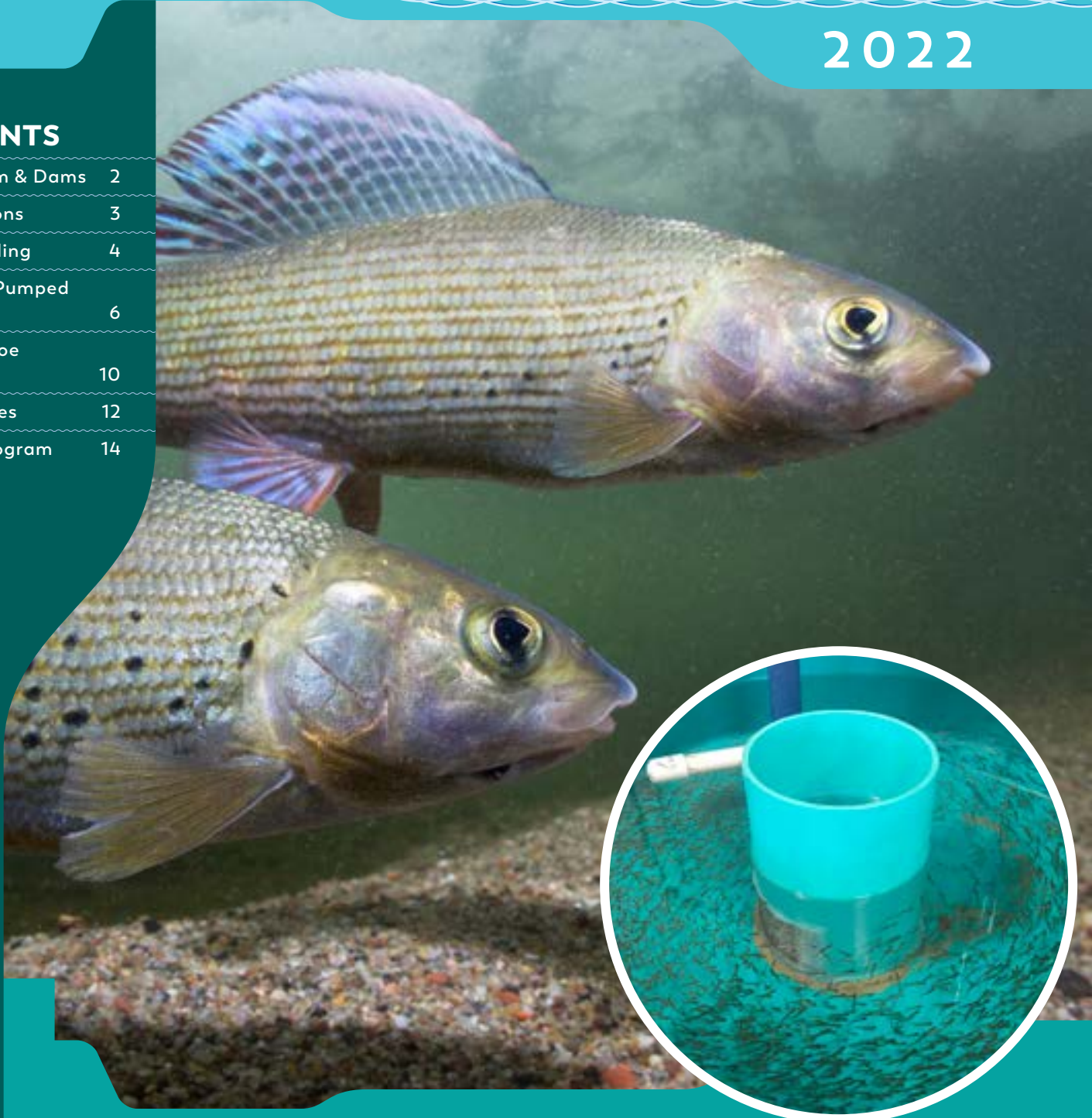


HYDRO REPORTER

2022

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The Arctic Grayling

Grant Supports Return of Native Fish

THE HYDRO REPORTER

Consumers Energy publishes the Hydro Reporter annually in conjunction with the Manistee-Muskegon-Au Sable Coordination Team to keep neighbors of the hydro plants and other interested citizens informed about progress in implementing the Federal Energy Regulatory Commission 40-year licenses issued in 1994. The MMAC Team, which includes representatives from Consumers Energy, state and federal Resource Agencies and an environmental coalition, coordinates the license implementation process. Contact information for MMAC Team members is listed below.

