Summer 2019

UPEnvironment

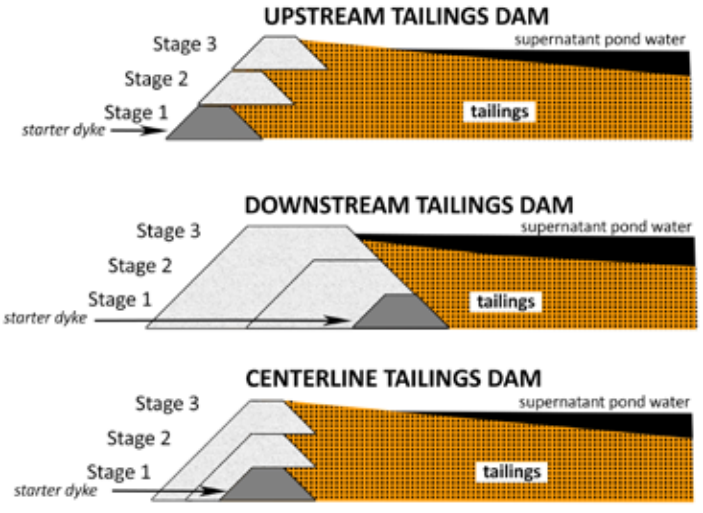
DESIGNED TO FAIL: The Aquila Back Forty Tailings Dam

Mining Action Group

> *When we consider the recorded life of tailings dams structures (a century at most) compared to the length of time that they must function (millennia), the number of failures observed in the first century of their operation is not comforting. Our society still does not fully appreciate the long-term implications of storing billions of tons of potentially-harmful and semi-fluid waste in large impoundments.*
>
> — Dr. David Chambers, Center for Science in Public Participation[1]

There's a looming disaster in the Aquila Resources' Back Forty Mine project—a "tailings management facility," or TMF, which the company proposes to build using the extremely risky "upstream" construction method. Tailings impoundment is a key feature of the mine's facility design, permitted separately by a Dam Safety Permit, an authority generally used for dams that hold water, rather than toxic waste. Both the Mine Permit Amendment and Dam Safety Permit are under review by regulators, and the subject of a consolidated public hearing slated for June 25 by Michigan's new Department of Environment, Great Lakes and Energy, formerly known as the Department of Environmental Quality.

The upstream dam is designed to fail, environmentalists warn. Objections to the Back Forty's TMF design have been raised by numerous environmental groups. Mining industry experts, too, consider the upstream method to be the least desirable type of tailings dam construction, due to its high risk of dam instability. It is not the "Best Available Technology," and investors are calling on mining companies to review and disclose their use of risky upstream tailings dams.



Tailings impoundment designs include centerline, downstream, and upstream tailings dams. Upstream dams are the riskiest, because the walls are partially supported by tailings. *Mining Action Group diagram*

In February, Brazil banned the use of upstream tailings dams: "National mining agency Agência Nacional de Mineração (ANM) said the resolution banned the construction of new upstream tailings dams and set a deadline of August 15, 2021, for existing upstream dams to be decommissioned or removed. It referred to other recent tailings dam failures including Brumadinho in Brazil and Mount Polley in Canada and said the upstream, cheaper form of construction that used tailings to raise dam walls could no longer be tolerated."[2]

The world's biggest miner, BHP, recently conducted a risk assessment of all their facilities, revealing that 29 of 67 sites use upstream dams. The report identified 13 BHP tailings dams with *extreme* or *very high* risk classifications: **10 of 13 are upstream dams.** "Extreme risk" means TMF failure would result in "more than 100 deaths" and major environmental/cultural loss, with "restoration impossible," whereas "very high" means 100 or fewer deaths, with "significant environmental/cultural loss" and "restoration impractical."

The Back Forty's upstream tailings dam will tower above the Menominee River landscape: a massive structure with external walls of reactive waste rock. It will be taller than most buildings in the UP, at least 138 feet tall. It will function like an enormous donut, filled with a pudding of reactive metallic tailings. And it will be left behind as a *permanent feature of the landscape.*

It is important to understand that the Back Forty tailings dam will be constructed even while in use: *"The TMF*

has been designed to contain up to 4.90 Mm³ (6.41 Myd³) of tailings and 5.91 Mm³ (7.73 Myd³) of waste rock (walls) … the TMF will be developed in stages." The walls will be consecutively "raised" with each raise partially supported by previously deposited reactive waste tailings, as shown in Aquila's engineering diagram, "TMF Cross Section" (below).[3]

Upstream dams are a cheap solution. Aquila clearly needs that—after all, they are high-grading the Back Forty deposit, and extracting ore at a speed that intentionally outpaces the processing capacity of the mill. Ore will be stockpiled, so the richest ore can be processed first.

