



Voices of Our Lake

Funders & Supporters

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Whitefish Community Foundation



WLI Members



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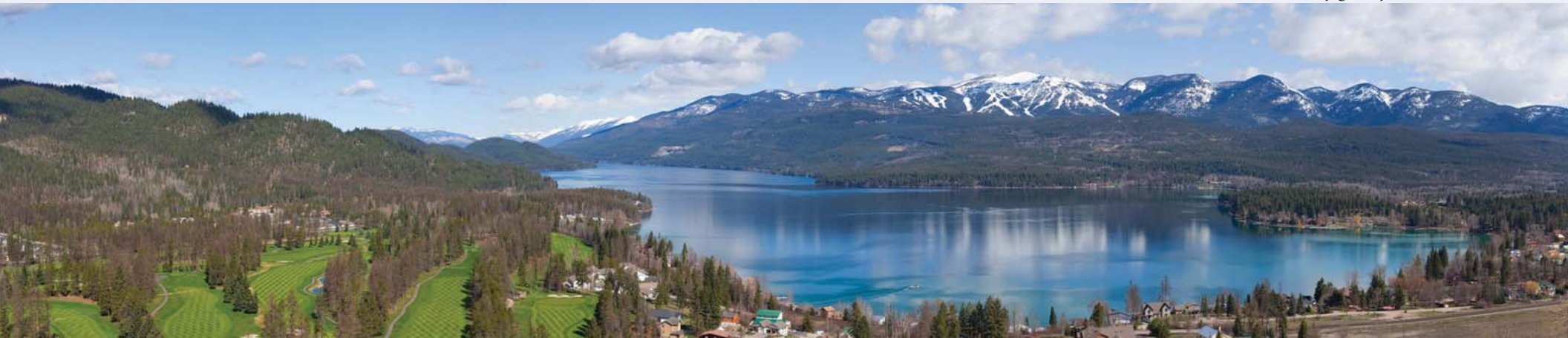




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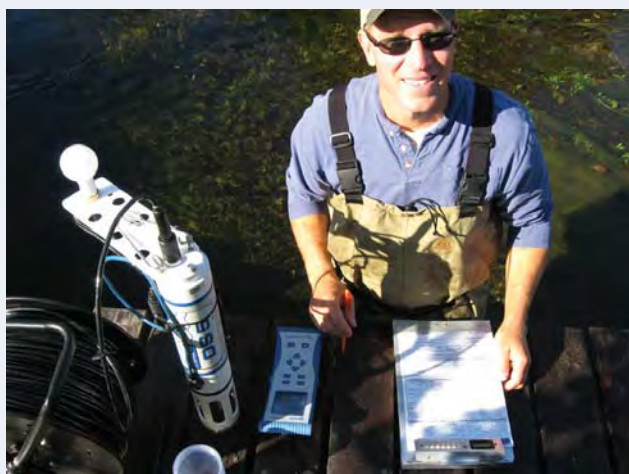


Photo courtesy Whitefish Lake Institute

I founded the Whitefish Lake Institute (WLI) in 2005 to give Whitefish Lake a voice. Its muted waters were undergoing increasing pressure and it needed better understanding. After all, the lake provides a beautiful backdrop to our community while being a major economic driver. WLI's role is to define the underpinnings of this lake-based ecosystem and to develop methods we can employ to manage and care for it.

Through the years, WLI and project partners have amassed a solid baseline awareness of the water quality and food web that shape the lake and local streams. In 2015, we compiled that information in one narrative—the *Whitefish Area Water Resources Report: A Status of the Whitefish Lake Watershed and Surrounding area*. This report and all its supporting resources are available at www.whitefishlake.org.

In the report, the lake's voice becomes clearer, revealing a unique record of trends and patterns – the result of natural forces and human actions that operate at time scales ranging from minutes to decades. These patterns clearly indicate that Whitefish Lake is a complex ecosystem, behaving in ways that cannot always be predicted. Between its covers, many questions are answered while others remain as challenges for us to solve. Some will never be understood and are left to the mysteries of the deep.

Whitefish Lake's voice now echoes in this publication through the vignettes submitted by community members that detail their diverse connections to the resource. Interwoven with their heartfelt ties to the lake are scientific observations. Ultimately, this publication is one of lessons learned, stewardship and hope. A hope that the lake's reflection mirrors our community values in a new age of understanding.

EXECUTIVE SUMMARY

Long-term watershed level conservation requires a baseline of scientific, cultural, and historical knowledge of an area; an understanding of its physical, biological, and chemical dynamics; and a program to monitor any changes over time from the baseline. With these elements in place, adaptive management plans and education programs can be created and implemented.

The Montana Department of Natural Resources & Conservation funded the development of the Whitefish Lake Institute's (WLI's) 2015 *Whitefish Area Water Resources Report: A Status of the Whitefish Lake Watershed & Surrounding Area*. In that report, WLI processed and analyzed the data and information collected since 2007 through its core monitoring program and assimilated historical data from project partners.

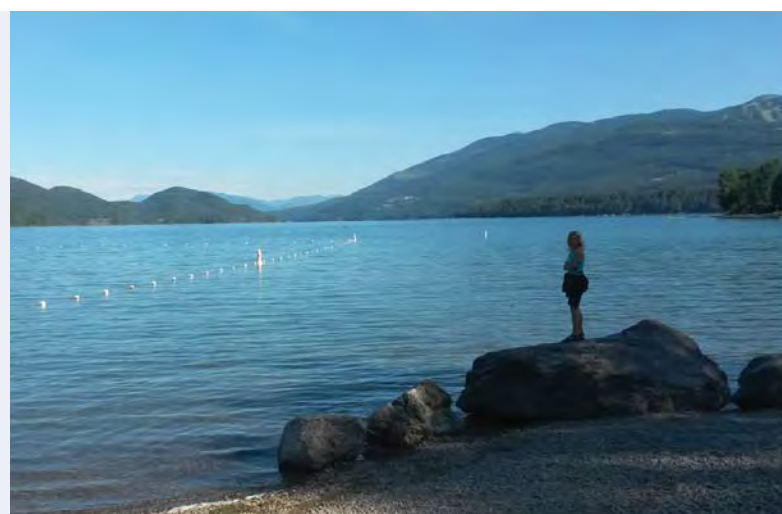
The result is a complete water quality status report, a Watershed Restoration Plan, and a scientifically comprehensive foundation for long-term water quality management of the Whitefish Lake Watershed & Surrounding Area. The City of Whitefish sponsored the report, Anderson-Montgomery Consulting Engineers, Inc. (AMCE) managed the contract work, and

WLI provided the project deliverables. Additional funding was provided by the Whitefish Community Foundation, the Whitefish County Water District, the Cadeau Foundation, and WLI members.

The report received content contributions from and was peer reviewed by scientists, educators, resource managers, and policy makers. It was distributed to all resource management entities to increase our collective understanding of the resource and to make more informed resource management decisions. It is over 400 pages long and scientifically rich. With more than 340 full color graphics and photos and 24 fold-out maps it costs over \$80 per unit to print and, given its weight, is costly to distribute. The full report is therefore available for viewing and downloading from the WLI website.



water resources, WLI is focused on leading a movement to protect our water quality from further decline. We are proactively combating Aquatic Invasive Species (AIS) through programming, partnerships and funding,



Whitefish Lake—July. Photo courtesy Walt Curtis

and we have set in motion important work to address septic leachate pollution and many other projects on Whitefish Lake. But it is the citizens of our community that hold the power to make a difference. Here in this publication, we have all come together to support the common goal of appreciating and protecting the health of the Whitefish Lake Watershed.

Watershed Restoration Plan Task Table

One of the key deliverables of the *Whitefish Area Water Resources Report: A Status of the Whitefish Lake Watershed and Surrounding area* is the Watershed Restoration Plan (WRP) Task Table. This table contains a comprehensive list of water quality issues, concerns, and goals identified by WLI, project partners, and the public. It addresses the water quality objectives of federal and state agencies, assists the local community and stakeholders in understanding water quality trends, and is intended to guide us in achieving our water quality goals.

The WRP Task Table includes 64 items broken down into major categories including: City of Whitefish – Policy & Government, Education & Outreach, Research, Restoration & Habitat Protection, and Miscellaneous. Each of the 64 water quality improvement task items were ranked relative to one another by the WLI Science Advisory Committee and then priority ranked as Tier I, II, & III. Whereas this priority ranking provided information for WLI and project partners to pursue projects, it does not preclude the completion of lower ranked projects if funding availability or unique partnerships make them timely to complete.

The WRP Task Table is paired with adaptive management strategies to estimate project costs and to identify funding sources, activities, and timelines for meeting local water quality benchmarks. However, there is uncertainty in predicting future political, social and environmental conditions and how water quality could be affected. The WRP is designed to be used over a five-year period (2016-2020) at which time a review will be required. It serves as a central record of projects that require the collective attention of local, state and federal resource managers, as well as citizens. We hope this work will also serve to further the cultural understanding of “place” in the Whitefish area. We welcome you to review the WRP Task Table on our website at www.whitefishlake.org. Click on Watershed Report, then Addendum XXIII.



LORI CURTIS
Science and Education Director,
Whitefish Lake Institute

Professor Emeritus of Landscape Architecture Robert L. Thayer wrote, *“Life-place culture, I think, is not a concept to be grasped hard by a tightly clenched fist; rather, it must be held lightly and balanced in the palm of an open hand. It also requires the joining of many hands—the active engagement of student hands raised in question, of clasped hands around shovels, of cradled hands around new seedlings, of hands shaking in agreement, of hands patting people on the back, of hands raised in celebration.”*

A “place” is not just where we live, but how we live, work and play. It is where we develop a sense of belonging, and its distinctiveness informs our viewpoints. “Living in place” requires a culture of coexistence—a balancing of human prerequisites and desires with the needs of non-human inhabitants and local environmental factors.

Older folks who have lived in Whitefish for their entire lives reminisce about a place less inhabited, less developed, and less visited. Younger folks who grew up or moved here brag about a place rich in history yet endowed with modernism. And visitors describe our town with accolades, appreciation, and envy. From all perspectives, Whitefish has a big personality. From its wild peaks to its engineered parks, it is full of wonders to be discovered and histories to be made.