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CONSUMERS ENERGY HYDROELECTRIC PLANTS

MMAC Hydroelectric Projects

Au Sable River



Alcona Dam
In-service: 1924
Capacity: 8 MW



Cooke Dam
In-service: 1911
Capacity: 9 MW



Five Channels Dam
In-service: 1912
Capacity: 6 MW



Foote Dam
In-service: 1918
Capacity: 9 MW



Loud Dam
In-service: 1913
Capacity: 4 MW



Mio Dam
In-service: 1916
Capacity: 4.9 MW

Manistee River



Hodenpyl Dam
In-service: 1925
Capacity: 17 MW



Tippy Dam
In-service: 1918
Capacity: 21 MW

Muskegon River



Croton Dam
In-service: 1907
Capacity: 8.85 MW



Hardy Dam
In-service: 1931
Capacity: 30 MW



Rogers Dam
In-service: 1906
Capacity: 6.75 MW

Non-MMAC Hydroelectric Projects



Grand River
Webber Dam
In-service: 1907
Capacity: 3.225 MW



Kalamazoo River
Calkins Bridge Dam
In-service: 1936
Capacity: 2.55 MW

Note: MW = megawatts; 1 MW = 1,000 kilowatts (kW)
One megawatt is enough to power 1,000 homes.

Cover photo: A pair of adult arctic grayling.
Inset: One week after hatching. Photo: Michigan DNR Fisheries Division.

Consumers Energy Names Three to Key Posts

CONSUMERS ENERGY is pleased to announce the promotions of three employees to leadership roles in Hydro Generation.

ADAM MONROE



Monroe is the new Executive Director of Hydro Generation as of July 2021. His primary responsibilities include dam safety, reliability, maintenance improvements, environmental initiatives and federal regulatory compliance at Consumers Energy's 13 hydroelectric facilities and the Ludington Pumped Storage plant.

Monroe also chairs the MMAC Team and is a member of the National Hydropower Association and Midwest Hydro Users Group, a nonprofit volunteer organization that provides members with opportunities to learn, share and network.

A registered Michigan professional engineer, Monroe has 15 years of experience in dam safety. He most

recently was Chief Dam Safety Engineer, overseeing construction projects, maintenance, monitoring, regulatory compliance and safe operation of the company's river hydros and the Ludington Pumped Storage plant.

Monroe joined Consumers Energy in 2006 after graduating from Michigan Technological University with a bachelor's degree in civil engineering. He succeeds Neil Dziedzic, who retired.

SCOTT KNIGHT



Knight was promoted to Manager of Dam Safety, effective December 2021. He takes on Monroe's former responsibilities leading the dam safety organization and the Owner's Dam Safety Program.

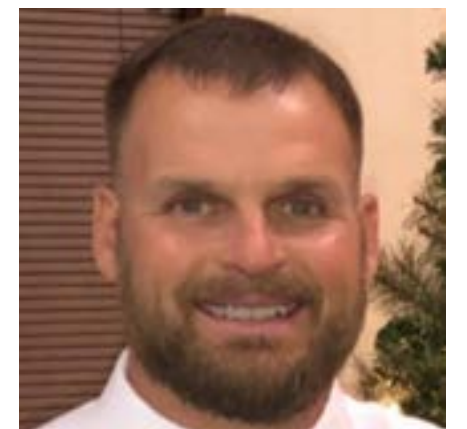
For over six years, Knight served as the Public Safety and Emergency Planner. In that role, he led a team that updated 14 Emergency Action Plans for the company's dams and

Ludington Pumped Storage plant. He also successfully developed and implemented programs focused on public safety and business continuity and oversaw regulatory compliance, environmental stewardship and security.

Before joining Hydro Generation, Knight was the Assistant Director of Risk Management and Safety at the University of Notre Dame, where he handled increasing responsibilities during his 22-year tenure.

Knight holds a bachelor's degree in industrial and environmental health management from Ferris State University and leadership certification from Notre Dame's Mendoza College of Business.

COLBY COTTICK



Cottick has served as Manager of Hydro Operations since January 2022. His responsibilities include planning and supervising the

(Continued on page 11)

Grant Supports Return of Native Fish

THE CONSUMERS ENERGY FOUNDATION has awarded a \$70,000 grant this year to Northern Michigan University to support the Michigan Arctic Grayling Initiative to reestablish a freshwater fish that disappeared from the state in the 1930s.

The initiative is led by the Michigan Department of Natural Resources and the Little River Band of Ottawa Indians and supported by more than 40 partners, including Consumers Energy. The partners are working toward a goal of restoring a self-sustaining grayling population in 2024 or 2025.

The grant will fund research to continue to develop and evaluate several rearing options to determine which will likely work best for Michigan streams and provide labor and cost savings.

A member of the salmon family, grayling were once native to the cold, clear waters of only Michigan and

Montana in the continental United States. However, they've continued to thrive in Alaska and Canada.

While remote site incubators have been used successfully to rear eggs in Montana streams, their successful operation is less certain in Michigan streams.

"RSIs used in Montana require intake pipes that are labor intensive to install and maintain," said Scott DeBoe, Consumers Energy Senior Environmental Analyst and MAGI representative.

"Michigan streams have a smaller change in elevation over the length of the stream than Montana streams. As this low gradient can cause sediment to plug the pipes, alternative designs are being researched that will be more efficient and effective."