A pond is not a pond, says Aquila

Aquila's public relations manager Dan Blondeau, is trying to assure concerned citizens that the Back Forty's upstream tailings dam won't fail. In correspondence with filmmaker Mark Doremus, Blondeau claimed the "Back Forty tailings facility is not a pond and will not store liquid tailings."[4]

"Blondeau should read the permits," says Kathleen Heideman of UPEC's Mining Action Group. "The tailings WILL be pumped as a wet slurry. These WILL be liquid tailings. The Back Forty tailings facility WILL contain a pond." According to Aquila's permit applications, wet tailings will be deposited in the TMF structure, and the structure will be topped by a huge pond—water from the tailings. Here are direct quotes from the permit application:

- *The decant pond expands from 100,000 cubic meters (m³) capacity to a maximum of 150,000 m³, then diminishes to 50,000 m³ at the end of operations.*
- *The height of the decant pond will rise as the TMF is constructed, with a maximum height of 36 meters at full build-out.*

It may be hard to visualize, but this means the volume of the decant pond will be roughly six times larger than the volume of water in the Lincoln Memorial Reflecting Pool in Washington DC.[5] The Dam Safety Permit describes an even larger volume of water floating on the surface of tailings:

- *The maximum volume of supernatant water allowed in the (tailings) decant area will decrease with time from 0.15 Mm³ (39.6 Mgal) to 0.05 Mm³ (13.2 Mgal).*
- *The tailings will be deposited near saturation as non-segregating thickened tailings as they are potentially acid generating and metal leaching.*

During operation, the Back Forty Tailings Dam will hold 40 million gallons of water in the decanting pond, hidden inside the growing walls of the TMF. How big is that?

- A good-sized bath holds 50 gallons, so a million gallons would be 20,000 baths.[6] *The Back Forty TMF pond will hold enough water to fill 800,000 baths.*
- An Olympic-sized swimming pool holds 660,000 gallons of water.[7] *The Back Forty TMF pond will hold enough water to fill 60 Olympic swimming pools.*

Blondeau claimed the Back Forty dam has a "maximum projected height of 130 feet" but the permit states the height will be "42 meters" (138 feet). How tall is that?

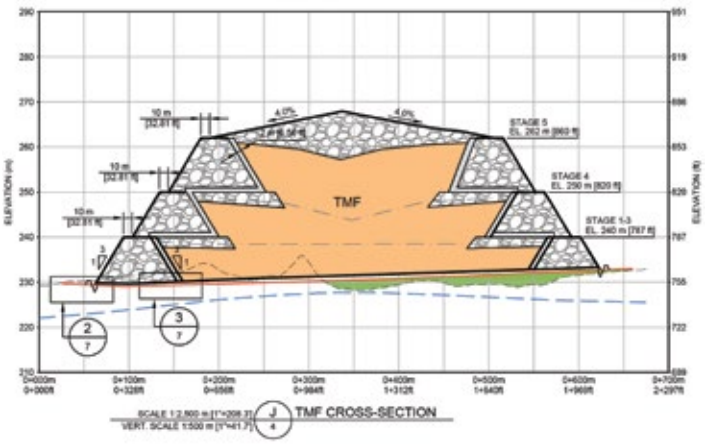
- A mature white pine tree averages 50 to 80 feet tall. *At 138 feet, the Back Forty tailings dam will be 55% taller than Marquette's Landmark Inn, which is only 89 feet tall.*

Will additional tailings storage be needed?

"Blondeau fails to acknowledge the monstrous size of the Back Forty TMF. One hundred twenty-four acres of tailings is the equivalent of 50 city blocks, or 100 football fields. Tailings waste will cover an area 25 times larger than the Superior Dome at Northern Michigan University," said Heideman.

And that may be just the beginning. The Mining Action Group has long questioned whether Aquila is being honest in calling the Back Forty project a "7 year open pit mine." They claim that Aquila is planning an underground mining phase, while permit applications deny that underground extraction will take place.

