Flood of 1986 Challenged Employees and Machines

Twenty-five years ago, as Consumers Energy celebrated the 100th anniversary of its 1886 founding, a two-day storm of epic proportions tested its Muskegon River dams and the people of west Michigan like no weather event has, before or since. By the time it was over, west Michigan was swamped with more than a foot and a half of rain, at least six people died, 89 more were injured and public and private property suffered millions in damages. The storm posed a real threat to the integrity of Rogers, Hardy and Croton dams. Had they failed, the scope of the disaster unquestionably would have been much worse.

The week of Sept. 7, 1986 started out as routine as any for the Muskegon River dam operations and maintenance staff. Periodic unit inspections were getting under way for Croton unit 1 and 2 and Hardy Pond had been lowered one foot to decrease the chances that it would need to pass flows through the spill gates at Croton while the two units were out. On Sunday, Hardy unit 1 had experienced a brake failure and also was pulled out of service for repair.

Such activities were a common occurrence and that September seemed a good choice for completing the unit inspections.

As dawn approached on Thursday, flow passage had to increase at all three plants as rising pond levels need to be controlled.

It had been a dry summer and that Monday, Sept. 8, the Muskegon reached its lowest flow in two years, about 1,100 cubic feet per second (cfs) at the Croton plant. Work was proceeding routinely on Tuesday Sept. 9, as a storm front began moving into Michigan. Unlike most storms, however, this storm did not move across the area and continue east. This front would stall over the Lower Peninsula.

By 10:00 a.m. on Wednesday Sept. 10 about two inches of rain had fallen in the Croton and Hardy area. Consumers Energy’s Muskegon superintendent Charles J. Smith contacted the U.S. Weather Bureau office in Ann Arbor to obtain additional...
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weather information and the latest forecast. The Weather Bureau said it had no reports of heavy storms elsewhere and wasn’t predicting severe weather at that time. Still, with the increasing river flows from the rain, Smith decided to take a cautious approach and discontinue the planned unit inspection on Croton units 1 and 2. He ordered the crew to reassemble the units and place them back in service. The units were ready by 2:30 p.m. that day.

Throughout the day on Sept. 10, while the crew had been working on the Croton units, the rain continued to fall. The severe rain inundated all of west Michigan. By 10 p.m. an additional four inches of rain had soaked the area, and all available hydro units were online. Spill gates were opened at Rogers Dam and at Croton Dam because there is more water flow than can be handled by the generating units. By Wednesday evening, Smith decided to place operators on extended overnight duty at all three dams. Croton’s spill gates were opened to four feet. The one-foot drawdown at Hardy for the Croton routine unit inspections had been almost entirely refilled.

Constant heavy rain accompanied by thunder and lightning, fell throughout Wednesday night and into the early morning hours of Thursday, Sept. 11. At a m.p.m. spill gates at the Hardy plant were opened. As dawn approached on Thursday, flow passage was increased at all three plants to help lower rising pond water levels. An emergency crew was brought in to get the damaged Hardy unit 2 repaired so it can go back online to help pass the increasing volume of water. Flooding was discovered in the basement of the Rogers plant and local volunteer firefighters responded with pumps and sand bags to help keep machinery dry and prevent the units from tripping offline.

At 2 p.m. on Thursday, water begins to flow across 36th Street and down through the basement of the Rogers plant. The number of units operating at 100 percent capacity.

Consumers Energy’s operations and maintenance staff remained on duty in the plants at considerable personal risk to monitor and operate the equipment in order to safely pass the flood waters.

of the debris in the highly hazardous setting to maintain flows through the spill gates. By midday the worst of the storm finally passed and flows into Rogers Dam begin to abate slightly. Hardy and Croton were by no means out of the woods.

At 5 p.m. Thursday, water begins to flow across 36th Street and down through the Hardy Dam emergency spillway. At this point the total flow at Hardy was approximately 12,700 cfs. At p.m. the Emergency Action Plans (EAP) for a possible failure of Hardy and Croton Dams also were activated. The decision recognized that if the dams were to fail, a sudden additional torrent of water ten to 20 feet high would be sent downstream, threatening the lives and properties of numerous residents on Croton Pond and downstream. The EAP triggered the evacuation by local emergency responders of all downstream residents in the Muskegon River floodplain.

Despite the threat, Consumers Energy’s operations and maintenance staff remained on duty in the plants at considerable personal risk to moni- tor and operate the equipment in order to safely pass the flood waters.

