam
Silver Lake	10855	0	23.4	1,464	32
Dead River	10855	5,500	134.3	3,202	14.4
McClure	10855	10,000	137.2	96	11.3
Forestville	2589	3,200	153.0	110	3.5
Tourist Park	2589	700	158.0	100	1.0

Flows that leave the McClure tailrace and bypass reach almost immediately enter the Forestville reservoir which is part of the Marquette Project. The Forestville development includes a 440-foot-long penstock that bypasses about one mile of the Dead River. The Forestville tailrace discharges into the backwaters of Marquette Project's second development, Tourist Park. From here, the Tourist Park powerhouse discharges directly into the Dead River approximately one mile from the mouth of the river at Lake Superior. Figure 1.0 depicts the lengths of the river reaches and the difference in elevation between the developments.

Figure 1.0. Dead River profile.



(SOURCE: UPPCO, 1994 as modified by staff)

The Dead River watershed measures approximately 158 square miles and lies entirely within Marquette County. It receives flows from numerous tributaries including Wildcat Canyon, Mulligan, Connor, Boise, Barnard, Clark, Reaney and Brickyard creeks and the Little Dead River. Based on project operation data, the average annual river flow is estimated to be 36 cubic feet per second (cfs) at Silver Lake and 240 cfs at Tourist Park. Average annual streamflow for the period 1991-1999 recorded at the U.S. Geological Survey's streamflow gage below McClure dam is 173 cfs.

The climate in the region is characterized by long, cold winters with heavy snowfall and cool, short summers. Usually the months of April and May have the highest river flows as a result of snow melt and October and November also experience high river flows due to fall rains. The climate is influenced by the

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northern latitude (N48^o 33.109) and by Lake Superior, which contributes to the heavy snowfall and moderates the extreme temperatures. Average annual precipitation is between 30 and 40 inches with snowfall ranging from 50 to over 200 inches in the drainage basin. Minimum and maximum temperatures for July are 55 and 80 °F, and for January are 5 and 25 °F.

Approximately 88 percent of all land in Marquette is forested. Vegetation in the project area is generally described as mixed northern hardwood and coniferous forest. Lands adjacent to the projects are dominated by deciduous and mixed deciduous and coniferous forests.

The largest city in the basin is the city of Marquette with a population of approximately 22,000 residents. It is located on Lake Superior near the mouth of the Dead River. Located west of Marquette are the towns of Negaunee and Ishpeming with populations of 5200 and 7000, respectively.

B. Environmental Impacts Resulting from the Breach

a) Geology and Soils

The topography and soils of the area are derived from materials deposited through glaciation. The soils consist of alluvial deposits. The activation of the fuse plug resulted in extensive bank erosion and the flushing of sediments downstream. Central to this point is the fact that the land below the fuse plug dike was not a river channel for flows downstream. The Silver Lake outlet works provides the mechanism for releasing flows to the Dead River. The confluence of the channel created by the breach below the fuse plug dike and the Dead River is approximately 1.5 miles below the fuse plug dike.

Also contributing to the amount of sediment downstream was the ratio of reservoir size to stream size and channel characteristics. The breach of a small dam and relatively small reservoir into a small stream will have measurably different consequences than a large reservoir being released in the same size stream. The ratio of storage capacity to stream size is significant in determining the impacts to the river. The reach below Silver Lake is considered a headwater stream with a relatively narrow width between 15 and 25 feet.

In determining the volume of sediment washed downstream at Silver Lake, the team calculated the volume of materials contained in the fuse plug dike that were completely washed away and estimated the bank erosion downstream. Because the dike was recently constructed in 2002, no accumulated sediment was contained behind the dike; however, when the fuse plug was activated and the dike breached, substantial back cutting

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occurred. It is estimated that approximately 800,000 to one million cubic yards of sediment was transported downstream from Silver Lake as a result of the breach. (Photo 1) Independently, the Michigan Department of Natural Resources estimated the total sediment released at one million cubic yards (Personal communication with J. Mistak, MDNR).