To me, Whitefish Lake is the heartbeat of this exceptional place. It is also the focus of my work—the subject of my research, the topic of my educational programs, and the leitmotif of my writing. I feel privileged to call Whitefish my home and to share it with the many appreciative people whose voices can be heard in this publication.

Photo courtesy gravityshots.com



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Paddleboarders. Photo courtesy Kim & Sonny Schierl

INTRODUCTION

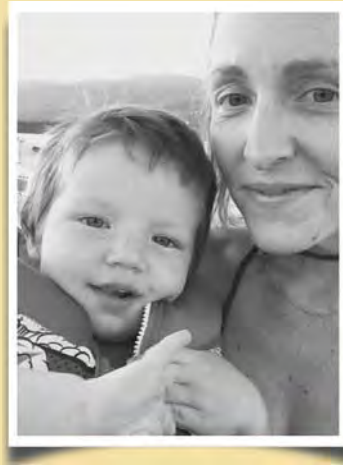
The Lake's Silent Voice

Other than waves lapping gently along the shoreline on a serene day, or big waves crashing against docks during a storm, Whitefish Lake is silent. The lake cannot describe its health or communicate its mysteries. Only through science can we attempt to categorize and understand the signs and symptoms of lake health. It is therefore up to us to give the lake a voice—from our emotional connections to our management ethics—to define and defend our community's most valuable natural asset.

The lake provides us with a sense of place, economic benefits, drinking water, and a lifestyle amenity to cherish. It also quietly renders hard-to-quantify ecosystem services such as flood attenuation, sediment and nutrient storage, and habitat for plants and wildlife.



Marissa and Solomon Keenan. Photo courtesy Marissa Keenan



MARISSA KEENAN Co-Owner, Sweet Peaks Ice Cream

My family and I live 3 blocks from city beach on Dakota Avenue in Whitefish. From our kitchen window we can see a beautiful gleaming sliver of the lake through the trees. Every morning when we fill up our coffee cups, we get a reminder of how fortunate we are to live near water.

Whitefish Lake is our source of renewal and relaxation. After a long summer day making ice cream, delivering ice cream, scooping ice cream or talking about ice cream for our company Sweet Peaks Ice Cream, we find

ourselves drawn to the lake as the perfect end to our work day. A jump in the water has always been our way to wash off the day's work and enjoy our proximity to nature.

We are lake people. From the last snow melt to the first snowflake, paddle boards sit leaning up on our back porch ready for the quick trip to the lake. Our wooden Lee Craft boat waits in our driveway for a cruise around Whitefish Lake with our kids. This water cleanses our spirit, fulfills our need to recreate in nature and supports our business. The lake is an asset that keeps us in Whitefish and brings others to visit this place we get to call home.

Our business thrives from its proximity to water. As we manage the beachside concessions at Whitefish City Beach, we reap the benefit of visitors and locals flocking to the lakeshore for their own moment of fun and renewal. What better way to enjoy summer and Whitefish Lake than to sit on the shore enjoying the view with a delicious ice cream cone in hand!

Whitefish Lake will always be an asset that we fiercely protect for ourselves, our children as well as our community and its many visitors.



Whitefish Lake Evening. Photo courtesy Lori Curtis

LAKE LIMNOLOGY PRIMER

Limnology is freshwater science—the study of inland waters. Water flows to lakes from streams, rivers, groundwater, and precipitation, carrying nutrients, sediments, and pollutants. Additional inputs reach lakes through atmospheric deposition as biological and chemical compounds that are carried through the air. Lakes are defined by processes involving plants, animals, and microorganisms found within the lake, but they are also influenced by other natural processes such as hydrology, weather, and climate; and by human processes such as land use and recreation. Some of the key concepts in lake ecology include *stratification* and *trophic state*.

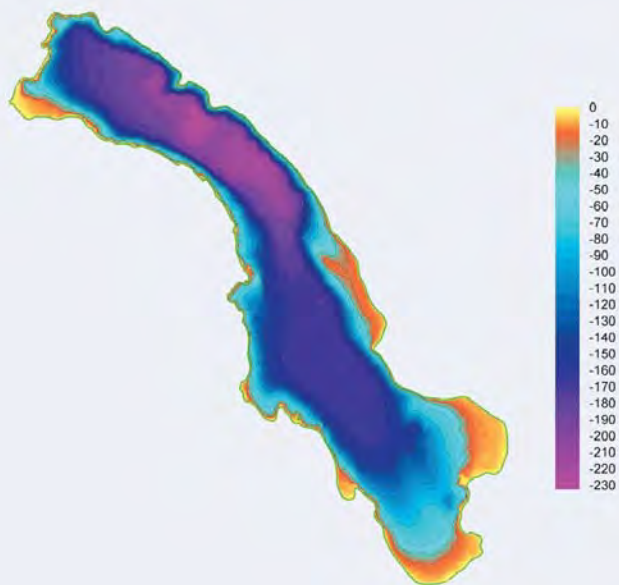


Figure 1. Bathymetric Map of Whitefish Lake. Courtesy Constellation Services, Mark Reller, MarksLakeMaps.com

Stratification

Most lakes located at the same latitude as Whitefish Lake are subject to *stratification*. Density plays a key role in stratification. Water is densest at 39.2°F (4°C) and becomes less dense at both higher and lower temperatures. This density/temperature relationship causes many lakes to stratify or separate into three distinct layers as influenced by climatic conditions and lake depth. In the summer months, sunlight and warmer weather heat the upper layers of the lake, while deeper waters remain cooler. The top layer where water is in contact with the atmosphere is the *epilimnion*. Below the epilimnion is the *metalimnion*, the transition zone between the surface and deep layers.

Within the metalimnion is the *thermocline*—the narrow plane of the water column at which temperature decreases most rapidly with depth. Below the metalimnion is the *hypolimnion* where cool, mostly nonturbulent water, which is denser than warm water, remains in the bottom layer of the lake. Stratification occurs when surface warming increases the temperature and water density difference to the point where resistance to mixing is greater than the mixing strength of wind turbulence.

Trophic State

Limnologists classify lakes and other waterbodies according to a *trophic state*. The

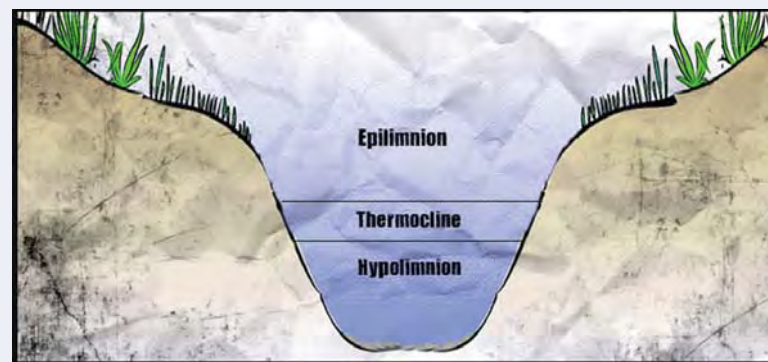


Figure 2. Generalized Lake Stratification Zones. Courtesy Intamedscience.com

trophic state is defined as the total weight of biomass in a given waterbody at the time of measurement. It is a methodology of “rating” lakes, ponds and reservoirs based on the amount of biological productivity occurring in the water. The amount of available nitrogen, phosphorus and other nutrients influence the trophic state. An *oligotrophic* lake has low levels of nutrients and low levels of primary production where algae make their own food to live and grow. A *mesotrophic* lake generally has an intermediate level of productivity, having clear water, sometimes submerged aquatic plants, and a medium level of nutrients. A *eutrophic* lake has high levels of primary productivity resulting from high levels of nutrients, often leading to algal blooms.

Lakes with frequent and/or severe algal blooms are considered *hypereutrophic*. There are no hard lines dividing these classifications as they vary based on an individual waterbody’s aquatic productivity. Whitefish Lake was historically oligotrophic but is now *oligomesotrophic*, meaning it is in a transitory state of increased eutrophication.



SHAWN DEVLIN, Ph.D.
Professor, Flathead Lake Biological
Station; Aquatic Ecologist, Whitefish
Lake Institute

Lakes fascinate me. They are complex and elaborate but somehow their complicated nature is hidden by their simplistic beauty. As an aquatic ecologist, I strive to understand the thousands of intricate processes underway in lakes at any given moment and how they might change over the course of time. To me, the way the physics, chemistry, and biology of water meld into ecology is nearly as beautiful as mountain views of Whitefish or Flathead Lake. I am fortunate to have the privilege of working on these lakes, two of the most beautiful lakes in the world- in my opinion. With this privilege comes a responsibility to understand what these lakes can teach us and to work hard to protect them through long term monitoring efforts.

We are incredibly lucky and blessed to have such amazing and pristine lakes in our region. Throughout the United States, the wa-

ter quality of most lakes is in severe decline, however, here in the Flathead Valley our lakes remain clear and clean. The foundation for the pristine state of our lakes starts with where they are located. Whitefish Lake is the headwaters of the Flathead system and sets the stage for clean, pure water to flow south to Flathead Lake. The same water that we swim in and boat on in Flathead and Whitefish Lakes flowed down from the mountain tops of the Whitefish Range, Glacier National Park and the Bob Marshall wilderness, reaping every benefit of the secluded and protected wilderness set aside to preserve Montana at its finest.

Over 60% of the Flathead Valley Watershed drains protected areas. Given this, the fact that our lakes remain clean is not surprising. However, our regional waters are not pure and clean only because of the rarefied landscape where they are found. Dedicated and hardworking stewards have worked tirelessly to ensure that these systems are protected and that they are managed with the respect and admiration they so deserve. Flathead Valley residents understand the importance of water quality and its preservation, and the role that residents play in keeping these lakes clean cannot be undervalued.

Unfortunately, the hard work of conservationists is not done. There are many threats to both Flathead Lake and Whitefish Lake, and these threats take many forms. Most notable, is the threat of invasive mussels that could severely impact our freshwater systems, leaving them nearly unrecognizable. Pollution in the form of nutrients also threatens the lakes of the Flathead Valley, despite the natural beauty of the region.

Without careful monitoring and quick action, increased nutrient loading from runoff and atmospheric deposition could turn our lakes from translucent blue to murky green. I am honored to have the privilege of being able to study these magnificent lakes. Moreover, I am humbled by my responsibility to continue the work of stewards who have come before me and will work hard to keep our lakes blue.