In addition to the Muskegon River flows being passed through Hardy Dam, Croton also was receiving the flow of the Little Muskegon River. At 6 p.m. on Sept. 10, the flow at Croton peaks at 18,020 cfs with 56 feet of spill gates open, in addition to the plant’s four units operating at 100 percent capacity.

Over the next 12 hours, the rain finally relented. The flows slowly decreased and pond levels gradually were restored to normal levels. The crisis at the dams was over, though many downstream residents would continue to battle flood waters and extensive damage in the coming days.

For Consumers Energy many lessons were learned. Programs to evaluate and make repairs and improvements to the dams to ensure they were safe were reduced.

Consumers Energy also has worked extensively with local units of government to strengthen Emergency Action Plan procedures for its dams. One of the most important lessons learned was the value of dedicated Consumers Energy employees who stand by their post throughout the storm and performed admirably under very adverse conditions.

Today, as Consumers Energy now cele- brates its 125th anniversary, television and electronic weather map radar displays pro- vide instant information about the weather. Yet we know that adverse weather never will be entirely predictable.

In two days, the week of Sept. 7, 1986 went from routine to the worst flooding disaster in west Michigan’s history.
Cooling Outflow Water Temperatures In 2011

During 2011, Consumers Energy continued to work in cooperation with the resource agencies to enhance hydro plant outflow temperatures. The work at the hydro plants continues to focus on the design, installation, and operation of “upwelling” systems that are being used during critical periods to bring cold water up from lower in the ponds, helping to cool outflows from the plants.

Upwelling systems at the Au Sable River Mio Dam and the Muskegon River Croton Dam, completed in 2010, in 2007 the one installed at Hodenpyl Dam on the Manistee River were in full operation in 2011. The modeling and design work for an upwelling system at the Manistee River Tippy Dam also was completed in 2011 and installation of the system is expected in 2012.

The study of summer hydro plant outflow temperatures, and efforts to improve those temperatures, continues to be an important part of Consumers Energy’s hydro project environmental objectives. So far Consumers Energy has invested nearly $4.5 million in this program as part of a $17.9 million commitment to address temperature and dissolved oxygen issues associated with the Manistee, Muskegon, and Au Sable River hydro plants.

Fish generally are grouped into classes of cold, cool and warm water species. Each group requires different ranges of water temperature for optimum survival and growth. The Manistee and Au Sable Rivers and the section of the Muskegon River below Croton are managed by the Michigan Department of Natural Resources as cold water fisheries, focused on species such as trout, salmon, and steelhead.

While Consumers Energy’s hydropower dam ponds provide excellent cool and warm water fisheries, managing the dams to support downstream river segments for cold water species presents some special challenges. Water temperatures in the outflows from the dams are affected by the size, depth and shape of their ponds. Other less obvious factors such as water chemistry also affect these cold water fisheries, especially during hot summer weather.

Water in the upper portion of the ponds absorbs more sunlight and becomes warmer than it would be under natural river conditions. Outflow temperatures can arise during the winter, spring, and most of the fall when natural conditions allow the water to mix throughout the pond, and there is less sunlight and heat from the water to absorb. During the heat of mid-summer, however, the water in the deeper ponds forms temperature layers. This is known as stratification and it happens in natural lakes, as well as the dam ponds. The deeper portion stays cooler and a boundary called a thermocline forms that prevents this colder water layer from mixing with the warmer water layer near the surface.

Most of Consumers Energy’s hydropower plants draw water from about the upper-third to upper-half of their ponds. In the summer when that shallower layer has warmed, the resulting plant outflows can be warmer than is optimal for cold water fish species. The cooperative efforts of Consumers Energy and the resource agencies have focused on methods of tapping the colder water layer in the hydro ponds.

This project, which began in 2005, has been complex. The depth of each pond, the volume of cold water available, how the cold water is replenished by inflows, determining when the cold water reserve should be tapped and determining how it could best be tapped are just a few of the questions that had to be answered for each dam.

The cold water resource is limited, so simply changing to a “bottom draw,” which has been suggested in the past, would deplete the supply of cold water during the spring and early summer when the river temperatures are already cool. This would result in little or no cooler water being available later in the summer when it would be most beneficial to fish.

The upwelling systems were developed to address this issue. They are designed to provide a mechanism that enables managers to control when the cold water layer is tapped. The systems use compressor driven air bubbler systems to upwell the colder water into the plant intake area. The systems are activated during the portions of the summer when they are most needed. Based on extensive data and computer modeling, each system is operated differently to match the characteristics at the dam pond where it is installed.