Further erosion occurred below each of the downstream dams as the river channel exceeded flood stage. Below Hoist, McClure and Forestville, the channel is more deeply incised than the river below Silver Lake. Continuing downstream, the breaching of the Tourist Park dam (Photo 2) resulted in substantial erosion and the release of accumulated sediment from behind the dam. Much of this sediment was deposited in Lake Superior. (Photo 3)

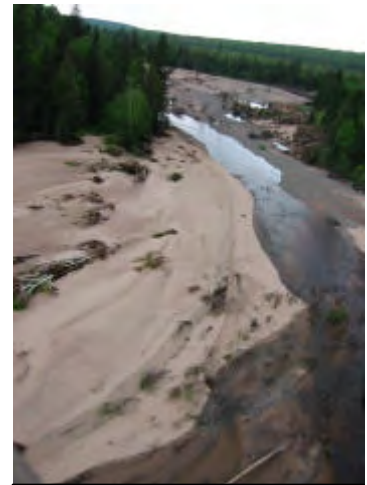


Photo 11. Sediment below Silver Lake. Source MDNR 6/9/03



Photo 13. Tourist Park dam breach. Source MDNR 5/15/03



Photo 12. Sediment plume into L. Superior. Presque Isle Power Plant in background. Source MDNR 5/15/03

Review of aerial photographs taken May 23, 2003 show that the sand and gravel sediment from Silver Lake was deposited along the streambanks up to 4.5 miles downstream from the breach (Aero Metrics). The Dead River is approximately 5.4 miles between Silver Lake reservoir and the Dead River storage basin. The difference in elevation between Silver Lake and the Dead River storage basin is approximately 120 feet (a slope of approximately 20 feet per mile) which allowed the larger alluvium and glacial outwash materials to be deposited along the 5.4 mile meandering stream (Photo 4). On May 28, 2003, a site visit to

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the project areas showed that the silt and fines were still suspended in the water columns of the downstream reservoirs and all the way to the mouth of the river.

b) Water resources

The water quality of the Dead River, its impoundments and tributaries, is a reflection of the mineral and organic composition of the soils and geologic materials in the watershed. The EA states that the waters of the Dead River exhibit low hardness, slightly acidic to near neutral pH (from 6.3 to 7.7), and a slightly organic, tea-colored stain. The EA also states that waters in the Dead River watershed have good chemical and biological quality. The river water meets Michigan state water quality standards for total dissolved solids, pH, microorganisms, nutrients, taste-and odor-producing substances, and physical properties appropriate for state-designated uses. The EA states that dissolved oxygen levels for the stream reach below Silver Lake are satisfactory (mostly high) with daily averages well above the state water quality standard of 7 mg/L for a coldwater stream. DO levels ranged from a high of 12.1 mg/L in September to a low of 6.5 mg/L in August.

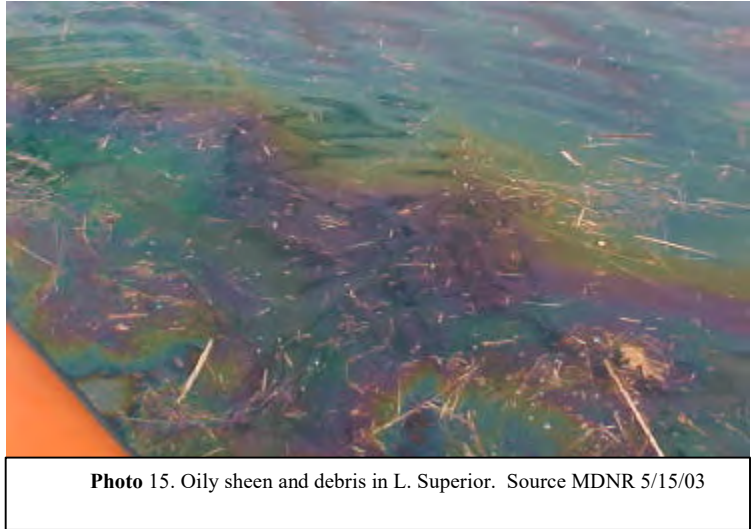


The EA adds that the Dead River is not used by any municipalities as a potable water source. In the freshwater estuary downstream of the Tourist Park development, the Dead River provides cooling water for operations at the Presque Isle coal-fired power plant operated by the Wisconsin Electric Power Company. There are no other substantial consumptive uses of project waters or discharge of wastewater into the projects' watershed.