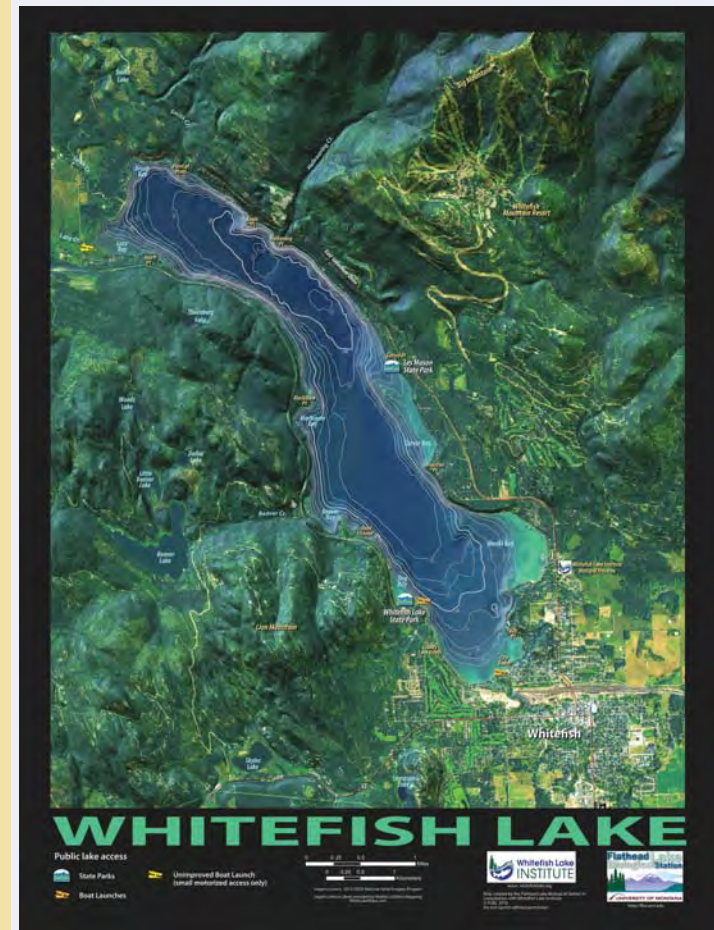


Figure 3. Whitefish Lake Map. Courtesy Whitefish Lake Institute and Flathead Lake Biological Station

GEOGRAPHIC SCOPE

Located at the headwaters of the Columbia River Basin in the greater Crown of the Continent Ecosystem, waters of the Whitefish Lake Watershed flow to Flathead Lake. Flathead Lake is the largest natural freshwater lake west of the Mississippi River. From Flathead Lake, water continues flowing via the Flathead and

Clark Fork Rivers before reaching the mainstem Columbia River with its outfall to the Pacific Ocean in Oregon.

What we do to protect Whitefish Lake not only preserves our human health, ecosystem fitness, and way of life, it sends a gift of stewardship to our downstream neighbors.



Whitefish Lake from Lion Mountain. Photo courtesy gravityshots.com



Figure 4. Whitefish Lake Nested in Flathead Watershed, Columbia River Basin & Crown of the Continent. Map courtesy Mobile LogiStics Mapping

WHITEFISH LAKE & ITS TRIBUTARIES

Whitefish Lake

Although the story is not “official,” historians have reported that in the 1850s trappers working in the area noticed Native Americans catching whitefish from the lake and consequently named it Whitefish Lake. The Salish called the lake *Epi'yu* which literally means “has whitefish.”

Whitefish Lake is the capture basin of its watershed. A watershed is an area of land that captures, stores, and sheds or discharges its surface waters to a single waterbody. Whitefish Lake is considered medium sized at 3,370 acres and 232 feet deep at its deepest point. It is 5.78 miles long with a maximum width of 1.37 miles and 15.85 miles of shoreline. The lake has a relatively rapid flushing rate (retention time) of around 2.5-3 years. Its elevation has the potential to fluctuate by almost 4 feet depending on tributary flow input or drought conditions.

Whitefish Lake is classified by the Montana Department of Environmental Quality (DEQ) as an A-1 waterbody meaning it is “suitable for drinking, culinary, and food processing purposes after conventional treatment for removal of naturally present impurities. Under this classification, water quality must be suitable for bathing, swimming, and recreation; growth and propagation of salmonid fishes and associate aquatic life; waterfowl and furbearers; and agricultural and industrial water supply.”



Whitefish Lake Looking Northwest from outlet. Photo courtesy gravityshots.com



MORIE ADAMS-GRIFFIN Pastor, Whitefish United Methodist Church

On Memorial Day weekend of 2015, my family came to Whitefish to look at houses to buy as we planned our move here. During a break, we decided to have a picnic in the grass above City Beach. As I looked out, marveling at the beauty of Whitefish Lake, I

felt extremely fortunate to be moving to this place. We ended up choosing a home within walking distance of the lake for ourselves to be able to enjoy its offerings. Not only do we, as a family, take advantage of the recreational opportunities like swimming and paddle boarding, but I also personally appreciate the peace it can offer me. At times, I find myself sitting at the waters edge contemplating my connection to this big world.

The lake offers a wonderful metaphor for me to consider how I want to be in the world: settling and flowing where I will; not polluting myself with what might harm me; and being one whom others want to be around. The wisdom the lake speaks instills in me a genuine hope for its present and future existence. I want others to be able to experience its beauty, offerings and wisdom.

Whitefish Lake Tributaries

Six perennial streams and a few ephemeral streams and seeps feed the lake, some with mountainous origins that typically reach peak discharge in late May. Others are lowland streams with peak discharge in mid to late April. Each stream is unique based on local geology, vegetation, and land use. WLI has developed a solid fingerprint of the chemical composition and discharge rates for each stream as a basis for future comparisons.

Whitefish Lake's six perennial tributary streams include Swift Creek, Lazy Creek, Hellroaring Creek, Beaver Creek, Smith Creek, and Viking Creek. Swift Creek is the largest tributary to the lake, draining 64% of the total watershed along the Whitefish Range. Lazy Creek, a meandering lowland second order stream which runs parallel to Swift Creek in the northern valley, is the second largest tributary.

Hellroaring Creek is the largest of the small tributaries and originates on Big Mountain. Viking Creek runs through a wetland preserve now owned and managed by WLI and is influenced by the City of Whitefish water treatment facility overflow and backflush discharge.

Baseline Monitoring

WLI monitors two sites of Whitefish Lake including the deep lake site (210 feet deep) near Hellroaring Creek and a site located close to the outlet of Whitefish Lake (56 feet deep) in order to describe nutrient cycling. The ongoing monitoring of a mid-lake site by the Flathead Lake Biological Station (160



Beaver Creek. Photo courtesy Whitefish Lake Institute



Stream Gage at Cow Creek. Photo courtesy Whitefish Lake Institute



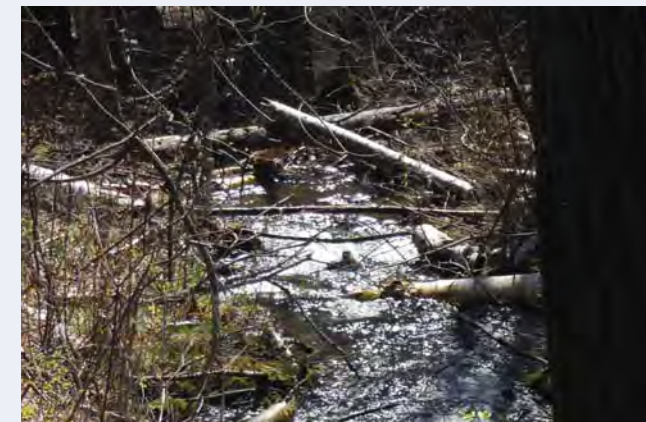
Hellroaring Creek in Fall. Photo courtesy Whitefish Lake Institute



Swift Creek. Photo courtesy Whitefish Lake Institute



Lazy Creek. Photo courtesy Whitefish Lake Institute



Viking Creek. Photo courtesy Whitefish Lake Institute

feet deep) compliments this work for a good analysis of the lake. Monitoring results from the three sites together provide a basis for understanding the dynamics of Whitefish Lake. In addition to Whitefish Lake's six tributaries, WLI also monitors other local stream including the Whitefish River (the outlet of Whitefish Lake), Cow Creek, Haskill Creek, and Walker Creek.