From 2015 until 2018, Aquila Resources described the project as a "16 year life of mine and mill of 16.1 Mt of ore, including both open pit and underground mining." This claim was repeated in press releases and investor statements, in presentations to the local community, and in correspondence with the State of Michigan and the Menominee Indian Tribe of Wisconsin. In 2016, Aquila told investors they would apply for underground permits "in 2019" after the mine was operating. Now the applicant is winking, telling investors that underground expansion requires "additional studies."



TMF cross-section. *Aquila engineering diagram*

Underground mining would create more tailings than the Back Forty TMF is designed to hold. The Dam Safety permit application claims that "regulated wetlands were identified within the Project site, limiting the land available for the facilities and stockpiles. Due to these site constraints, it was important to reduce their footprint areas.…"

That's one reason why mining companies build upstream tailings dams: structures can "grow higher" if the mine needs to store more waste, expanded via additional raises, increasing the height of the dam walls and volume of liquid waste. This habit of incremental "lifts" exacerbates the problem of instability, however, and has resulted in catastrophic collapse.

Since Aquila intends to pursue underground mining, it is reasonable and foreseeable to assume that Aquila selected the controversial upstream method because it enables expansion. Remember: these permits are really designed to regulate water dams, which can be completely drained if they become structurally unsound. The upstream tailings dams at Brumadinho and Mount Polley were all raised higher than originally designed, dozens of times, until they collapsed.

Permanent waste storage

"Instead of talking about 100-year rainfall events, we need to be thinking about a 10,000-year lifespan," says Heideman. "What are the real storm risks, the real seismic risks, and groundwater risks from failure of materials with a limited life, like the plastic liners underneath the TMF?"

When the risks are properly calculated for a 10,000-year lifetime—a figure suggested for how long these tailings structures will need to maintain their integrity—experts say there is "a significant and disproportionate chance of failure for a tailings dam."[8]

"Tried, tested, and proven"?

Blondeau claims that the design of the Back Forty TMF "uses tried, tested, and proven engineering methods" because "similar facilities are already in operation at the Malartic Mine and the Musselwhite Mine in Canada, and the Neves-Corvo Mine in Portugal."

These mines offer proof of nothing. The type of ore, tailings, and method of disposal varies widely, and the TMF designs are very different:

Malartic Mine. The Malartic Mine has operated only since 2011. Malartic's tailings are non-reactive. The thickened tailings have "solid material concentrations of between 65 and 70%" with little or no free water. They form cone-shaped cells of various heights. The tailings are used to "cover acid-generating tailings" (to a depth of 3 meters), to remediate a previously abandoned tailings impoundment. To "avoid overflows, a sterile stone wall" will surround cells. *This is significantly different from the Back Forty TDF, where tailings will be highly reactive, tailings will decant a large quantity of water, and TMF walls will be built using reactive waste rock, not sterile stone.*[9]

Musselwhite Mine. The Musselwhite Mine in northwestern Ontario went into production in 1997 and "began thickened tailings disposal in May 2010." "The cold climate presents a special challenge to operating the thickened tailings system as there is very little precedent experience." To reduce the likelihood of acid generating and metals leaching in the long term, Musselwhite plans "to remove the sulphide minerals from the tailings stream using a flotation plant." A tailings thickener (2009) was constructed "to allow for an increased life span (capacity) of the current tailings management area. The thickener will reduce the water content in the tailings to approximately 74% solids to allow for stacking/mounding of the dry tailings.…"[10] *This is significantly different from the Back Forty TDF, where tailings are highly reactive, sulfides are not removed, and tailings are not "dry" or "stacked."*[11]

Neves-Corvo Mine. Owned by Lundin Mining, the Neves-Corvo Mine opened in 1988 "as an underground operation, exploiting a number of polymetallic sulphide orebodies" with tailings from the mine "stored into a 190 hectare tailings management facility" bounded to the north by a rockfill embankment across a natural river valley. Developed for subaqueous tailings deposition, it was converted to thickened tailings deposition in 2010 "with an accompanying thickened tailings plant to increase the storage capacity." Due to "multiple expansions of underground mining" and "expansion of the zinc processing plant and the volume of tailings produced, there will also be a need to expand the tailings thickening plant." *This is different from the Back Forty TDF: Neves-Corvo uses an upstream dam*[12] *but thickened tailings did not solve their storage problems: "expansion of the zinc processing plant" resulted in more waste; a new "feasibility study for expanding the TMF … will provide a comprehensive tailing development scenario."*