Following the breach of the fuse plug and subsequent increase in suspended solids and decaying vegetative material, the dissolved oxygen concentration would have decreased significantly while water temperature would have increased slightly. Review of aerial photographs taken on May 23, 2003 show that the river reach below Silver Lake was the first segment to exhibit clear water. This is not surprising since most of the sediment has been deposited and the water flowing downstream is clean inflow to Silver Lake. However, with the extensive turbidity of the Dead River storage basin, it is expected that the water quality below Hoist dam will remain substandard for a longer

period significantly impacting aquatic resources. Physical measurements of the various water quality parameters are not available at this time.

Reports of the event (Environmental News Network web page, May 16, 2003) also state that when the Tourist Park dam failed, the flood waters swept through the Presque Isle Power Plant grounds washing coal piles out into Lake Superior. Aerial photographs of the mouth of the Dead River and Lake Superior, taken the day after the breach, show an oily sheen over the surface of the water. (Photo 5)



c) Aquatic Resources

a. Fishery.

The impacts of the fuse plug breach resulted in small numbers of fish in Silver Lake being stranded in isolated pools as the reservoir drained. On May 15, 2003, Commission staff observed fingerling smallmouth bass (*Micropeternus dolomieu*) dead near small pools. No fish were observed swimming in seven small pools that were examined. At the time of staff's visit on May 15, the reservoir had not completely drained and the reservoir elevation was continuing to recede. The topography of the reservoir, the lack of massive fish strandings and the high rate at which the reservoir was evacuated suggests that a substantial portion of the fishery were transported downstream.

The MDNR has historically stocked Silver Lake with coldwater fish species. Among all the negative impacts associated with the breach, there may be a positive effect resulting from the draining of the reservoir. The draining of the reservoir will allow the MDNR to restock the reservoir with selected species and manage a coldwater fishery in the impoundment. The EA indicated that in 1984 and 1987, the MDNR conducted operations to remove white suckers and yellow perch in an effort to manage a coldwater fishery. If the MDNR's fishery objectives remained unchanged, a more effective eradication program can be conducted before restocking the reservoir.

Moving downstream, the sediment laden waters certainly had an adverse impact on the stream's primary producers, invertebrate populations, and fishery. Turbidity reduces light penetration through the water and subsequently photosynthesis which has a negative impact on the herbivorous invertebrate populations. Concerning macroinvertebrates, the most common response to high

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turbidity is an increase in downstream drift. Aquatic insects will dislodge from the substrate in response to decreased light. Prolonged levels of turbidity will result in the depletion of benthic macroinvertebrates and severe damage can result from heavy sediment deposits. (Photo 6).



Photo 6. Erosion below Silver Lake. Source UPPCO 5/15/03

Fish will naturally try to avoid areas of high turbidity. In areas where there is a high concentration of suspended solids and an opportunity to migrate, fish will withdraw from such an environment leaving it devoid as if a fish kill had happened in the area. With the high flows associated with the breach, it is likely that any surviving fish in the river reach below the Silver Lake migrated with the heavy flows to the Dead River storage basin. The heavy turbidity throughout the entire basin likely affected all fish life stages. The impacts in the river reaches below the dams would have been more severe due to the concentrated high flows in a limited channel. Aside from the salmonids, the majority of the fish species in the basin reproduce in the spring/early summer. The window for reproductive success is short in the colder climates. Also, the turbidity and high deposits of sediment reduce juvenile fish rearing habitat and growth, and likely will result in the loss of an entire year class of fish in the populations of the Dead River basin.

Also lost for the year are the fish stocked by the MDNR. The MDNR reports that the Marquette Fish Hatchery stocked 5,500 brown trout (*Salmo trutta*) below Hoist dam (estimated value \$4,125) and 20,000 brown trout below county road 550 (estimated value \$15,000). Also, approximately 120,000 chinook salmon (*Oncorhynchus tshawytscha*) were provided by the MDNR to the South Shore Fishing Association for rearing near the mouth of the Dead River. The MDNR stated that although an attempt was made to prematurely release the juvenile salmon during the flood, it is estimated that silt and stress caused an undetermined amount of delayed mortality. Surveying the damage of the rearing pens, the President of the South Shore Fishing Association stated in the Marquette Mining Journal (May 16, 2003) that more than likely all the salmon were dead from the lack of oxygen in the water. Lastly, the walleye stocking (*Stizostedion vitreum*) scheduled for Hoist and the splake stocking (hybrid between brook trout and lake trout) scheduled for Silver Lake did not occur this year. This will have an adverse impact on recreation, local businesses and tourism.

b. Mussels

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The freshwater mussel's life cycle is complex. Fertilized eggs develop into larvae, called glochidia, within the gills of female mussels. After the glochidia are expelled from the female, they must come in contact with a passing fish and parasitize its gills, fins or body. After a few days to several weeks, the glochidia drop off the fish host and settle to the river bottom to begin life as juvenile mussels. It may take several years (2 to 9) before juveniles mature and can reproduce. Mussels may live more than 70 years if conditions are adequate.