After the design with the greatest likelihood of success is determined, the new incubators will be placed into streams to help protect eggs from predators and increase



The backs of arctic grayling are usually dark and their sides vary from black, silver, gold or blue.

Arctic grayling eggs. Photo: Michigan DNR Fisheries Division.



Arctic grayling have colorful, iridescent scales.

their hatching success. Once hatched, the young fish (fry) swim directly into streams where they grow, imprint the stream (become familiar with the water), hopefully establish residency and return to spawn.

"The incubator designs being evaluated represent a game changer for the logistics of grayling reintroductions," said Todd Grischke, Assistant Chief, DNR Fisheries Division. "A critical part of our action plan is to reduce as many risks as possible and increase our chance of success."

A Northern Michigan University graduate student in Marquette will analyze the performance of a variety of designs in experimental stream settings and provide data to identify the best egg incubation technique. Assistant Professor Dr. Brandon Gerig and Research Fisheries Biologist Dr. Troy Zorn will oversee the project.

The university is close to the Marquette State Fish Hatchery where about 4,000 juvenile fish are being reared to maintain their growth and survival. Eggs, brought from Alaska in 2019, were hatched at the Oden Fish Hatchery near Petoskey and transferred to Marquette in 2020. Eventually, the adults will be used

for brood stock, a source for eggs that will be placed in containers in the streams.

The docile fish disappeared from Michigan streams due to habitat loss from logging practices, overfishing and competing with more aggressive non-native species such as the rainbow trout and brown trout.

"The effort to reintroduce grayling into the species' historic range in Michigan would restore a species important to tribal culture and has been a priority of LRBOI for some time," said Archie Martell, Fisheries Division Manager for the LRBOI Natural Resources Department.

The award is the second grant given by the Consumers Energy Foundation. A 2017 grant supported stream habitat evaluations to determine suitable habitat for grayling, including upstream from Consumers Energy's Hodenpyl Dam.

To read the final report, Google "Rating the Potential Suitability of Habitat in Michigan Stream Reaches for Arctic Grayling."



The Ludington Pumped Storage plant sits below an embankment along Lake Michigan. The fish barrier net visible in the background helps prevent fish from entering the reservoir.

THE BIG BATTERY: Ludington Pumped Storage

WHILE CONSUMERS ENERGY'S 13 hydroelectric facilities harness river water to generate electricity, the Ludington Pumped Storage plant uses water from Lake Michigan.

Together, the historic river hydros and LPS are an important part of the company's Clean Energy Plan to produce clean, reliable and affordable energy from renewable sources.

Named one of the state's Top 10 engineering

achievements of the 20th century, LPS is the fourth largest pumped storage hydroelectric facility in the world and the second largest in North America. It's jointly owned by Consumers Energy and DTE Energy and operated by Consumers Energy.

LPS generates electricity during high electric demand times and helps reduce electric costs for customers who would pay more for power from outside sources.

The project sits on 1,000 acres on the east shore of Lake Michigan in Mason County. It consists of a powerhouse with six pump turbines each weighing 1,620 tons, a 110-foot-deep man-made reservoir and a host of public recreational facilities.

How LPS Makes Electricity

LPS generates hydroelectric power using water, gravitational forces and the everyday cycle of supply and demand.

The reservoir, which is 2-1/2 miles long and 1 mile wide, is surrounded by a 5-1/2 mile embankment. The 890-acre body of water can hold up to 27 billion gallons of water.

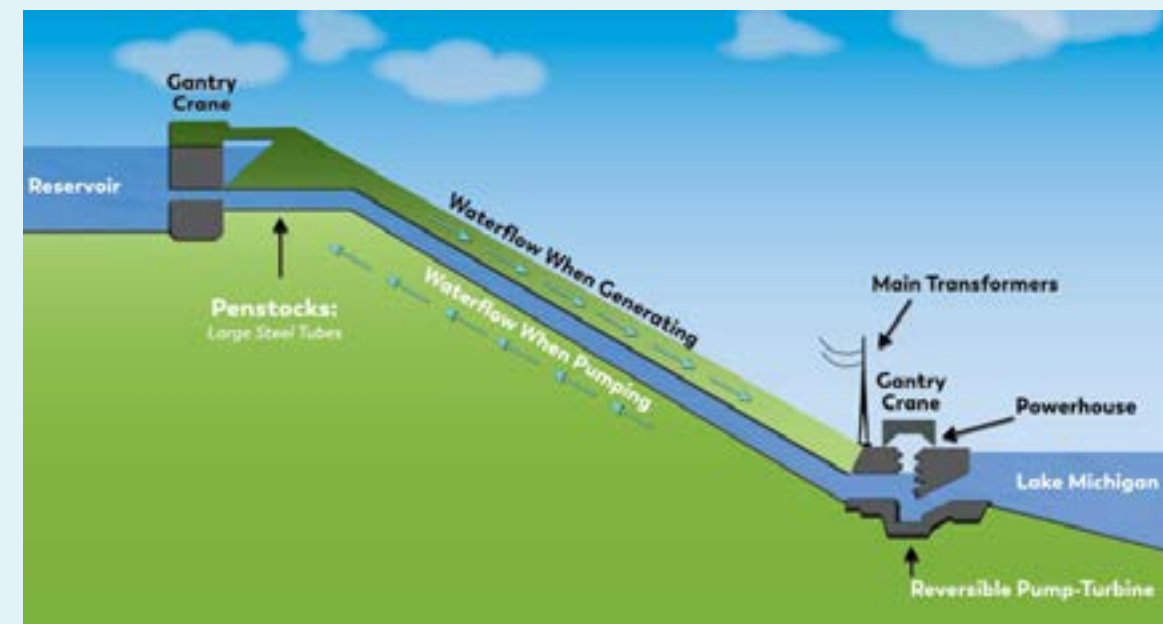
At night, when the demand for electricity is low, the turbines pump water 370 feet uphill from Lake Michigan through pipes (called penstocks) to the reservoir.