Read that again: after 30 years of mining, Lundin is still trying to come up with a comprehensive tailing solution? Ever-expanding operations demand "additional tailings and mine waste rock storage at the Neves-Corvo tailings storage facility, beyond the 2015 deposition design … **an increase**

of up to 27 Mt of tailings and as much as 10 Mt of mine waste rock need to be accommodated…" (emphasis added).[13]

That's exactly what must be avoided at the Back Forty. All of these mines have "capacity problems" caused by expanding mining operations—suggesting these mines were not carefully planned, or failed to disclose future mining phases, resulting in undersized tailings storage. Mining companies treat TMFs like magic garbage bins, which must expand on demand to "accommodate" whatever amount of tailings and waste is produced.

Filled with reactive waste

The Back Forty is a polymetallic orebody. After processing, the finely ground tailings will contain hazardous metals capable of producing acid mine drainage and mobilizing metals through leaching. Aquila's geochemical modeling demonstrated that 77% of the waste rock and nearly all of the ore is reactive. Leachate produced by geochemical analysis of Back Forty tailings predict a pH of 2.5, very acidic.

All tailings held inside the TMF will be reactive, at risk of acid mine drainage. Recent dam collapses in Brazil and Canada caused catastrophic environmental damages, but the tailings released were either inert or minimally reactive. A release of highly reactive sulfide tailings into the Menominee River would be far worse.

Blondeau downplayed the hazardous nature of the Back Forty tailings, comparing them to "toothpaste" and "drywall mud."

"Mr. Blondeau's comparison of the consistency of the dewatered tailings to 'drywall mud' or 'toothpaste' is not reassuring when you consider that with the 'upstream' design these mudlike materials end up being a structural part of the dam!" said Steve Garske of the Mining Action Group. "The remaining water in the tailings is what causes these dams to fail."

Heideman calls the comparison with drywall mud and toothpaste "insulting."

"There is no beneficial reuse. These are toxic industrial tailings, full of mercury, lead, cancer-causing metals, acid-generating sulfides, residual sodium cyanide, chemical frothing reagents used in the milling process, and more. Failure of the Back Forty's upstream tailings dam, whether it happens in five years or five hundred, would be an unspeakable environmental catastrophe."

Designed to fail

Upstream mine tailings dams have been called "bombs waiting to explode." The "failure rate of tailings dams has remained at roughly one failure every eight months.… Over a 10,000-year lifespan (a figure often used for how long these structures will need to maintain their integrity) this implies a significant and disproportionate chance of failure for a tailings dam."[14]

"This is the mining industry's dirty secret: upstream tailings dams are cheap, risky, and unstable," says Heideman. "The State of Michigan must not permit the Back Forty project to proceed as designed."

Notes

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Update provided by members of the UPEC Mining Action Group. Learn more about their work at miningactiongroup.org.

A MOST EXTRAORDINARY LIFE: A Tribute to Jack Parker

Catherine Parker

"Once upon a time, a very long time ago now, about last Friday…." So begins *Winnie the Pooh*, a book my dad and I loved. After 88 years, Jack Parker is gone too soon. This is my personal remembrance of one of our region's most effective and well-respected environmental activists.

Jack arrived in the world on July 14, 1930, on the eastern-most shore of England, in the town of Lowestoft, where his father was a deep-sea fisherman. "Never go to sea, son!" his dad would say, then advise him to shape up lest he end up feeding boilers below-decks. While Jack was still a young child, he and his brothers were evacuated by train to the English countryside due to threats from German bombs, and placed in the homes of strangers.

Finishing high school at the age of 16, Jack completed courses under the National Coal Board education scheme and went to work in the mines as a surveyor/planner/engineer.

Conditions were dirty and dangerous, both above and below ground.

> *Just before I left a conveyor caught fire at neighboring Cresswell Colliery. Dense black smoke, and 82 men died there, all from the same small village. Crowds waited at the pithead, hoping and praying. But most were fatalistic. Even when a slag pile slid and buried a school full of kids, at Aberfan, Wales, in my time, there was grief, but acceptance.*

Top: Jack leaving England, June 1953.
Bottom: Working at a Canadian mine, 1955.

COURTESY THE PARKER FAMILY

In the winter of 1952–1953, while skiing in Norway, he resolved to leave the coal mines—and did, immigrating to Canada at the age of 23, where he worked for a mining company on Hudson's Bay and enjoyed camping out with the Eskimos, as Canada's Inuit people were then called.