Monitoring equipment. Photo courtesy Whitefish Lake Institute



Surveyor. Photo courtesy Whitefish Lake Institute

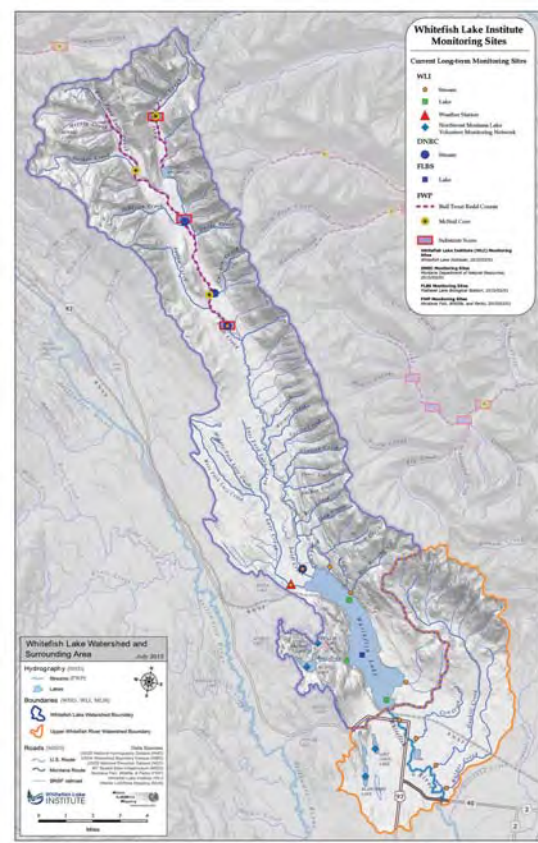


Figure 5. Map of WLI monitoring sites; Photo courtesy Mobile LoGISTICS Mapping



Hydrolab DS5. Photo courtesy Whitefish Lake Institute

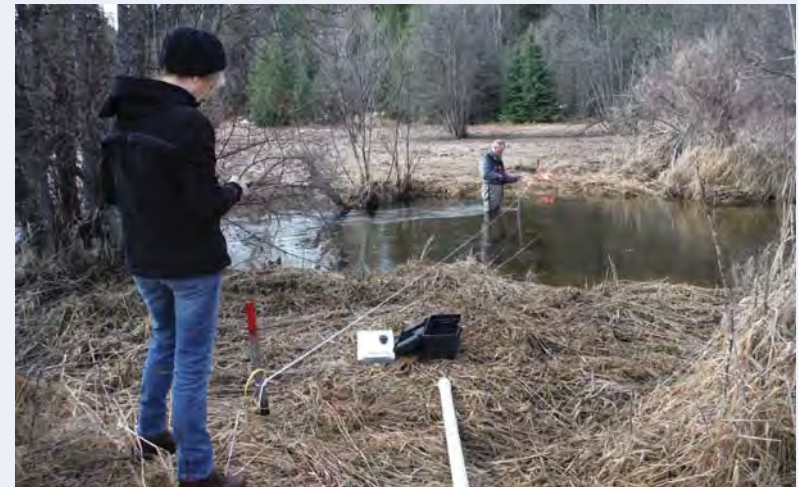
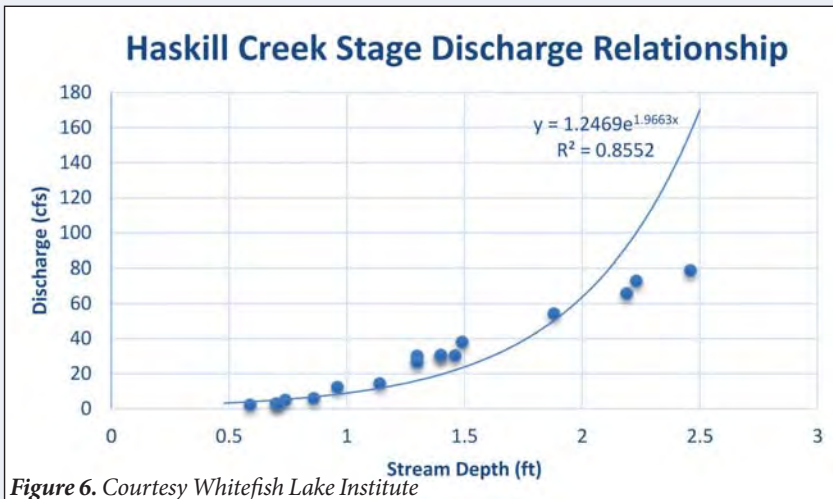
At each site, water chemistry suites are collected according to Montana Department of Environmental Quality protocols as modified by WLI. Physical parameters are also collected using a multiprobe sonde including; depth, pH, dissolved oxygen, conductivity, resistivity, salinity, oxidation reduction potential (ORP), photosynthetically active radiation (PAR) – atmospheric and *in-situ*, and total dissolved solids (TDS). A portable turbidimeter is used to determine turbidity



Turbidimeter. Photo courtesy Whitefish Lake Institute

levels, or the amount of suspended particles in a water sample.

WLI conducts stream gauging on all its monitored streams and the Whitefish River. This involves measuring stream stage - the height of the water surface using a staff gauge; collecting periodic discharge measurements - the volume of water in cubic feet per second (cfs), and developing a stage-discharge relationship (see Figure 6) to maintain a continuous discharge record. In 2014, WLI also installed pressure transducers to continuously measure water level and temperature.



Mike and Lori on Lazy Creek. Photo courtesy Whitefish Lake Institute



JIM ELSER
Director, Flathead Lake Biological Station

I live on the shore of Flathead Lake, about 50 miles south. My connection to Whitefish Lake is via the partnership between the Bio Station and the Whitefish Lake Institute. We support WLI by doing routine sampling

of the lake, using the same protocols and methods that we use in our monitoring of Flathead Lake. This makes for some terrific opportunities for comparisons and joint studies.

Whitefish Lake is upstream of Flathead Lake. In many ways, it's a microcosm of the issues we face with Flathead – nutrient management, invasive species, etc. It's an indicator – if something is going wrong in Whitefish Lake, eventually it will find its way to Flathead. So we need to work together! Everyone in the region benefits from recreation in Whitefish Lake, of course (swimming, boating, fishing). It's also a drinking water supply and you can't get more important than that! However, these benefits may not always be available. The most immediate threat to Whitefish Lake is from invasive species and from dreissenid mussels in particular. We must keep these damaging mussels out of the Flathead basin – the Whitefish Lake com-

munity is showing great leadership in this regard. In the longer term, we all need to come to grips with climate change.

Our winters are changing and with them our snowpack and therefore the hydrology and pattern of river inflows. Fire frequencies and severities are changing. All of these changes will impact the supply of water to Whitefish Lake and ultimately the quality of water we all experience there.

Indeed, a lake is a reflection of its watershed. If the watershed is protected, so is the lake. By protecting it now we can pass it to future generations largely in the condition in which we enjoyed it. This is our solemn obligation.

I would just like to wish all the residents of Whitefish Lake the best as they come together around this incredible resource. Here at Flathead Lake Biological Station we look forward to working together to be sure our lakes stay blue and mussel-free for the near- and far future.

Tributary Loading

Nutrients can be delivered to Whitefish Lake in a number of ways, including tributary conveyance, atmospheric deposition, groundwater interaction, internal loading, or by organisms. Most of the nutrient loading to Whitefish Lake is conveyed by tributaries during the spring freshet, when snow and ice melt in streams and rivers.

Figure 7 shows the percentages of phosphorus and nitrogen that came from each of Whitefish Lake's six tributaries and from precipitation during 2014, the year that WLI refined its methodology for calculating nutrient loading. Nutrient dynamics are important to understand as they are a contributing factor to eutrophication.

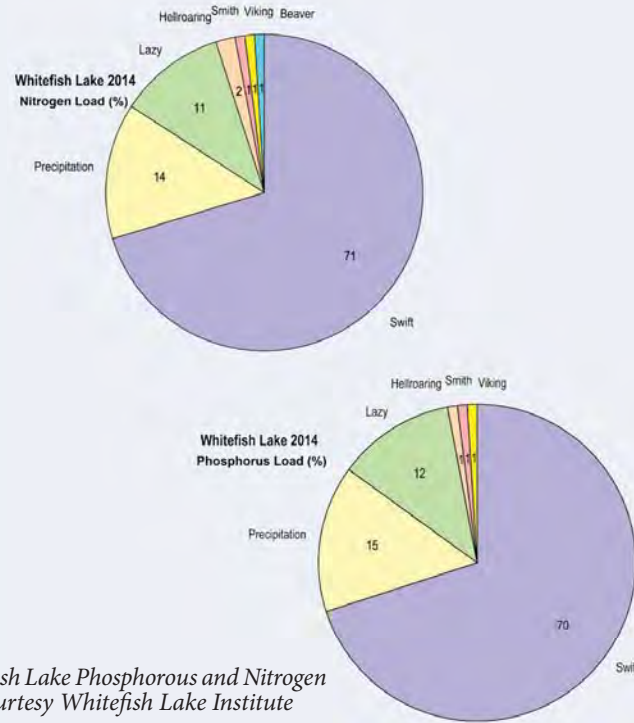


Figure 7. Whitefish Lake Phosphorous and Nitrogen Loads, 2014. Courtesy Whitefish Lake Institute

At the Weather Station. Photos courtesy Whitefish Lake Institute

Weather Station

WLI installed a weather station and a wet/dry bulk precipitation collector in 2007 near Lazy Creek at the north end of Whitefish Lake to study general weather conditions and to document wet and dry atmospheric precipitation, which helps to identify and describe the influence of atmospheric bulk loading to water quality.

The station measures and logs temperature, relative humidity, rainfall, photosynthetic active radiation (PAR), wind speed, wind direction, and gust speed data. It is not unusual for around 20% of the lake's nitrogen and phosphorus budget to come from the atmosphere.



Chris Ruffatto



Lori Curtis

Special Studies

Whitefish Lake Elevation

In partnership with Brian Sullivan of F&H Surveying of Whitefish, WLI completed an elevation analysis of Whitefish Lake along with associated statistics for Whitefish Lake spanning the 58 years from 1957 to 2014. Of the 39 years with survey data, 21 years with adequate survey data were used to calculate the mean fluctuation for the lake. The mean maximum high water level for Whitefish Lake over the study period is 3,000.63 ft. The average mean minimum water elevation is 2,997.06 ft.

The elevation analysis was compared to the mean high water elevation used in the lakeshore protection regulations determining that an adjustment was needed. The elevation analysis helps answer regulatory questions for the City of Whitefish—which annexed the bottom of the lake in 2005, Flathead County which administers the lakeshore protection regulations, Montana DNRC which regulates the state owned lakebed, and private landowners whose property extends to the mean low water elevation.



Whitefish Lake at high water. Photo courtesy Koel Abell



Whitefish Lake at low water. Photo courtesy Koel Abell



2nd Creek Intake



3rd Creek Intake

NEIL DEZORT Utilities Operations Supervisor, City of Whitefish

The City of Whitefish has a long-standing connection to Whitefish Lake dating back to the City's incorporation in 1905. The lake has been crucial to the economic success of the City throughout its history from providing a method to transport logs for the timber industry in the early days to providing economic boosting recreational opportunities more recently. It has also played a key role in providing a stable water supply to the City for over a century being the sole source of water early, and now acting as a supplementary water source. Currently, there are City owned parks and multiple pieces of City owned infrastructure that come into direct

contact with Whitefish Lake. The lake itself was annexed in August of 2005 and now resides within City limits.

Whitefish Lake was the City's sole source of drinking water supply from 1907 until the primary water source was changed to the tributaries of Haskill Creek in 1919. Since that time, the water supply has been supplemented with lake water on an as-needed basis. Due to population growth and a trend toward hotter and drier summers, the water supply has needed to be augmented with lake water more frequently in recent history. Currently, an average of 25% of the City's drinking water supply comes from Whitefish Lake during the summer months (typically July through September).