During the day, when demand for electricity is high, water is released from the reservoir to flow downhill into the lake through those same six pipes (each large enough to drive an 18-wheel semi-truck through), which causes the turbines to spin and make electricity.

"During the peak season in August and September, we fill up the reservoir from 10 p.m. to 6 a.m. and then run during the day until the reservoir is exhausted," said Plant Manager Jason Durand, a mechanical engineering graduate from Michigan State University with 13 years

of experience. "When we run all available units, it takes about nine hours to completely refill the reservoir."

Similar to vehicle batteries that store electricity and provide quick starts, the reservoir stores energy. LPS is often called the "big battery" as it can generate electricity within five minutes and reach peak output in less than 30 minutes. Powering up a coal-fired plant takes much longer as water is heated to create steam to turn turbines that produce electricity.



Aging Causes Concerns

Built between 1969 and 1973, LPS incorporated the best technology at the time. As it approached its 40th anniversary, efforts to upgrade the facility were underway.

Problems with the aging turbines and critical operating parts caused

forced outages and more costly maintenance. Plus, crucial parts were becoming obsolete, making it difficult to get replacements.

“Major components were nearing the end of life and installing the latest technologies would make daily operations more efficient for less cost,” Durand said.

“Another issue was when the lake levels were low, the turbines couldn’t completely fill the reservoir. Less water meant less electric generation. The overhaul would remove that constraint.”

In 2011, the joint owners announced an \$800 million investment in improvements that would increase generating capacity from 1,872 megawatts to 2,172 megawatts.

As the plant’s 50-year operating license issued by the Federal Energy Regulatory Commission in 1969 was expiring in 2019, the overhaul would extend the life of the plant another 50 years.

Overhaul Boosts Performance

After extensive reviews and competitive bidding, Consumers Energy and DTE Energy chose Toshiba Corp. of Japan, a global leader in electric generation technologies, for the new turbines.



Overhead view of the Ludington Pumped Storage powerhouse.

The replacement turbines — among the largest in the world — are one piece and made of stainless steel while the old turbines were made of carbon steel. To achieve improvements in efficiency, performance and increase output and discharge, the turbine blades were increased from six to nine and made longer.

The turbines were delivered one at a time via the Atlantic Ocean and Gulf of Mexico, up the Mississippi River and into Lake Michigan, arriving on a barge in Ludington.

Before the major overhaul of the first unit was completed in 2015, Consumers Energy and DTE Energy began the nearly five-year relicensing process with FERC. In 2019, with four new turbines in place, FERC issued a new 50-year license for the facility.

To minimize disruption to operations, turbines were replaced one at a time. It took about 450 days to disassemble each of the old turbines and install the new ones along with additional new parts.

The sixth and final overhaul is expected to be completed in the second quarter of 2022, allowing the plant to return to full service.

The massive overhaul took over 10 years to complete and increased efficiency 7% and generating output 15%. The added capacity enables the plant to provide electricity to about 250,000 more households.

LPS sells its electric output daily to the Midcontinent Independent System Operator market, which then sells the power to energy companies that serve customers in Michigan’s Lower Peninsula. MISO notifies the plant when and how much electricity is needed.



The Turbine Monument sits across from the Ludington Pumped Storage plant.

LPS Creates Monument

In 2019, Consumers Energy employees floated the idea to repurpose one of the obsolete turbine runners. The idea became reality in December 2021 when the Turbine Monument was installed across from the plant entrance along South Lakeshore Drive.

“We looked at the monument as an educational platform for the general public to see the enormous size of the equipment used to generate electricity,” Durand said. “It also preserves a piece of the station’s iconic history over the past half century.”

With a nod of approval from FERC and the Mason County Planning Commission, planning for the monument began in late 2020. In November 2021, the towering turbine was moved a few hundred yards uphill on a goldhofer (a trailer used to transport heavy loads) to its final destination on LPS property near Mason County Park.

Besides parking, a picnic pavilion, playground and restrooms, the park features a premier disc golf course where the Michigan Disc Golf Championships are held on Labor Day weekend.