Encouraged by his boss, Jack applied to every mining program in the U.S. and Canada and was turned away from all but one, Michigan Tech, because he'd had very little math, and no chemistry or physics, in high school. Jack earned two bachelor's degrees in four years, in Mining and Geological Engineering, finishing fourth out of 384 students, then picked up a Master's degree in Geology, earning a 4.0 while teaching part-time and working vacations at various mines.

Jack spent a year with a Minneapolis-based mining firm, then took a job with White Pine Copper, in White Pine, Mich-

igan, where he worked for 10 years, the majority of them as Director of Rock Mechanics. He subsequently taught part-time at Michigan Tech while establishing a business as Jack Parker and Associates, resolving problems in design and operation in over 500 mines, here and abroad. Jack also taught seminars at numerous universities and individual mining properties, testified as an expert witness in more than a dozen legal cases, and accumulated a lengthy list of publications and awards, becoming known as an "industry icon." Although he considered retirement in 1995, a continuing demand for "practical help," as opposed to that from "computer jockeys," kept him working part-time for some years afterward. The complications of travel had nearly retired him to his fishing and wood-carving and painting, when the Eagle Mine application was thrown his way.

COURTESY THE PARKER FAMILY

Jack with a couple of his friends, May 2018.

Hired by the National Wildlife Federation (NWF) to evaluate the application to mine on the Yellow Dog Plains (northwest of Marquette, Michigan), Jack concluded that it was an amateur production at best, fraudulent at worst, and agreed with the state's own expert that the mine, as designed, would prove to be unstable. After a year and a half with NWF, he continued to work on his own, writing numerous technical reports and countless letters detailing his objections to the Eagle Mine. Recipients included the EPA, US Army Corps, US Fish and Wildlife Service, Michigan Attorney General, North Central District of the Mine Safety and Health Administration—and ultimately the FBI.

While he continued this battle, he took on others as well—the proposed Penokee mine and the now-closed Flambeau mine in Wisconsin, PolyMet in Minnesota, Graymont and the Back Forty project in Michigan's Upper Peninsula, and of course the expanded Eagle Mine, *aka* Eagle East. Jack also lobbied against the clearing of land for Eagle's current haul route and the proposed County Road 595, loaned his expertise in a legal challenge to a US Forest Service land exchange involving Wildcat Falls, in the western UP, and was a tireless advocate for the gray wolf.

It was my privilege to work with him on many of these issues, and to be copied on countless emailed communications. One missive in particular made me smile, in which he'd described me to several high-ranking officials as his "stubborn, scientifically-inclined daughter." Thank you very much, I'm sure! On another occasion, he sent a late-night message to Eagle's local PR guy, reminding him of the very real possibility of a collapse at the mine, closing with, "Have a good sleep, Daniel!"

As the years went on, Jack became increasingly disillusioned by what he saw as a lack of justice and appropriate oversight. Always a humble man, he'd shrug his shoulders at the apparent disregard for the facts, backed by his knowledge and reputation. He sent out his final report, to the FBI, in October of last year, and sat in front of his computer, wondering what to do next. Quitting was never an option, nor would he relax his vigilance. He advised us to "be sure to keep your boot-heel firmly on the head of the snake."

Jack's giant intellect and common-sense smarts, delightful wit, warmth, and everlasting curiosity earned him respect and affection from a plethora of friends and colleagues which endure to this day. A favorite memory shared with me is the way he'd burst into song at the most unlikely moments. Another comes from one of the many young men he mentored and inspired: "Within a few short years we exchanged hundreds of emails loaded with our scholarship, life stories, theories, and bad jokes. He believed in my productivity and potential, and made sure that I knew it."

Scientist, artist, and prolific writer, he left behind an extraordinary legacy. As my dad used to colloquially say to us kids, I now say to you, Jack Parker: "You done good."

Jack passed away on Easter Saturday, 2019.