As the population of the City continues to grow and summers get longer and hotter, Whitefish Lake will become a more vital source of drinking water for the City. The most immediate threat to the lake, and thus the City's water supply, is the potential for aquatic invasive species (AIS) to be introduced to the lake and ultimately establish reproductive populations. It is imperative to the long-term feasibility of utilizing Whitefish Lake as a source for the City's water supply that everything possible is done to keep AIS from entering the watershed. The City currently partners with the Whitefish Lake Institute in an effort to prevent AIS from entering the lake. The City has boat inspection stations set up at the lake's two public boat launches (City Beach and State Park) to detect any watercraft that may be unknowingly transporting AIS to the lake. These continued efforts will be critical to preventing the spread of AIS to Whitefish Lake.

Septic Leachate

Septic leachate contamination was reported on Whitefish Lake by the EPA in 1977, the Flathead County Sanitarian in 1981, the EPA in 1984, the Flathead Lake Biological Station in 1984, 1986, and 2003, and by WLI in 2012. All of these studies indicated a growing concern for human health and water quality on Whitefish Lake. There are a growing number of examples of lake communities throughout the U.S. that ignored the signs of decline from septic leachate pollution and that are now spending millions to attempt recovery from declined water resources. We hope to help protect our community from these consequences.

When properly placed, functioning, and maintained, septic systems are designed to collect wastewater to neutralize contaminants before they enter ground or surface water systems. This is particularly important where ground and surface water drain to water bodies such as lakes. Decomposition of waste begins in the septic tank and ends in a leachfield after undergoing a series of treatments whereby wastewater is chemically, physically, and biologically processed to remove contaminants.

Modern septic systems are considered cost-effective wastewater treatment, however improper initial system design, impermeability of soil, improper soil drainage, incorrect vertical distance between the absorption field and water table, unsuitable slope, or improper maintenance may lead to system failures. Nearly one-fifth—approximately 21.5 million U.S. households—use septic systems. Approximately 20% of all septic systems experi-

ence some form of failure. Even when properly installed and maintained, septic systems have a finite life expectancy. Many of the septic systems around Whitefish Lake are 25 to 40-years old, less technologically sophisticated, and have exceeded their roughly 20-25 year life expectancy.

Decreasing septic leachate pollution is difficult because individuals are responsible for their own systems. Nationally, over 28 thousand miles of streams are designated as "threatened or impaired" because of septic system failure and sewage pit waste, and lakes across the country are suffering eutrophication from septic leachate. Numerous studies show that septic leachate from household systems is transported by groundwater through lake-bottom sediments into lake water, elevating nutrient concentrations and decreasing water quality and safety.



WLI has been working on the septic leachate issue since 2011. We conducted the “*Investigation of Septic Leachate to the Shoreline Area of Whitefish Lake*” and reported the results in 2012. Following the publication of the report and communicating the results to the public, the City of Whitefish developed an *ad hoc* Whitefish Community Wastewater Committee on which WLI served as technical facilitators. The Committee further considered the issue and produced the Whitefish Community Wastewater Management Plan.

From that effort, WLI partnered with the City and the Whitefish County Water District to raise funds and conduct Preliminary Engineering Reports (PERs) in two of the five neighborhoods identified as having septic leachate concerns. The City also adopted a 20-year deferred annexation policy for affected neighborhoods. To date, this pressing social, ecological, and economic issue remains to be fully addressed.

WLI employs a fluorometer when studying septic leachate, which detects the specific light spectrum emitted from long wavelength Optical Brightener Agents (OBAs) found in domestic cleaning products. When found in waterbodies, OBAs suggest improperly treated wastewater effluent.



Fluorometer. Photo courtesy Whitefish Lake Institute



ED LEISER
Retired Forester, Flathead National Forest Service; Whitefish Lake Institute Board Member

As a thirty-year resident of Whitefish living in near proximity to Whitefish Lake, I have become enamored with that magnificent water body. It may be trite or hackneyed to say that clean water is our most precious resource, but regardless, I believe it. Born in Minnesota, the “land of 10,000 lakes” I saw the deterioration of water quality in many of the lakes around the Twin Cities. Over time, I realized that the demise of many of the lakes was a result of leachate, the effluent from individual septic systems. The only reasonable and cost effective solution to restore and rehabilitate these lakes was to connect homes to the local sewage treatment facility.

In my opinion, no individual has the right to pollute our water, including lakes, streams and other water bodies. In fact, Article IX Section 1 of the Montana Constitution clearly states, “The state and each person shall maintain and improve a clean and healthful environment in Montana for present and future generations.” Court decisions have

upheld this provision of the constitution. In a 1999 landmark decision, *MEIC v. Montana DEQ*, the Montana Supreme Court ruled unanimously that Montanans’ constitutional right to a clean and healthful environment (Article IX, Section 1) is a fundamental right and one that is intended to be preventative in nature.

Unfortunately, Whitefish Lake has fallen victim to the problems found in Minnesota lakes. Years of studies by multiple state, federal and local agencies dating back to 1977 have determined that our lake is not only at risk, but is showing signs of reaching a tipping point where it is trending toward a condition in which it is increasingly difficult to buffer the influx of human caused nutrients. These nutrients which include phosphorus and nitrogen support plant populations that can stress or kill animal populations.

As recently as 2015, the Whitefish Lake Institute prepared a comprehensive study titled *Whitefish Area Water Resources Report: A Status of the Whitefish Lake Watershed and Surrounding Area*. This report further describes the problem of phosphorus and nutrient loading from human sources. The study included a public survey of Whitefish residents which identified septic systems as the greatest concern of all respondents.

Thankfully there are cost effective solutions to maintaining one of the major threats to water quality. For those neighborhoods located near existing sewage treatment infrastructure, homeowners should connect to Whitefish City Sewage Treatment system. In 2016 a Preliminary Engineering Report

(PER) was prepared by Carver Engineering to address the problem of leachate from septic systems. The report analyzed five alternatives, including replacing old septic systems with new systems. Connecting to city sewage treatment was not only the most effective at treating leachate but also the least cost to homeowners.

I understand that this is a complicated issue. Sorting through the science of non-point source pollution is a daunting task. Grasping all the physical and biological variables can be overwhelming. To add to all that, there are the political and economic aspects. However, when we consider what is at risk, we must act. Complacency is not an option.

Gasoline Constituent Loading and Motorized Watercraft Use Level in Whitefish Lake

This study examined potential public health risk from motorized watercraft-caused gasoline constituent loading to shoreline areas used for recreation. WLI analyzed the levels of BTEX (benzene, ethylbenzene, toluene and xylene), agents known to cause myriad health problems from cancer and birth defects to nervous system, liver and kidney damage. Results found high levels of benzene at City Beach. WLI concluded that the main mechanism for the high levels of benzene was when a boat owner pulls their transom plug on the boat ramp, petroleum effluent enters the lake adjacent to the swimming area. WLI recommended the installation of an effluent-collecting catchment system to protect public health. The Whitefish City Council approved financing for the project which was completed in 2013.

Tally Lake

Tally Lake is the second deepest lake in Montana and regionally unique due to its morphometric (size and shape) attributes and chemical input (humic matter) from Star Meadows. Those factors, among others, lead to a severe depletion of dissolved oxygen at depth throughout the calendar year. WLI is the first to monitor Tally Lake from the surface to bottom (445 feet). In 2008, a preliminary study was funded by Montana Department of Environmental Quality (DEQ). From 2009 to 2013 work continued via U.S. Forest Service Resource Advisory Committee grants. From 2014 through the present, research on Tally Lake has been supported by WLI members. WLI and project partners will soon publish a paper on this unique lake.

Biological Communities Research

Aquatic Macroinvertebrates such as insects, worms, mussels, and snails, tend to be sensitive—in varying degrees—to pollutants. Because many macroinvertebrate community assemblages change with declining water quality, they are good indicators of negatively impacted water quality. Existing populations can also elucidate specific aquatic ecosystem changes such as increases in sediment and thermal pollution. Sampling and identifying macroinvertebrate life allows researchers to set a baseline of water quality from which to measure any changes. Aquatic macroinvertebrates were sampled by WLI in 2015 to determine community assemblages and their relative pollutant tolerance. Thanks to funding from the Cadeau Foundation, WLI now has a professionally conducted baseline macroinvertebrate study that helps describe the health of the Whitefish Lake shoreline, and Whitefish area streams. This information

will also be used to compare future research results, allowing WLI to report changes from outside influences such as development, pollutants, and climate.

Periphyton is a complex mix of algae, cyanobacteria, microbes, and detritus that is attached to submerged surfaces in aquatic ecosystems. Like macroinvertebrates, periphyton is an important water quality indicator because it is sensitive to and responds quickly to change and is fairly easy to sample. Periphyton has long been used as a water quality indicator in streams and rivers, but no metrics have yet been developed for determining periphyton tolerance in freshwater lakes. Thanks to funding provided by the Cadeau Foundation, WLI has baseline periphyton information for a better description of the health of Whitefish Lake.

Anecdotal accounts: WLI has heard from a number of long-time community members that have said the rocks along the shoreline of Whitefish Lake used to be crisp and clean. Now, most rocks appear greenish-grey and fuzzy due to attached periphyton.

WLI—in partnership with the Flathead Lake Biological Station—conducted a 2016 **Mysis shrimp** study in early September during the low light phase of the lunar cycle. Sampling occurred after midnight when Mysis shrimp (*Mysis diluviana*) had migrated from the lake bottom vertically to the near surface. Mysis have had significant adverse impacts on the Flathead Lake ecosystem, so it is important that we assess their population densities and distribution locally. The Mysis study, when compared to prior studies in the 1980s to provide a necessary update regarding the trophic status and dynamics of Whitefish Lake.

NATURAL HISTORY

Geology

Born at the end of the Pleistocene Epoch roughly 12,000 years ago, Whitefish Lake formed from a retreating glacier of the Cordilleran Ice Sheet in the Rocky Mountain Trench, which begins at the Yukon/British Columbia border and extends south into the Flathead Valley. When the ice retreated, one large proglacial lake that contained both present-day Whitefish Lake and Flathead Lake remained. In some places around Whitefish—like the *Averill's Viking Creek Wetland Preserve*—a several meters deep lacustrine (clay) sediment found just beneath the surface indicates the existence of a lake environment that existed for thousands of years. Slowly, the two lakes separated and morainal deposits of glacial till at the southern and eastern shores of Whitefish Lake now form the boundary of the lake in that area.