At Hodenpyl in 2011, the upwelling system was activated on July 11, when outflow temperatures began to average 71°F. Based on previous modeling and testing, the Hodenpyl system is operated between midnight and 6 a.m. when it builds on natural night time cooling to maximize the river cooling impact downstream. The studies showed that running the system continuously would exhaust the pond’s supply of colder water before the end of the warmest summer period in mid-August.

Once the Hodenpyl system was activated, based on the trigger temperature agreed to with the resource agencies, it was operated on a daily basis through September 3 when the average outflow temperatures consistently had fallen below 68°F. During the time the system was in operation, the outflow water temperatures were observed to drop about 1.8°F to 2.5°F.

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The complete reconstruction of this site will ensure that the Foote Tailwater Access remains one of Michigan’s most popular fishing access sites and that it will continue to serve the public for decades to come.

In 2012, the lower half of the sheet pile wall will be closed off from public access. Engineers working on the design of the rebuild determined that this closure is necessary to maintain an adequate margin of public safety at the site. Anglers still will be able to fish the upper half of the access area and also will be able to gain access by way of an existing stairway to the river below the end of the sheet pile wall. The fenced closure area is expected to be in place by April 15, 2012.

The 2013 access site reconstruction will be a component of a larger dam safety project. The design work is in process and is being conducted in consultation with the MDNR. The final design requires the review and approval of the Federal Energy Regulatory Commission. Once site plans have been finalized and approved, Consumers Energy will place a design drawing at the site for public information along with additional details regarding the dates of the 2013 closure as they become available.

Consumers Energy regrets the inconvenience to the public that will result from temporary closure in 2012 and the construction project site closure in 2013. However, the complete reconstruction of this site will ensure that the Foote Tailwater Access remains one of Michigan’s most popular fishing access sites and that it will continue to serve the public for decades to come.
Trumpeter Swans of the Au Sable Valley

The past winter brought a remarkable wildlife presence to the lower Au Sable River. Au Sable Valley Audubon Society members recorded 36 trumpeter swan observations in a single day on the Alcona, Loud and Cooke Dam hydrodams. Consumers Energy played a major role in the reestablishment of the trumpeter swan, one of Michigan's native waterfowl, to the Au Sable valley. Since that effort began in 1997, not only has a self-sustaining population become established on the hydro ponds, but the area has become a winter mecca for trumpeter populations from there and elsewhere.

Trumpeter swans once common in Michigan, but virtually were eliminated by the early 1900s. The chief culprits that brought about their demise were unregulated hunting to supply feathers for high society headgear, introduction of exotic mute swans from Europe, and loss of habitat as wetlands were drained and inland lakes throughout the state were developed.

In addition, there are also resident pairs from a much wider area.

The Au Sable trumpeter releases have shown was the kind of success that was hoped for when the reintroduction plans were developed.

The native trumpeter is easily distinguished from the exotic mute swan. While the adults of both species are all white, the trumpeter swan has a smooth, jet-black bill, while mute swans have a distinctive foghorn-like call, while mute swans have no distinct call and make no sound louder than a hiss.

The Au Sable trumpeter releases have proven remarkably successful. There are one or more resident nesting pairs of trumpeters from the original releases and their offspring at the Alcona, Loud, Cooke and Foote reservoirs.

In addition, the site also provides barrier-free access to a fishing area below the dam is being upgraded as part of dam maintenance project that will be completed in early summer 2012. A new access facility on the north side also is being developed and is targeted for completion by the end of 2012. The fishery below the Miö Dam has gained steadily in quality and popularity in recent years thanks to Michigan Department of Natural Resources efforts. This segment of the Au Sable River has benefited from a variety of habitat improvement efforts and a companion rainbow trout stocking program that takes advantage of those habitat enhancements. Habitat Improvement Account funds, contributed to the state by Consumers Energy under the hydro project licenses, were key in making many of the habitat enhancement projects possible.

MDNR has followed up the fisheries work with new regulations that include provisions for year round fishing in this portion of the river. The result has been an increased interest in better access, including barrier-free access for disabled anglers.

The existing south side access at Miö, completed in 1999, includes a parking area, vault toilet and a canoe launch site. The facility connects to the downstream Miö North Tailwater site. FERC approval by mid-summer 2012 is being sought. This would allow for construction to proceed this fall.

The fishing access improvements at the Miö North and South Tailwater sites are another element in a multi-party effort to enhance the Au Sable River segment downstream of the dam, both for natural habitat goals and for making the area more accessible to the public. The combined efforts of the Michigan DNR, the U.S. Forest Service, Big Creek Township and Consumers Energy will provide a rewarding opportunity for anglers and many others who will enjoy the cool, clear waters of the Au Sable River and its outstanding fishery for many years to come.