THE UNIQUE COASTER BROOK TROUT FISHERY OF LAKE SUPERIOR

Bill Ziegler

A brook trout that migrated from tributary streams to Lake Superior was historically reported as widespread and common. This type of lake-run brook trout was referred to as a "coaster" by anglers. The mystique with this variation of the native brook trout is great since they can grow to a large size. The classic fisheries text *Fresh Water Fishes of Canada* reports a 14.5-pound brook trout (coaster) was caught in the Nipigon River of Ontario in 1915. According to the Great Lakes Fishery Commission's Brook Trout Rehabilitation Plan for Lake Superior, historical evidence indicates coaster brook trout spawned and lived part of their lives in 106 Lake Superior tributary streams. Coaster brook trout were very vulnerable to exploitation (especially angling and netting), and reportedly coaster numbers rapidly declined in many areas of Lake Superior in the late 1800's. Coasters first declined in the most accessible areas of Lake Superior. Reportedly, coasters within 30 miles of Marquette, Michigan, were "fished out" by 1865. Intensive logging in the watersheds and barriers like dams in tributary streams to Lake Superior also degraded coaster spawning and nursery habitat. Coaster brook trout were reduced to a few streams of Lake Superior by the mid 1900s.

Robert Barnwell Roosevelt in his 1862 book, *Gamefish of the Northern States of America and British Provinces,* referred to large brook trout found in Lake Superior and its tributary streams. He also referred to heavy exploitation of those fisheries and the vulnerability of fisheries that were readily accessible. In Roosevelt's 1865 book, *Superior Fishing,* when he stated, "The finest trout fishing in the world can be obtained in Lake Superior," he was referring to numbers and size. He also wrote of extremely large numbers of trout being taken by anglers. He wrote that in the vicinity of Bayfield, Wisconsin (Apostle Islands), "250 pounds of speckled trout (brook) have been taken in one day by one good fisherman and one poor one; fish 2 to 3 pounds are common."

A coaster brook trout caught during a Michigan DNR survey on UP's Lake Superior tributaries thought to produce coasters.

TROY ZORN / MICHIGAN DNR

Today, Henry Quinlan, a fisheries biologist for the US Fish and Wildlife Service (USFWS) in Ashland, Wisconsin, says there are several major factors limiting coaster brook trout rehabilitation, those being exploitation, lack of regulations protection, habitat degradation, and competition with other fish species. Quinlan says that larger minimum size limits and low bag limits in Minnesota and Ontario, and Isle Royale National Park (nearshore waters), are producing positive results in coaster brook trout surveys.

Troy Zorn, Michigan DNR fisheries research biologist, says the DNR has implemented protective regulations on the Michigan Lake Superior tributary streams and that doing so is their highest probability of reestablishing coaster brook trout. The new regulations are a relatively high minimum size limit (MSL) and a bag limit of one on all brook trout, splake, or lake trout in the defined lower sections of eight streams. According to Zorn, these are the same regulations that are producing positive results on coasters in Minnesota." The regulation affects the Pilgrim, Silver, Slate, Ravine, Big Huron, Little Huron, Iron (Lake Independence outlet), and Big Garlic. Special regulations were already in place on the Salmon Trout River in Marquette County (see page 55 of the 2018 Michigan Fishing Guide). Zorn feels that over-harvest is the greatest limiting factor restricting coaster brook trout recovery and these regulations address the highest priority streams to affect coaster recovery in Michigan.

US FISH & WILDLIFE SERVICE

Henry Quinlan, fisheries biologist, Ashland Fisheries Office, US Fish and Wildlife Service, holds a coaster brook trout taken during a survey of a Lake Superior tributary stream.

Quinlan feels stream habitat degradation for coasters is most severe in Wisconsin, Michigan, and Minnesota. Some of the trout habitat degradation is still present from intensive logging that occurred on the Lake Superior tributary watersheds in the late 1800s and early 1900s. The degradation consists of loss of long-lived conifer riparian zones, sedimentation of spawning and food production gravel, sedimentation of holding pools, and loss of large wood cover from deadfalls of large riparian trees. Additional habitat degradation occurs when historically high abundance of beaver resulting from ample riparian aspen regrowth after logging leads to damming coaster trout migration up streams. Increased beaver also results in increased sedimentation of gravel and warming of streams (due to beaver impoundments) sometimes above summer water temperatures that would be tolerable to brook trout.

More recent habitat degradation to coaster habitat would result from numerous culvert road crossings that can often act as a barrier to stream movement by these fish that require movement to live out their life cycle. Of course, man-made dams are also major barriers to trout movement in streams in addition to all the sedimentation and stream warming covered above.