The failure of the Tourist Park dam resulted in the impoundment being evacuated and mussel beds exposed. On June 3, 2003, the fuse plug investigating team surveyed the Tourist Park dam and reservoir site. Numerous desiccated freshwater mussels (*Bivalvia: Unionidae*) were observed scattered throughout the reservoir floor. Staff identified at least two species based on the presence or absence of pseudocardinal or lateral teeth.² Following the dam breach, the once 100 acre reservoir was reduced to a 30-foot wide river channel. Presumably some freshwater mussels survive in the thalweg section, however, the hundreds of desiccated shells throughout the dewatered reservoir indicate a substantial mortality rate. Given the life history of mussels, recovery is expected to take many years.

d) Terrestrial

The EA indicates that the area surrounding Silver Lake is forest land composed of northern hardwoods (about 29 percent of the area), quaking aspen, paper birch, spruce-fir, mixed swamp conifer, and pine (jack, red and white pine). The forests are mostly second-growth that developed in response to the extensive logging activities in the area around the turn of the century.

Using the National Wetlands Inventory maps for the preparation of the EA, staff estimated the acreage of (palustrine) emergent marsh, scrub-shrub and forested wetlands within the reservoir pools, as well as wetlands contiguous with the reservoir and Dead River shorelines within the project area. The estimates are indicated in Table 2 below.

² Daniel L. Graf. (2000). A Key to the Freshwater Mussels (*Bivalvia: Unionidae*) of the Hudson Bay and Lake Superior Drainages of Northern Minnesota, North Dakota, and Canada. University of Michigan, Ann Arbor MI 48109.

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Table 2. Acreage of palustrine wetlands in the vicinity of the Dead River and Marquette reservoirs and along the Dead River in the project areas.

Reservoir/River Reach	Palustrine Wetlands (acres)
Silver Lake storage basin	184
Dead River reach below Silver Lake storage basin	184
Dead River storage basin	890
Bypassed reach below Hoist dam	0
Dead River reach below Hoist powerhouse	0
McClure storage basin	0
Bypassed reach below McClure dam	160
Within/upstream of Forestville reservoir	6
Bypassed reach below No. 2 dam	11
Tourist Park reservoir	11
Dead River below No. 3 dam	6
Total	1452

The flood waters released by the fuse plug most likely modified the size and structure of the wetland areas. In some areas of the basin, enlargement of the wetland area may have occurred; however, the wetland area along the Dead River reach below Silver Lake storage basin has been negatively impacted by reducing the available habitat through the deposition of sand and alluvial materials.

Below Silver Lake reservoir and each of the subsequent reservoirs downstream, hundreds of mature trees and shrubs were uprooted or knocked down as a result of the torrent flows (Photo 7). Others, along the stream banks below Silver Lake have sediment several feet thick piled over the roots that will prevent moisture from reaching the roots system and slowly cause the trees to die.



Photo 7. **Downed** trees and debris below Silver Lake.
Source MDNR 6/9/03

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e) Threatened and Endangered Species

The U.S. Department of Interior (Interior) has identified four federally listed species that may occur in the project area: peregrine falcon, Kirtland's warbler, gray wolf, and bald eagle. In a May 24, 1999, letter concerning licensing the project, Interior stated that the peregrine falcon and endangered Kirtland's warbler may occur in the project area as transients, but are not known to nest in the area. The peregrine falcon was delisted August 25, 1999 (64 FR 164). The May 14 event likely had no impact on these species.

The endangered gray wolf is known to occur in the project area. Habitat for this species is any large forested area supporting an abundance of deer with minimal human intrusion. The May 14 event likely had no impact on this species.

The threatened bald eagle occurs within the project area. Unless there was a nest in a tree that was toppled by the flood, there was likely no adverse impact to this species. There were no reports of any nests in the flooded area.