Left: Trumpeter swans at Alcona hydro.

Above: Plans for Miö Dam Tailwater improvements.
Improving Fish Habitat – The Habitat Improvement Account Program

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ince the Au Sable, Manistee and Muskegon River river projects were completed, project licenses were issued in 1994. Consumers Energy has provided more than $17 million to the Michigan Department of Natural Resources (DNR) - Fish Habitat Improvement Account (HIA) program.

These HIA funds, which were agreed upon as a way of mitigating any fish damage caused by the hydro plants, have been invested in a combination of fisheries research and projects that include habitat improvement, fishing access and erosion control. For 2011 Consumers Energy contributed about $17,000 to the HIA. The company’s HIA contribution is increased annually at the rate of inflation.

Projects eligible for HIA funding can be found by clicking here in the right sidebar. Projects are selected based on addressing management needs identified in the river assessments that the DNR has completed for each of the three rivers. The assessments may be found online at the DNR site: www.michigan.gov/dnr.

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Projects funded from the HIA program in 2011 included the placement of large trees on a section of the Au Sable River between the Alcona Dam and the Loud Dam Pond. This effort is part of an ongoing strategy aimed at replacing large trees along the Au Sable that typically fell into the river along the shorelines before the major logging drives began 200 years ago.

The trees improve fish habitat by providing fish cover and nutrients as well as by adding complexity to the river habitat by altering stream flow in their immediate vicinity. The Au Sable large wood restoration project was a joint effort of the U.S. Forest Service and Huron Pines Resource Conservation. The HIA contributed $150,000 toward this $175,000 project.

The Lower Manistee Restoration Partnership and Conservancy Resource Alliance (CRA) were awarded $175,000 in HIA funding for a $200,000 project to clear the Lower Manistee River of large water temperature and flow data in the upper Au Sable and Manistee River watersheds. The Michigan Department of Environmental Quality (DEQ) has issued a number of permits to drill new wells for natural gas in these areas using the hydraulic fracturing process. The long-term potential impacts of such activities on cold water trout

fisheries are largely unknown. This study, similar to a project now underway in Pennsylvania, is designed to provide baseline data for an assessment of possible future impacts. The monitoring and data analysis will be done through the Geology Department at Michigan State University.

The Michigan DNR and other partners will utilize an $85,000 grant to lead a multi-agency study on the Higgins Lake level control structure in the upper Muskegon River watershed.

The purpose of the study is to evaluate the likely effects of removing the control structure (returning the lake levels to their “natural” condition) on Higgins Lake and the Cat River system, including evaluation of surface water levels, shore-line characteristics, erosion, and fishery habitat.

Participating stakeholders in this project include DNR Fisheries Division, DEQ Water Division, the Muskegon River Watershed Assembly (MRWA), the Higgins Lake Property Owners Association, the Higgins Lake Foundation, Huron Pines as well as Michigan State University and University of Michigan researchers. The Roscommon County Board of Commissioners oversees the lake level dam and is supportive of this project. The study will take place over a two-year period and will include future management recommendations.

The Michigan DNR will receive $350,000 in HIA funding to conduct a late fall to early spring creel survey on the Au Sable River below Foote Dam. A major focus of the survey is to assess the success of steelhead trout stocking in the Au Sable River. The DNR is spending a significant amount on the stocking program and would like to have more details regarding the success of those stockings. It is anticipated that the survey would take place in 2013.

A $27,600 HIA grant to the Michigan DNR will fund 50 percent of the cost of a project designed to collect data on a watershed site inventory of dams and road crossings in the Muskegon River and tributaries, using Geographic Information System (GIS) technology. Information collected in this project will be entered into the standard barrier inventory database recently developed (through a 2010 HIA Grant) for Michigan DNR and other agencies bordering Lake Michigan.

The database was developed to insure information gathered will be consistent across waterbodies for each barrier, can be used by any agency or organization, and can be used for prioritizing barrier removal. The information gathered in this project will be used to determine the needs and costs of dam and road crossing stream crossing to improve fish passage and water quality.

Overall the HIA supported $191,400 of fisheries research, habitat improvement and stream restoration activities in 2011.

The Anglers of the Au Sable, Sportsman, and Muskegon (SAM) Anglers Association, Michigan Commission on Natural Resources, Michigan DNR, Muskegon County Board of Commissioners, and Muskegon County Conservation and Recreation Commission.

Michigan DNR has committed $100,000 to support the Michigan Watershed Assembly (MRWA), which is the Muskegon River Assessment.

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