Nearby is the Mason County Campground, several overlooks and Hull Field used by Twisted Sticks R/C Club to fly radio-controlled model aircraft.

To ensure these recreational facilities are well maintained for use in co-operation with the Mason County Parks and Recreation Commission, LPS helps with improvements and overhead.

The recreational facilities are part of the plant’s operating license, which also includes the Pigeon Lake North Pier in Port Sheldon Township on the Campbell Generating Complex site. The satellite facility includes a parking area, boardwalk and access to Lake Michigan.

A separate project to upgrade the reservoir liner was completed in 2021. It took 80 days to add new coating to the asphalt layer along the reservoir’s 5-1/2 mile border. The liner helps to prevent water from seeping out of the reservoir into the surrounding areas.

Community Spirit

The announcement that the plant was relicensed to operate until 2069 was good news for the owners, employees and community. LPS pays \$10 million a year in property taxes for area governments and schools and employs a number of area residents.

“We support community events and undertake volunteer opportunities with local organizations and nonprofits and work closely with Mason County on emergency drills,” Durand said.

Called “the project” by locals and billed as “an engineering marvel,” the facility is a magnet for tourists and local residents who can walk to the scenic overlooks of the reservoir and Lake Michigan.

Workers oversee the movement of a critical component during the overhaul project.





Alcona Pond Gets New Launch

AFTER BEING DELAYED DUE to high water levels in 2020, a new canoe/kayak launch on Alcona Pond was completed in June 2021. The launch enables paddlers to more easily portage around the dam and continue down the scenic Au Sable River.

The walkway to the launch and the launch deck are made of durable concrete. A smooth steel edge surrounds the launch deck. A welcome feature is paddlers can board their small watercraft without having to get into the water.

The modern launch replaced aging wood steps and railings along the embankment where paddlers needed to enter the water to get into their canoe/kayak. Over

the years, the water at the location became deeper, making it more difficult for paddlers to board their watercraft.

The new launch was installed a short distance downstream where the water is shallower. To protect the shoreline from erosion, rip-rap was also added to both sides of the shoreline.

“We researched solutions to create a launch that is safer, more convenient and long-lasting while continuing to provide recreational access to the river,” said Matt Carmer, Natural Resources Administrator at Consumers Energy, who coordinated the project.

In 2019, the canoe/kayak slide at Five Channels Dam was upgraded and the first-ever slide was installed at Mio Dam.

As the portages at Alcona, Five Channels and Mio dams are on the route of the 120-mile AuSable River Canoe Marathon, the slides and launch were designed with input from representatives of the planning organization, the nonprofit AuSable River International Canoe Marathon, Inc.

The 120-mile race from Grayling to Oscoda is held

annually on the last weekend in July. The event attracts professional paddlers and up to 50,000 spectators from the United States and Canada. Along the route, two-person teams portage at Consumers Energy’s six hydro dams.

“Consumers Energy is a longtime marathon partner and sponsor,” Carmer said. “The event gives us an opportunity to support local communities and showcase our hydroelectric sites that generate clean, renewable energy from one of the nation’s most scenic rivers.



An angler enjoys casting on the spacious Alcona Pond launch.



A tall sign directs paddlers to the launch.



Rip-rap along the shoreline helps control erosion.

Consumers Energy Names Three to Key Posts

(Continued from page 3)

safe and efficient operations and maintenance of the company’s dams and equipment while adhering to safety and environmental policies.

Cottick comes to Hydro Generation after 11 years at Consumers Energy’s coal-fired Karn Generating Complex near Bay City, where he was Fuel Handling, Environmental and Technical Services Manager.

Besides his new position, Cottick will continue to handle his responsibilities as Environmental and Technical Services Manager at Karn until July 2023 when the facility is scheduled to close.

Cottick earned a bachelor’s degree in industrial and environmental health management from Ferris State University. Before joining Consumers Energy in 2010, he worked for the Michigan Department of Environmental Quality for 12 years. He succeeds Don Baker, who retired.

Scenic Trails Open

TAKE A HIKE or spin your wheels on two of the state's newest nonmotorized trails. Sections of Michigan's Dragon Trail at Hardy Dam and the Iosco Exploration Trail are open year-around and ready to welcome visitors for hiking, biking, birding, cross-country skiing and snowshoeing.

As the entire Dragon Trail and a portion of the IET are on Consumers Energy property, the proposals required the approval of the MMAC Team and Federal Energy Regulatory Commission.

"This ensures the public trails will be operated and maintained responsibly with minimal impact on the environment," said Brooke McTaggart, Consumers Energy Administrator for Land and Recreation Management.



A bridge along the Dragon Trail enables visitors to safely cross a stream.



A biker on the Dragon Trail takes a break to enjoy the scenery.