TROY ZORN / MICHIGAN DNR

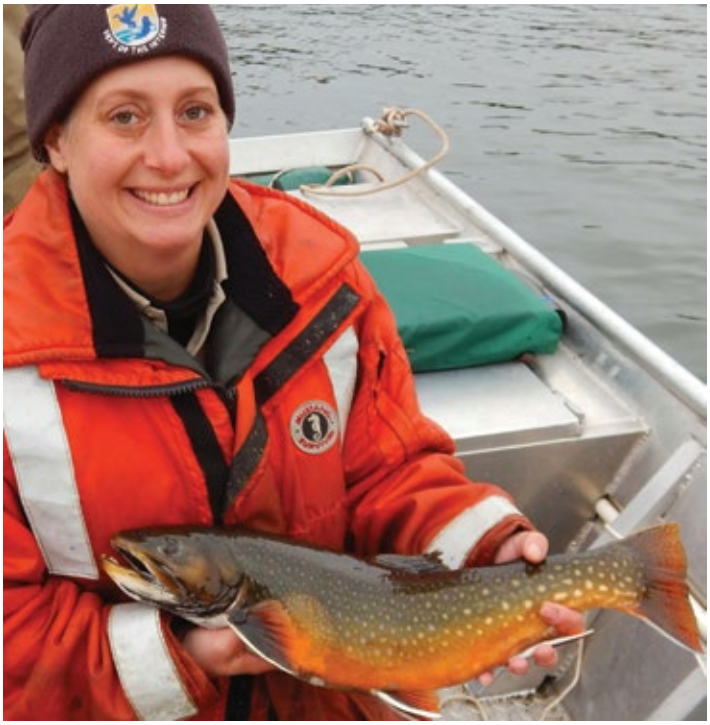
Coaster brook trout survey by Michigan DNR Fisheries survey crew on one of Lake Superior's coaster research streams.

Quinlan also feels that coasters are impacted by competition from other fish species, especially salmonids (trout and salmon). Many former coaster streams have strongly established Coho salmon, Chinook Salmon, brown trout, steelhead, splake, suckers and other warm-water fish species that would not have been present in those streams historically.

Both biologists Quinlan (USFWS) and Zorn (MI DNR) confirm that coaster brook trout have not been found to be genetically different than wild brook trout in Lake Superior-area streams. It appears that coasters result from a natural behavior to move down some streams into a lake environment. Once in the lake, forage conditions and growth potential are significantly greater than in streams. As a result, the coaster grows to much larger size than resident stream trout. In my own 35 years of inland trout surveys handling many thousands of brook trout, the largest stream brook trout we captured and measured was 16 inches. Stream trout over 10 inches are very rare. Of course, that would be a small coaster brook trout.

The USFWS Iron River National Fish Hatchery in Wisconsin maintains approximately 10,000 adult and juvenile captive lake trout and coaster brook trout as brood stock. USFWS biologists need to keep adding wild genetics to this captive brood source by periodically capturing wild fish and taking spawn from them. These efforts have been targeted at the wild coaster population at Isle Royale. Biologist Quinlan says that "we've developed a Lake Superior coaster brood stock from Isle Royale over the last two decades. Production fish are stocked in Lake Superior at various locations. In recent years, three tribal natural resource departments—Keweenaw Bay Indian Community, Grand Portage Band of Lake Superior Chippewa, and Red Cliff—have stocked these fish."

There have been a number of recent successful re-establishment efforts on wildlife populations in the northern lake states. A few examples are bald eagles, wolves, UP moose, and fishers. The coaster brook trout appears to have the potential to be another successful re establishment of a historical unique fishery in Lake Superior and some of its tributary streams. Recent survey evidence suggests the potential for coaster brook trout increases are good. Zorn says that they "recently had confirmed coaster captured in the Pilgrim River" in the Keweenaw Peninsula. Zorn feels there also is potential for coasters in the more remote streams in the Upper Great Lakes, especially the UP's east end along northern Lake Huron.



US FISH & WILDLIFE SERVICE

Carey Edwards, biologist at the Iron River National Fish Hatchery, holds a nice coaster brook trout taken in trap nets at Isle Royale National Park as part of their spawn take and survey effort.

Bill Ziegler worked as a federal fisheries biologist in the Upper Great Lakes and Middle Mississippi River regions. Recently retired, he spent the last 24 years of his career as a Michigan DNR fisheries management biologist in Crystal Falls. He now writes for Michigan's two largest-circulation outdoor magazines, and enjoys fishing, hunting, and numerous silent sports with his family in the Upper Peninsula.