CLIFF CLARK
Geoscientist, Alpine Geotechnical

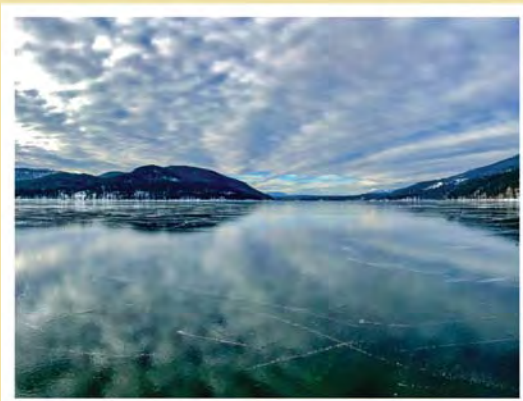
Although my perspective of the lake from a scientific viewpoint is likely very different than others, I believe Whitefish Lake is a keystone to the community that allows us to bond over a common interest, the excitement and beauty the lake offers to us all. In recent years, water quality studies

have been done by WLI concerning the viability of the lake with ongoing natural and anthropogenic threats. One threat I've been aware of concerns septic leaching from homes neighboring the lake. Although I'm not an expert in the field of limnology, I believe it's our responsibility as educated members of this community to help sustain the natural systems that surround us such as Whitefish Lake. If there's one thing my experience and education in environmental remediation has taught me is that it's much better to prevent than to treat. Solutions exist to mitigate threats to Whitefish Lake and maintain a healthy watershed; we should explore those options now rather than wait to try to repair the damage later.

Whitefish Lake is an amazing resource, however, like any resource, its sustainability shouldn't be overlooked. As a native of Whitefish and someone who appreciates the importance of the health of our lake, I can't stress enough how significant this matter is to our community.



Whitefish Lake. Photo courtesy gravityshots.com



BRIAN SCHOTT
Founding Editor, *Whitefish Review*

A Time for Reflection

The power of Whitefish Lake for me comes not from its clear waters, but rather from the energetic body this ancient basin holds.

12,000 years ago, our home was deep below 3,000 feet of ice. The Stillwater Glacier pressed into the Flathead Valley, moving rock. Then 10,000 years ago, Whitefish Lake emerged, created by the glacial moraine that now cups the cool water.

Over the 24 years since I first saw the lake and the curves of the mountains above, I've enjoyed the water for the play we create in the molecules that move from liquid, to solid, to vapor. Some lazy days on a friend's motorboat as a younger man. A sunset waterski. An amorous afternoon with my wife. A midnight ice skate when the ice cracked and boomed.

My favorite play times have more recently been with our children. The rhythm created on a paddleboard. That first dive into the waters when it takes your breath away. The laughter that motion creates as we splash and propel ourselves through the mystery.

In the spring when the streets and sidewalks clear of ice, I'll jog along the footpaths that wind along the river and finally pause at City Beach. I'll bend down and touch the water. Catch my breath. Wipe my face with the coolness. And breathe.

The most powerful times for me and this lake have been when my breath has been tight. The world pressing in. The death of a friend. A baby about to be born. It's then that I'll visit the lake by myself, sit on the shore, and listen. The weight of the water will release me from the pressures in my heart and in my head. I'll breathe again, with some understanding of my smallness.

One afternoon this past winter I experienced a miracle. A fast, cold hard freeze with no snow or calm air had given breath to four inches of clear solid glass. I moved out from the cobble shore at Les Mason in the belly of the lake and gazed straight down to the bottom, my head dizzy from walking on water. I moved out further. The cold clarity extended for miles.

There is a lesson in the stillness. A reflection of our own selves in this body of water.

Whitefish Review is a non-profit art & literary journal founded in 2007.

Fish Species

Native fish species like bull trout and west-slope cutthroat trout first colonized Whitefish Lake and flourished in its pristine waters. Since European settlement, a number of non-native fish introductions have occurred, reducing native species food and habitat. A well-intended introduction of *Mysis* shrimp in 1968 further led to the decline of native species and dramatically altered the food web. Today, the Whitefish Lake food web has reached a new dynamic equilibrium, dominated by bottom dwelling lake trout and lake whitefish.



Gordy Duvall with lake trout. Photo courtesy Stumptown Historical Society

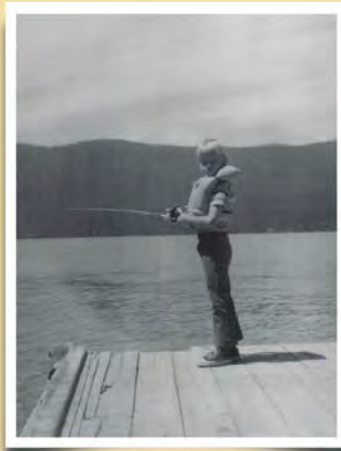


Bull trout. Photo courtesy U.S. Fish & Wildlife Service

Figure 8. Fish species found in Whitefish area waterbodies. Courtesy Whitefish Lake Institute

Species	Approximate Date of Introduction	Status
<i>Family Salmonidae</i>		
Bull trout		Threatened Species of Concern
Westslope cutthroat trout		Species of Concern
Arctic grayling	1928	Extirpated
Brook trout	1913	Rare
Rainbow trout	1914	Rare
Lake trout	1905	Abundant
Kokanee	1916	Extirpated
Coho salmon	1941	Extirpated
Mountain whitefish		Common
Lake whitefish	1890	Abundant
Pygmy whitefish		Species of Concern
<i>Family Cyprinidae</i>		
Fathead minnow		Common
Redside shiner		Common
Northern pikeminnow		Common
Peamouth		Common
Longnose dace		Abundant
<i>Family Catostomidae</i>		
Longnose sucker		Abundant
Largescale sucker		Common
<i>Family Esocidae</i>		
Northern pike	1960s	Rare
<i>Family Cottidae</i>		
Rocky Mountain (mottled) sculpin		Common
Slimy sculpin		Common
Shorthead sculpin		Common
<i>Family Centrarchidae</i>		
Pumpkinseed	1910	Rare
Largemouth bass	1898	Rare
<i>Family Percidae</i>		
Yellow perch	1910	Common

Bold = native



CHRIS SCHUSTROM Co-Owner, Garden Wall Inn

Growing up in Whitefish, riding my bicycle to the City Beach or friends' houses who lived on Whitefish Lake to swim, canoe, waterski and fish were an important part of my summers. Our house in town was just over a mile from City Beach. I was told one day by a friend's father as we waterskied, "not bad for a town kid." It always feels good to be on, or in Whitefish Lake. Water has always been an important part of my life. My family ran the tour boat concessions on St. Mary Lake (4 summers) and Lake McDonald (13 summers) in Glacier Park for 17 of my first 18 summers. I even recently discovered that the original Swedish spelling of my family's last name translates as "lake stream."

As I became co-owner of a Whitefish business, I also became an advocate for water in our area and Montana, first as President of the Flathead Valley Chapter Trout Unlimited and currently as State Council Chair of Montana Trout Unlimited. During this time, the importance of advocacy to protect watersheds and water bodies like Whitefish Lake

became even more apparent to me. Whitefish Lake provides an important part of the clean water I use at home and in my business. It provides important year-round recreation opportunities for residents and visitors, supporting many levels of our local economy. It also defines who we are as a community of people who tend to measure their worth by the number of days spent in the natural world. As such, we have to pay constant and close attention to threats to important parts of our community like Whitefish Lake.

Fortunately, threats to the lake are being managed and as they are all human-caused can be avoided. The introduction of the wrong food source at the wrong time continues to pose challenges for native westslope cutthroat and bull trout, but recent habitat protections for important tributaries of Whitefish Lake provide hope. The possibility still remains for another train derailment along Whitefish Lake, but the work of community groups advocating for train safety keep this threat at the front of railroad company vision. The challenges posed by aging septic systems around Whitefish Lake remains, but the Whitefish Lake Institute works to document, address, and reduce this threat. And, the threat to our water supply infrastructure posed by a possible introduction of aquatic invasive species such as non-native mussels is real. But, because of the work of committed Whitefish residents, groups, and the City, they have not gotten into Whitefish Lake or the surrounding watersheds.

Whitefish is a community of advocates for many good causes, including Whitefish Lake. Being informed about the threats to important community assets like Whitefish Lake is important. I encourage everyone to be an advocate. It makes our community stronger.

Lake Health Indicator Species - Nature's Barometer

Native bull trout and westslope cutthroat trout are important barometers to aquatic health because of their long evolutionary history in the area and their survival and adaptation through natural disturbance regimes such as glaciations, floods, fires, and droughts. Bull trout are federally listed as “threatened” under the Endangered Species Act, and westslope cutthroat trout are considered a “Class A Species of Special Concern” through a joint listing developed by Montana Fish, Wildlife and Parks and the Montana Chapter of the American Fisheries Society. These two native species require a variety of cold, clear, complex, and connected habitats and are subject to myriad human affects from land use activities, and both have suffered from the introduction of non-native species.

The Whitefish Lake bull trout population as represented in Swift Creek redd (nest) count data show a perilously low population level. For the entirety of Whitefish Lake, only around 50 adult fish move up Swift Creek each year to spawn placing them at a high-risk level for extirpation in the watershed. Researchers from the Flathead Lake Biological Station indicate that in Flathead Lake, extirpation of some of the native fishes (bull trout and westslope cutthroat trout) in the near future seems possible and recovery of these populations would be difficult given strong food web control by the expansive non-native lake trout population.



Westslope cutthroat trout. Photo courtesy capradio.org

CULTURAL HISTORY

From native inhabitants to early settlers, the people of Whitefish have depended on the abundance of natural resources to sustain and build this community. European settlement around Whitefish Lake represents only about 1% of the lake's historic timeline, yet some of our activities like the construction of the railroad, land clearing, shoreline development, recreational pursuits, and the introduction of non-native species have significantly affected water quality and the lake's food web. As we move forward, this lake-based community must weigh our needs and desires against our responsibility to galvanize as a voice to protect the lake.