Michigan's Dragon Trail at Hardy Dam

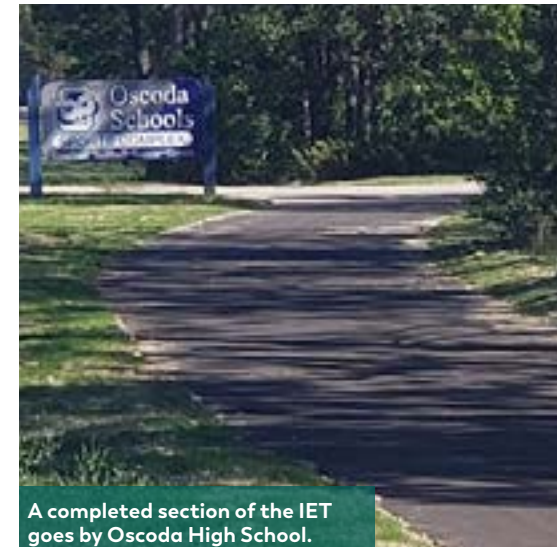
About 22 miles of the 47-mile Dragon Trail are completed with 9 miles scheduled for completion in 2022.

Named for its dragon-like shape, the trail encircles Hardy Pond, crosses over Hardy Dam and winds through a marina, campgrounds and day-use parks on land owned by Consumers Energy. Parking and trailheads are available at the campgrounds and parks.

The route features a natural surface, boardwalks made of red cedar and white oak, 20 fiberglass bridges and 13 scenic overlooks. One of the trail's 11 sections will be designed to exceed Americans with Disabilities Act standards.

Newaygo County worked with the trail developer, Applied Trails Research, to strategically place bridges, water crossings, scenic overlooks and trailheads where wildlife would continue to thrive.

Photos: Newaygo County and the IET.



A completed section of the IET goes by Oscoda High School.

Martin Hall, Trail Coordinator for the 400-member West Michigan Mountain Biking Alliance, leads volunteer efforts to inspect, maintain and groom the trail year-around.

After hearing Big Prairie Township Supervisor David Wright pitch plans for the trail about 11 years ago, Hall became a staunch advocate.

"There was nothing of this caliber for mountain bikers in the Midwest," Hall said. "I saw the potential to develop a great trail system that was valuable to bikers, residents and communities."

The trail is funded by grants, corporate and private donations, Mecosta and Newaygo counties, the Michigan Department of Natural Resources, and foundations, including the Consumers Energy Foundation. The final completion date for the trail depends on funding.



The IET passes through pristine forests near Loon Lake.

Iosco Exploration Trail

Phases 1 and 2 of the Iosco Exploration Trail in Hale at Loon Lake Park and Oscoda have been completed. Phase 1 has a paved surface while Phase 2 has a crushed stone surface.

The paved Phase 3 will cover about 5 miles and is scheduled to be completed this year, pending approval from FERC and the U.S. Forest Service. That segment winds through Old Orchard Park Campground located on the shores of Foote Pond on property owned and leased by Consumers Energy to Oscoda Township.



The route meanders through the Huron-Manistee National Forest and continues alongside the River Road National Scenic Byway, which runs parallel to the Au Sable River. There are multiple trailheads and scenic stops, including Foote Site Park, Foote Pond and Au Sable River scenic overlooks.

When all eight phases are completed, the trail will stretch 44 miles between Au Sable Township and Hale and include stops at Lumberman's Monument, Iargo Springs and others.

The IET is a segment of the 774-mile Michigan Iron Belle Trail from Belle Isle State Park in Detroit to Ironwood in the Upper Peninsula. The state of Michigan is working with local governments to connect existing trails and build smaller trails, such as the IET. When finished, the Iron Belle Trail will be the longest designated state trail in the nation.

The Iosco Exploration Trail, Inc. oversees planning, development, construction, funding, programming and community outreach. The IET is funded by grants, corporate and private donations, federal agencies, townships, Iosco County, and fundraising initiatives. Iosco County Parks and the IET are responsible for maintenance.



Improving Fish Habitat The HIA Program

SINCE THE AU SABLE, MANISTEE AND MUSKEGON RIVER HYDRO PROJECT LICENSES were issued by the Federal Energy Regulatory Commission in 1994, Consumers Energy has provided more than \$9 million to the Michigan Department of Natural Resources — Fish Habitat Improvement Account program.