THE PROMISE

Horst Schmidt

For over four decades, UPEC has worked to keep our region from environmental harm. There was mining throughout the UP in the 19th and 20th centuries, stopping in most areas in the 1960s. Much of the infrastructure and tailings have become invisible over the past half century. The legacy of the area is still preserved as historic structures for tourism, highlighting the glorious challenge while minimizing the damage. Water was poisoned from processing the ore with tailings dumped into lakes and streams. This toxic legacy is still being mitigated where water pollution still exists. A mixed bag at best.

Now the next generation of mining exploration companies has been combing the UP for minerals in our volcanic landscape. The Eagle Mine started non-ferrous mining in 2010 after years of protest and failed legal challenges by environmental organizations, including UPEC, and tribes for whom Eagle Rock is a sacred site. Two other exploratory companies are waiting to begin. Mines are energy intensive leading to noise, light, water, and air pollution, which cannot be appreciated unless one goes to a going operation in the heart of a mountain wilderness. UPEC along with other groups attempted to dissuade the State of Michigan from granting permits for three new ventures in the last three years:

- Copperwood in Gogebic County in a wetland by the Porcupine Mountains next to Lake Superior.
- Back 40 immediately adjacent to the major river watershed of the central UP.
- Eagle Mine in the wilderness of the headwaters of two streams in the Huron Mountains.

Why? Sulfide-based ores react with water to create sulfuric acid leading to a phenomenon known as acid mine drainage. Once the rock is exposed, it can become a perpetual drainage of the acid into waterways, affecting aquatic life.

It is disconcerting now that one of the companies, Lundin, is exploring westward, seeking new lodes. In order to gain community acceptance, they started a campaign of visiting townships in June 2019 west of Marquette to let residents know they are drilling holes in their search for metals. Not wanting to upset citizens of these areas, they have meetings that are called listening and community sessions where they provide food and refreshments, put on a slideshow, answer questions. They are solicitous of the audience members, attempting to ascertain any resistance to their projects. They minimize the negative impacts, highlight the positive—safety, jobs, being good corporate citizens. Not because they are concerned about the environmental issues, but looking for obstacles they can overcome to future projects. Corporations are set up to attain limited goals of which the most important is profits. The greater good of having an environment that is safe and healthy for all creatures and vegetative life can impede those goals.

It is easy to be lulled by their talk of social responsibility. Promises are made. Those they know they are unable or unwilling to keep remain in the oral realm. Only those responsibilities that are required are written. However, they will ask for modifications, which are violations of the mining regulations of those responsibilities when they cannot meet them, going so far as to seek out sympathetic legislators to change laws so their needs override those of the environment. Lundin personnel admitted modifications are a normal part of doing "business." Again, when all is said and done, getting the ore is their first priority, the environmental protections are a distant second.

Once Lundin and other mining companies get the nod from communities, they treat them as permanent approvals rather than being conditional, subject to revocation or modification to protect the environment as circumstances change. Again, a one-way street to profit. The jobs of the public relations staff depend on successful sales pitches with as many elements of truth as necessary and shaving the truth as needed.

Why do they work so hard to court residents in communities? Mining is a gamble. Even with today's technology they have to spend millions of dollars to find an economically viable ore body. It takes millions more to bring the mine into operation. They are reluctant to lose all those investor dollars should their gamble be jeopardized. Hence the single-minded efforts to convince the residents, the regulators, the government officials, the business leaders, the legislators that polluting the environment is good for everyone.

The siren song of profits, tax revenue, jobs are always played to the hilt. The environment only sustains our biological base. The excitement of economic development created by mining in people's minds is missing. How can you make that profitable? Global heating is ignored or denied.

In the land of Oz, the characters complete their journey to the Emerald City. They find the wizard has created a façade of power that everyone believes will keep them safe until Toto, Dorothy's dog, pulls aside the curtain. There he is, manipulating the levers. Our Emerald City is technology. We believe it will protect us from climate heating activities. Unlike the plucky characters in Oz, many of us do not recognize the ultimate power to save the planet is within us, not the public relations people.

Horst Schmidt is president of UPEC.

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HENRY QUINLAN / US FISH & WILDLIFE SERVICE

US Fish and Wildlife Service coaster brook trout survey with an electrofishing boat at Isle Royale National Park. See article by Bill Ziegler beginning on p. 7.

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