The First People

Ept̓ X̓w̓x̓w̓y̓ú - Has Mountain Whitefish

From the time the Whitefish Lake and Flathead Valley area became habitable at the end of the last ice age, this has been an important part of the aboriginal territory of the Q̓lispé (upper Kalispel or ‘Pend d’Oreille’). Whitefish Lake is known in the Salish language by a name of similar meaning: Ept̓ X̓w̓x̓w̓y̓ú, meaning ‘Has Mountain Whitefish.’

Q̓lispé territories encompass all of the Flathead, lower Clark Fork, and Pend Oreille drainage systems, from the North Fork in British Columbia down to the Pend Oreille River in eastern Washington. Across that vast region, the tribe lived as hunters, gatherers, and fishers, subsisting comfortably and sustainably here, drawing from a profound material and spiritual understanding of their homelands.

Prior to the introduction of non-native diseases in the eighteenth century, tribal populations were much larger, and the Q̓lispé were organized in at least many distinct bands—at

least 11, and possibly close to 20—based at various places within the overall tribal territory. One of the tribe's largest bands was called the Śl̓q̓etk̓w̓ms̓ci̓nt̓, meaning People of the Broad Water, in reference to the waterbody known in English as Flathead Lake. In Salish it is called Čl̓q̓etk̓w̓ (Broad Water).

The Q̓lispé were known for their unique, blunt-ended bark canoes, which they used to travel down and up the river system that connected the various bands. Numerous other tribes referred to the Q̓lispé by names meaning ‘paddlers’ or ‘real paddlers.’ So central are canoes and canoeing to the identity of the Q̓lispé that in sign language, the tribe is indicated by a gesture simulating a paddling stroke.

By the late 1700s and early 1800s, the loss of population due to smallpox and other exotic diseases, combined with increasingly frequent raids by enemy tribes, forced many tribes—including the Q̓lispé—to coalesce into fewer groups. Early non-Indians encountered some that were based further upstream in the Flathead drainage system, and others that were centered further downstream in the Clark Fork and Pend Oreille systems. The newcomers therefore came to refer to the upper and lower Kalispel or upper and lower Pend d’Oreille. The Śl̓q̓etk̓w̓ms̓ci̓nt̓ (People of the Broad Water) moved their winter camps south into the Mission Valley, with many of the people based in an area the people had known and utilized from time immemorial, called Nm̓lá Sew̓tk̓w̓s (Raven's Waters—known in English as Crow Creek).

Today, Ept̓ X̓w̓x̓w̓y̓ú — Has Mountain Whitefish — remains a place of great cultural importance to the Q̓lispé.



**MARCIA SHEFFELS
SUSAN ABELL**

Whitefish Lake has been our “backyard” since 1955, and what child does not love his/her backyard? As part of our childhood responsibility, we did not mow grass but instead learned to respect and care for the natural beach, shoreline, and clean water. In return, the lake offered us swimming, fishing, paddling, waterskiing, ice-skating, cross-country skiing, and snowshoeing. Family members were active in the first lake boat club and were instrumental in the creation of a legislative bill to protect the lake in the 1970’s (Senate Bill 175). Between us, we have served on the Whitefish Lakeshore Protection Committee (10 years), the City Park

Board (20 years) and the County Park Board (19 years).

We now watch our children, grandchildren, and friends continue to appreciate all that the lake offers from our multigenerational-family home which sits approximately 75 feet from the high water line. Fourth and fifth generations now enjoy the lake as the “hub” for family gatherings, and the lake provides a natural landscape for activities and friendships, instead of the more prevalent, digitalized experiences available.

The lake is one of Whitefish’s “gold mines”! It has brought growth to the area, which in turn has supported economic prosperity. For year-round citizens, it provides recreation, sport, and beauty. It is also a drinking water source for the city, plus commercial and private entities. Yet Whitefish Lake did not become a “gold mine” without early-lake users and current stewards working to sustain its water quality and natural shorelines. Much is credited to the Whitefish Lakeshore Protection Committee and the Whitefish Lake Institute. It is disappointing that there has been a willingness on the part of some to bend or disregard ordinances put in place to maintain and sustain this natural wonder.

As our family members visit, they are taught at an early age to be good stewards. However, changes made in the name of progress and economic growth have altered the natural shoreline and affected the clear and pristine water quality. Commercial expansion, the steady in and out floatplanes in the summer, and more and larger recreational watercraft, such as “bladder boats” have brought this clear, mountain lake to questionable water quality, caused a water safety issue for the people, eroded its shores, and led to high levels of sedimentation on some beaches. Evidence abounds that the lake and lakeshore are in jeopardy.

We hope that by sharing our love and connection to the lake it will encourage others to take action to protect the water quality and shoreline rusticity, which if not maintained, will ultimately lead to decreased property values and tourist visitation. We would like to spread a message of good long term stewardship instead of short term personal gain, and preservation before “progress.” The protection of Whitefish Lake and its watershed will benefit generations to come.

Abell Family Photo Collage. Photos courtesy Charlie Abell





CHARLIE ABELL
Retired Whitefish Credit Union
Manager; Past Board Member,
Whitefish Lake Institute

I've lived on Whitefish Lake most of my life. The only time of record not living on the lake or calling Whitefish my home was a couple of years as a security analyst in Helena. My family's early connection with the lake was a cabin at Mackinaw Point (I've seen maps that called it Abell's point). Attached is a photo of my father and his cousin on the lawn/garden in front of that dwelling. Over the years I've been asked "what are the most important

things in your life," and the lake certainly receives a high ranking.

The lake is a family heritage, having been associated with us for over 100 years. We have fished in it, water skied on it, raced boats on it, and been involved in protecting it through the Lakeshore Protection Committee and the Whitefish Lake Institute.

The lake is the community's most important natural asset! It has attracted visitors since "First Nation" fished it. Our citizens gain much from our lake – the beauty, recreation, solitude, and water.

The threats to our lake began as soon as European settlers arrived, and they continue and expand today. From the train load of lake trout to today's fear of mussels, nature has been attacked. The human pollution has been lessened in places by the extension of the sewer system but is then offset by the continued development along the shore. The sport fishing was quite good before the introduction of Mysis shrimp that destroyed the Kokanee and the native cutthroat populations. As a result of the over use of the lower part of the lake for recreation and lakeshore development, particularly Monks Bay, now you

can only see bottom in winter through the ice. The water was always clear year round except at high water and a major wind.

The popularity of the lake for both living and visiting will continue, along with its use as a drinking water source. I hope our community stories about the lake will encourage the community and resource managers to protect the lake and work to improve its water quality. If political decision makers and lake users understand the problems, they will be more likely to help us in our care for the lake. It is a very valuable asset from all aspects – from beauty to business.



Young Abells. Photo courtesy Marcia Sheffels



Whitefish Lake Timeline

Pre-European Period (Pre 1880)

The *Pre-European Period* for Whitefish Lake had pristine water quality and a healthy watershed. There was a well-defined native fish community without competition from non-native species. The highest magnitude flood event in recorded history for the Whitefish area occurred in 1894, but there was little increased sedimentation in the lake suggesting an intact watershed that could buffer natural disturbances.

Stumptown Period (1880 - 1940)

During the *Stumptown Period*, initial development of the shoreline and town-site (Stumptown) ensued. Construction of the railroad occurred along the west shore of the lake (1901-1904). Timber harvesting took place along the shoreline of Whitefish Lake and in the Lazy and Swift Creek drainages. To access Swift and Lazy Creeks, road building occurred in addition to a railroad spur up Lazy Creek.

Multiple non-native fish species were introduced, most notably lake whitefish in 1915. The most severe fire disturbances to the area were in 1910, 1919 and 1926. The sedimentation rate to Whitefish Lake in the 1930s was the highest on record suggesting that early timber harvest and road development in the watershed had an impact on water quality.



RON BUENTEMEIER Chair, Flathead Conservation District; Retired Forester, F.H. Stoltze Land & Lumber

With the interest by the community of Whitefish in the Haskill and Trumbull Creek areas it seems appropriate to review the land ownership history. All of these lands were patent under the Homestead Act between 1901 and 1910. F.H. Stoltze began purchasing these lands from the homesteaders in 1904 under the State Lumber Company. Access to these lands was to be by a railroad however only those in the Trumbull Creek area received a railroad. Harvesting began in the early 1920's in the Trumbull Creek area first using the Shay engine and 10 railcars that were purchased from the Brooks-Scanlon mill in Eureka. Harvesting in the Haskill Creek area did not begin until the 1940's when trucks were more reliable.

The original water lines and reservoir for Whitefish were installed in the 1920's. There were no charges for the easements however Mr. Stoltze did want payment for the 20 acres where the reservoir is located. After much discussion a price of \$20 was agreed upon.

In the late 1950's, 40 acres was sold to Big Mountain Ski area since they had already built the Chalet on the property.

There was a total of 6 logging camps established with most being in the Trumbull Creek area. Western red cedar, white pine, western larch and Douglas fir were harvested. At that time there was no market for spruce, grand fir, or alpine fir. These cutting standards affected the species of the stands we have today. The 1925 fire on the ridge between the valley and Haskill Basin created a much younger stand of tree. This area has seen much pre-commercial thinning and harvesting in the last 30 years.

Mr. Stoltze came for a visit in 1965 when I was a young forester for Stoltze. I was asked to take him for a tour of the Trumbull and Haskill areas. We visited many of the old camp sites, at one of which he recalled the story of the cook who took after a black bear with the meat cleaver. The harvested areas had very nice regeneration of larch, Douglas fir, white pine and cedar. Most of the old railroad grades had so much regeneration that it was difficult to walk on them.

Because of the construction of Hungry Horse Dam in the late 1940's, harvesting on Company lands had stopped. There were more logs available than the mills could process.

So there we stood in 1965 looking at a forest that had no activity for 20 plus years. I showed Mr. Stoltze stands of very nice regeneration with way too many stems per acre. I thought without some type of management, they would not produce the

wood fiber needed in the future. Mr. Stoltze was a very quiet man and it seemed to me that I had done all the talking that day with very little response from him except for the camp and railroad stories.

It was time to head back to the mill. Being a young person who was too impatient, I decided to go for broke and ask Mr. Stoltze what he would like me to do with his forest. He sat there with his arms folded on his chest for what seemed like hours but was only minutes, and he turned to me and said “Just manage it as if you owned it.”