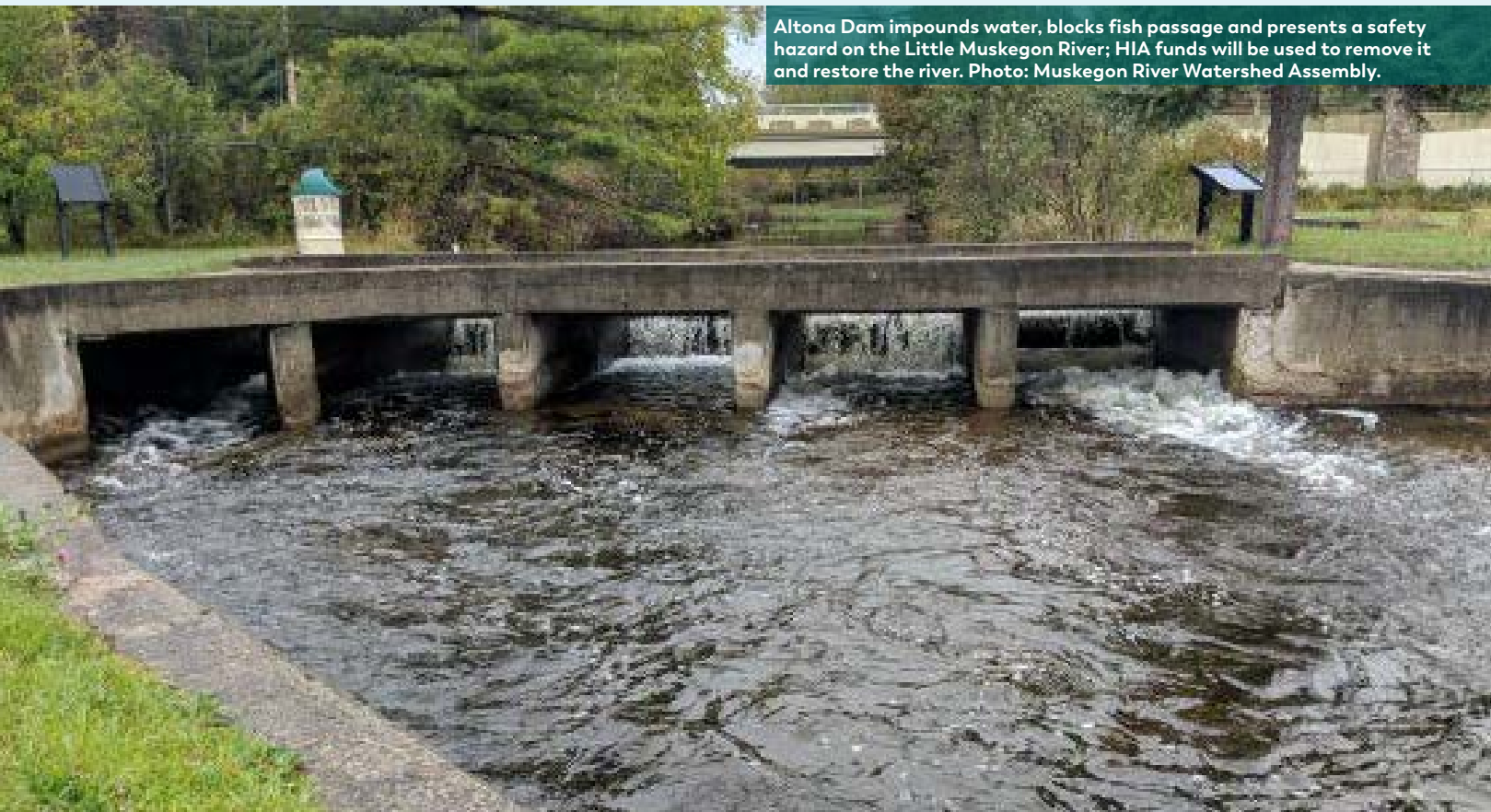
These HIA funds, which were agreed upon to mitigate fish damage caused by the hydro plant turbines, have been invested in a combination of fisheries research and on-the-ground projects that include habitat improvement, fishing access, and erosion control. The company's HIA contribution is increased annually at the rate of inflation.

In 2019, with support from Consumers Energy, the DNR united the HIA program with its Dam Management Grant and Aquatic Habitat Grant into the new, annual Fisheries Habitat Grant. HIA program funding will be tracked separately and still supports projects on the

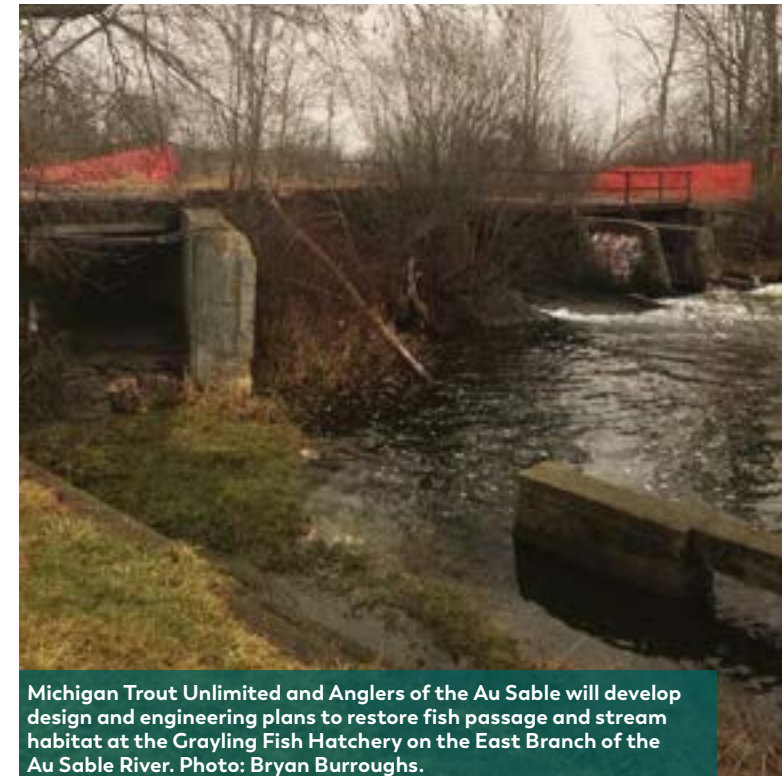
Au Sable, Manistee, and Muskegon watersheds for fisheries habitat rehabilitation or enhancement, preparation of comprehensive river management plans, conducting aquatic studies, and improving fisheries recreation at locations with surface water connections to the aforementioned rivers.