As reported in the EA, Interior states that no federally listed species of fish or wildlife are known to occur in the vicinity of the Marquette Project; therefore, it is expected that there were no impacts to listed species in that area.

f) Cultural Resources

The EA states that there are no archaeological sites or historic resources in the areas of potential effect for the Dead River or Marquette Projects. However, an old gun powder factory site, from the late 1800's to early 1900's, was discovered in the Tourist Park reservoir. The site consists of bricks and mortar at the ground level. Nearby are the remains of timber dam (Photo 8). The flooding event did not impact the site other than to



Photo 8. Timber dam near old gun powder factory (not shown) in Tourist Park reservoir. Source FERC 6/03/03

expose an area that was previously submerged. The State Historic Preservation Office will need to be consulted regarding future activities that may affect the site.

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g) Recreational Resources

The Dead River area and project reservoirs provide an abundance of outdoor recreational opportunities. During the spring, summer and fall months, some of the opportunities include fishing, hunting, boating, canoeing, and camping. During the winter months, snowmobiling, cross-country skiing and ice fishing are traditional activities.

With the failure of the Silver Lake dike and the Tourist Park dam, fishing opportunities in those reservoirs and the 5.4 mile river reach below Silver Lake have been eliminated and/or substantially impacted for 2003 and for an undetermined period thereafter. Additionally, due to the high concentration of silt and the high flood flows, the fishing opportunities in the remaining reservoirs and river reaches will also be negatively impacted. As of July 2, the Marquette County webpage stated that the basins remain hazardous because of debris and water turbidity and as a result the Hoist, McClure and Forestville reservoirs remain closed to the public with no recreational boating or fishing in accordance with the Governor's Evacuation Order of May 16, 2003. The Governor's Evacuation Order was lifted on June 11, 2003, allowing access to the Dead River with exception of Silver Lake. Recreational users, including boater and swimmers, are urged to use caution since dangerous conditions may still exist. Although the reservoirs are open to the public, it is anticipated that the success of anglers will be diminished due to the recovery and stress on the fishery.

At the Marquette Project's Tourist Park development, located on the north edge of the city of Marquette, there exists a 40-acre day use and camping area. The park features picnic areas, 100 recreational vehicle (RV) campsites, tent campsites, various ball fields, a playground, a swimming and beach area where canoes and kayaks are also launched, and a National Scenic Trail. The failure of the Tourist Park dam eliminated the reservoir and will have a substantial impact on beach users and swimming opportunities. Also, downstream from the Tourist Park development is an ADA-accessible fishing platform, restrooms and parking area that will need repairs and maintenance before usage can resume. Additionally, the damage in the Tourist Park area is likely to reduce the usage of RV and tent campsites for, minimally, the summer of 2003.

The Upper Peninsula is a popular summer destination region. The negative effects from the flood on hotel, restaurant and associated tourism businesses are unquantifiable at this time. The temporary closure of fishing in the Dead River basin and the loss of the Tourist Park reservoir will certainly impact the spring and summer tourism seasons.

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h) Land Use and Human Environment

The two projects are located near the largest urban area (City of Marquette) in the Upper Peninsula of Michigan. The major land uses within the project areas are residential development, light industrial, commercial forestry and recreation.

The Milwaukee Journal Sentinel (May 15, 2003) reported that following the breach of the Silver Lake dike, authorities ordered the evacuation of a 485 acre area in the northern half of Marquette. The report stated that more than 1,800 people were evacuated from their homes on Thursday, May 15, 2003. Marquette County reported that residents were allowed to return to their homes on Friday afternoon. There were no injuries reported and no missing persons associated with the flood. The report also stated that 20 vacation and permanent homes were damaged along with three businesses sustaining structural damage (Photo 9).



Photo 9. Homes flooded and turbid water in the Dead River Storage Basin. Source MDNR 5/15/03

The largest economic impact of the flooding event was the shutdown of the Presque Isle Power Plant located at the mouth of Dead River (and immediately below the Tourist Park development). The Marquette Mining Journal (May 29, 2003) reported that the combined waters from Silver Lake and Tourist Park reservoir inundated the plant damaging motors, gearboxes, switching equipment and transformers. The coal-fired plant has nine generating units that produce approximately 635 megawatts of power. Three hundred megawatts of the plants capacity is used to run the Marquette Iron Range mines that employ about 1,500 people. The Marquette Mining Journal (May 30, 2003) reported that shutdown of the power plant and subsequent shutdown of the mines resulted in approximately 1,100 miners being



Photo 16. Flooded Presque Isle Power Plant 5/15/03. Source: Marquette County

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temporarily laid-off since May 15. Cleveland Cliffs, the owner of the mines, estimated that the shutdown cost the local economy approximately \$1 million a day. (Photo 10)

Wisconsin Electric Power Company who owns the Presque Isle Power Plant estimates that the power plant produces about 50 percent of electricity used in the Upper Peninsula. As a result of its outage, residents and businesses were asked to voluntarily cut back on their electricity usage in order to prevent blackouts. The Milwaukee Journal (May 30, 2003) quoted a Marquette County official saying that 30 semi-trailer trucks equipped with diesel powered generators rolled into the Upper Peninsula to help cover the electricity shortage.

Other utility structures sustaining damage include the switchyard at the Tourist Park development (completely destroyed) along with a number of utility poles that were knocked over due to the flood waters. The Milwaukee Journal Sentinel (May 15, 2003) reported that in the town of Big Bay, about 30 miles from Marquette, some power and telephone service was lost. Also, residents of the Island Beach community were temporarily without power on Thursday, May 15. Water service returned to the area on Monday, May 19 with a temporary connection. A boil order was still in effect a week after the event for residents of Island Beach.

i) Transportation

At the end of May 2003, the Marquette County web page, reported that in the City of Marquette, part of Granite Street, Tourist Park, bridges over County Road 550, and the bridge over the Dead River at Lakeshore are closed due to damage. (Photo 11) Further, County Roads AAO and AAT remain close as does Lakeshore Boulevard north of Hawley Street. Marquette County estimated that the cost of repairs to roads and bridges destroyed or damaged at \$3 million. Sections of railroad tracts were also damaged causing a disruption in service and operation of the LS&I Railroad.



Photo 17. Damaged Lakeshore Blvd. bridge, 5/15/03.
Source: Marquette County

C. Summary

The activation of the fuse plug at Silver Lake reservoir (owned and operated by the Upper Peninsula Power Company) resulted in the release of an

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estimated 9 billion gallons of water. The uncontrolled flood swept through three additional reservoirs before causing the failure of the City of Marquette's Tourist Park development or the first dam on the river. A complete environmental and economic assessment of the impacts associated with activation of the fuse plug and subsequent failure of the dike will not be known for some time. Various local, state and federal agencies continue to assess the damage resulting from the flood. This report provides a description of the environmental baseline conditions and a qualitative evaluation of the various natural resource and human impacts associated with the breach. When available, quantitative data is provided.

The torrent waters from the Tourist Park dam resulted in the flooding and shutdown of the 625 megawatt coal-fired Presque Isle Power Plant. Over 1,100 people were out of work due to the shutdown of mines that rely on electricity from the power plant. The power plant's June 16 report on its web page stated that 4 units are back on-line with more to be added soon.

On Thursday, May 15, 2003, Governor Jennifer Granholm declared Marquette County a state disaster area. On June 5, 2003, the Governor requested that President Bush declare Marquette County a federal disaster area. According to the Marquette Mining Journal (June 28, 2003), this request was denied by the Federal Emergency Management Agency and the State is expected to appeal the decision.

The preliminary cost estimate of the flood's impact is \$102 million. Marquette County stated that on May 28, 2003, it submitted preliminary damage and injury assessment estimates to the Michigan State Police Emergency Management Division. The County indicated that the economic impact is throughout the Upper Peninsula. The estimate includes damages to public facilities, individuals, businesses, and the environment. A breakdown of the impacts consists of the following:

- Persons evacuated: 1,872
- Persons sheltered: 57
- Emergency and Public Safety Costs: \$127,000
- Roads and Bridges Damaged or Destroyed: \$3,000,000
- Dead River Damage including Fisheries, Soils, Trees: \$4,000,000
- Utility Facilities Damaged or Destroyed: \$10,400,000
- Primary or Secondary/Vacation Homes Damaged: 20
- Businesses Damaged (structural): 3
- Community Economic Impact: \$84,000,000

X. Appendix

A. Appendix A

Discussions during June 3-4, 2003, Site Visit