Details about the Fisheries Habitat Grant can be found on the DNR website: michigan.gov/dnr/buy-and-apply/grants/aq-wl/fish-hab. The website includes information for applicants such as a summary of the application process, the program handbook, a list of priority projects developed by DNR Fisheries biologists, and contact information for the grant's administrators.

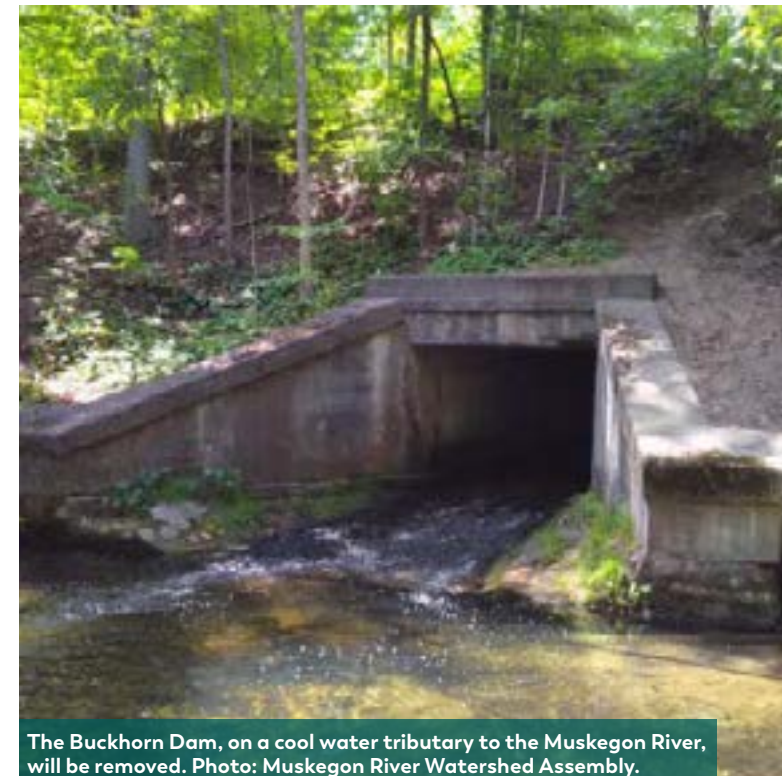
More information about the Fisheries Habitat Grant proposal and selection process is available from Joe Nohner (NohnerJ@michigan.gov; 517-284-6236) and Chip Kosloski (KosloskiC3@michigan.gov; 517-284-5965).



Altona Dam impounds water, blocks fish passage and presents a safety hazard on the Little Muskegon River; HIA funds will be used to remove it and restore the river. Photo: Muskegon River Watershed Assembly.



Michigan Trout Unlimited and Anglers of the Au Sable will develop design and engineering plans to restore fish passage and stream habitat at the Grayling Fish Hatchery on the East Branch of the Au Sable River. Photo: Bryan Burroughs.



The Buckhorn Dam, on a cool water tributary to the Muskegon River, will be removed. Photo: Muskegon River Watershed Assembly.

HIA-Funded Projects

Two derelict dams in the Muskegon River watershed will be removed using HIA funding. Buckhorn Dam, on Buckhorn Creek, and Altona Dam, on the Little Muskegon River, present hazards to public safety, block fish passage, and degrade fish habitat by warming the streams.

Removing these two dams will reconnect 24 miles of streams for fish passage to the mainstem of the Muskegon River, decrease water temperatures, and improve brook trout and other fish populations for anglers at these publicly accessible sites. Furthermore, stream habitat will be improved by addition of large woody habitat and channel restoration.

Additionally, Michigan Trout Unlimited and Anglers of the Au Sable will develop design and engineering plans to restore fish passage and stream habitat at the Grayling Fish Hatchery on the East Branch of the Au Sable River.

Fish passage within the river system is currently impeded at the site of the hatchery (by various small dams and barriers in the river), cutting off 22 miles of the upper reaches of the Au Sable. Fish passage at the site will benefit brook trout, brown trout, and other species in the ecosystem.

A collaborative process with a diverse group of stakeholders will be used to develop an optimal set of design plans that, pending county approval, will provide the groundwork needed for eventual reconnection and restoration at the site.



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