Historic Ice Houses and Rail Cars. Photo courtesy Charlie Abell

Ski Town Period (1941 - 1967)

Development expanded around Whitefish Lake and in the town of Whitefish during the *Ski Town Period*. The community started the slow transition from a railroad and timber economy to a tourism economy as the Big Mountain Ski Resort (now Whitefish Mountain Resort) was established in 1947.



Whitefish River Log Drive. Photo courtesy McKeen-Gilliland Family

Two notable fish introductions occurred during this time-period including lake trout (1941) and kokanee salmon (1945). Lake trout began directly competing with native bull trout for food and habitat, but remained at relatively low population densities. Kokanee salmon started to compete with native peamouth chub, pygmy whitefish, and westslope cutthroat trout, and became the most popular sport fishery in the history of Whitefish Lake. The third highest magnitude flood event in recorded history for the Whitefish area occurred in 1964.



Historic Ski Area. Photo courtesy Whitefish Chamber of Commerce

Mysis Explosion Period (1968 - 1980)

Researchers have described the most deterministic event in the legacy of Flathead Basin waters as the introduction and establishment of *Mysis* shrimp. Introduced to Whitefish Lake in 1968, with peak numbers estimated to have occurred from 1973-1976, *Mysis* shrimp thrust the lake into its most chaotic food web transition to date. Lake whitefish and lake trout—both introduced deep water species—benefited from the increased forage base that *Mysis* provided, while other species like introduced kokanee salmon (now extirpated) and native westslope cutthroat trout suffered.



Mysis shrimp. Photo courtesy NOAA Great Lakes Environmental Research Lab

Another top-end fish eating predator, Northern pike, were introduced to Whitefish Lake in the early 1970s. The second highest magnitude flood event in recorded history for the Whitefish area occurred in 1974. This period produced the first regulatory action designed to protect the lake with the passage of the Whitefish Lakeshore Protection Act of 1975. Also in 1975, the first cursory water quality study of Whitefish Lake by the U.S. Environmental Protection Agency (1977) took place.



DICK AND JANE SOLBERG
Science Advisory Committee,
Whitefish Lake Institute

(Dick is the retired director of the Flathead Lake Biological Station)

Brad and Del Seely came to Whitefish in 1946 with their children John and Jane. So, why did they leave the comfortable home they had in Helena? Because they had negotiated the purchase of Glenwood Park summer resort on the shores of Whitefish Lake. Twenty-four split log cabins built during the early 30s had outhouses, ice boxes, wood stoves, screened porches, and no outside running water.

For the next quarter century Brad turned the camp into a modern facility while Del directed the weekly maid duties for the summer-only guests, washed all the laundry in a wringer washer, dried them on outside lines, ironed them on a mangle, and she kept track of the charges from the guests and the gas pump and pop sales. Jane and John skied in winter and spent hours each summer day in the lake, while also tending to chores assigned by their parents.

Glenwood Park flourished but in 1972, the Seelys decided to turn Glenwood into a private homeowners' association. Lots were platted and sold, and cabins were removed by a 1982 deadline. The family lived in a remodeled cabin which initially had no insulation, was heated by an oil stove, and where water pipes froze in the winter so water had to be carried from the lake. An outhouse was used and a root cellar provided refrigeration. The water for the house and cabins came from two lakeshore pump houses. In 1966, Brad built a lovely home on the lakeshore and it along with one original cabin remain today at 275 Glenwood Road. The City incorporated the property and installed city roads and water lines. In the 1970s the ownership of the property was transferred to daughter Jane and her husband Dick Solberg. We then transferred the ownership to our four children in 2009.

In 1987, both Jane and Dick retired and moved to Glenwood. The home, beach and the muchly remodeled cabin (including a sewer lift station) continue to be the central focus for family and guest activities and shenanigans. Jane quickly became an advocate of lake quality, serving for 13 years on Whitefish City/County Lakeshore Protection Committee, and Dick has served on the Science Advisory Committee for the Whitefish Lake Institute. The importance of Whitefish Lake water quality cannot be overstated. Life itself is immediately dependent on two factors: water and air. In various time dimensions ALL biological creatures die without both.

The degradation of water and air quality affects all living beings. Pollution is a constant enemy of quality. It is usually hidden, insidious and difficult to find and eliminate. It affects the economy, enjoyment of healthy lives, our basic culture and the future of yet to be born generations. By protecting Whitefish Lake, we protect our quality of life and that of our community.

Forestry Period (1981-2000)

A number of regulatory actions during the *Forestry Period* heightened protection and cultural awareness of water quality issues. The Flathead County phosphate ban occurred in 1983. Forestry Best Management Practices (BMP) became law in 1989. The Montana Streamside Management Zone (SMZ) Law took effect in 1991.

However, even with protections in place, there was a high amount of timber harvest activity in the watershed, second only to the 1930s. Even with BMP and SMZ protection tools in place, the Montana Department of Environmental Quality (DEQ) concluded in 2006 that reasonable land, soil, and water conservation are not always accomplished by using only these tools.

BMPs are land management practices that provide a degree of protection for water quality, but they may not be sufficient to achieve compliance with water quality standards or protect beneficial uses. Therefore, reasonable land, soil, and water conservation practices generally include BMPs, but additional measures may be required to achieve compliance with water quality standards and restore beneficial uses.

During this period there was also increased shoreline development and an ever increasing pressure by recreational users on the lake. The first comprehensive study of Whitefish Lake occurred in 1982-1983 by a master's student at the Flathead Lake Biological Station.

Protection Period (2001 - Current)

Beginning in the *Protection Period*, forest harvest activities slowed and nutrient concentration levels in streams decreased. Lake trout have become the dominant fish species in the lake. Native bull trout and westslope cutthroat trout populations also have stabilized but at much lower levels compared to their historic baseline.

Research, management, and regulatory measures to protect water quality ramped up in this period. A Habitat Conservation Plan (HCP) was completed for the lands of the Stillwater State Forest. HCPs effectively build upon SMZs and BMPs with additional layers of protection such as increased buffer zones and specific road building requirements.

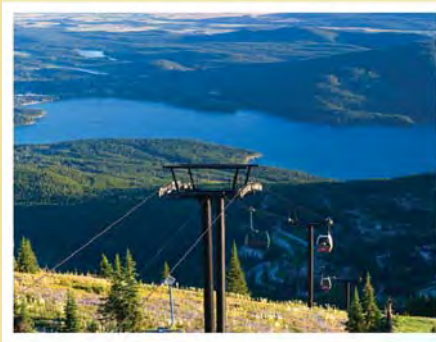
The Flathead Lake Biological Station returned to Whitefish Lake through the years to build upon their historic data set, and the Whitefish Lake Institute, founded in 2005, began long-term, baseline monitoring of the lake and all its perennial tributaries.

The City of Whitefish passed the Critical Areas Ordinance (2008) which was renamed the Whitefish Water Quality Protection Ordinance (2012). In 2018, the Whitefish Lake Watershed Project, a project between Montana Fish, Wildlife & Parks, Montana

Department of Natural Resources and Conservation, Weyerhaeuser, The Trust for Public Land, and the Bonneville Power Administration was nearing finalization to protect over 16,000 acres in the Swift Creek and Lazy Creek drainages through the placement of easements and by directly purchasing lands.

Recreation

In addition to providing drinking water, Whitefish Lake is a popular recreational lake, offering swimming beaches, picnic areas, and launch sites for both motorized and non-motorized boating, as well as winter sport activities such as ice fishing, skiing, snowshoeing and ice skating. City Beach is a popular gathering place with its peak use during summer months.



DAN GRAVES President & CEO, Whitefish Mountain Resort

I've always been drawn to water. This connection stems from growing up and living near the Pacific Ocean. The open expanse of a large body of water is alluring and relaxing to me. Whitefish Lake gives me the opportunity to reconnect to the ocean that played a special role in my youth.

I am fortunate to live five miles, a mere 15-minute drive, from Whitefish Lake. I pass its shores as I drive to work at Whitefish Mountain Resort. When I'm out on the mountain in the winter, summer and fall I can admire it from above, a view few resorts can offer. It's no surprise that our guests, like our community, find ways to enjoy their time on both the mountain and Whitefish Lake. The two simultaneously set us apart from other destinations while bringing us together to recreate and unwind with family and friends.

Just as long winters are best enjoyed by skiing the slopes of our resort, the long days of summer warrant spending time on the lake. Personally, I can't think of any better way to cool off on a hot day than to sit in a beach chair with my feet in the water and a beer in my hand. I love looking across the blue waters at the distant shoreline with the treed mountain slopes and hearing the lapping of the water on the sand.

Whether standing on our slopes overlooking the lake, or sitting in a boat looking up at the mountain both scenes define Whitefish's most attractive attributes as well as a sense of place. Whitefish Lake is why the first residents chose to settle here, it's the town's namesake, and it's the reason many of us live here.

As much as I am committed to the longevity and success of Whitefish Mountain Resort, I am equally compelled to support the future and sustainability of Whitefish Lake. It's been an attraction for decades, and we want to make sure that it remains that way.



CARLA BELSKI
Community Services Coordinator,
City of Whitefish

Swish. Swish. Swish. The sound of gliding through light powder is the only noise accompanying me across the vast white, open space besides the patter of my dog, Jute, running beside me. The ski across Whitefish Lake had become our daily ritual since moving to town. It was the winter of 1996-97, a very snowy winter for the Flathead Valley, and Whitefish Lake was prime for skiing.

The daily excursions twenty years ago across the frozen surface of Whitefish Lake was the beginning of a deep bond with this special place. Whether ice skating or skiing in the winter, kayaking and swimming in the summer, the lake has always been a favorite place to play with my family and reconnect with the outdoor world. That is what Whitefish Lake is for a lot of people – an amazing place to recreate.

Today I have created a new ritual with Whitefish Lake. Every morning in the summer, I jump on my bike and ride a half-dozen blocks to the oldest park in town,

Whitefish City Beach. The beach property was acquired in 1903 as part of the City's original plat. Located near the lake's outlet, the beach is one of the most popular public access points. As you can expect, the beach is a buzzing place in the summer, with large boats and family vans jockeying around a normally quiet neighborhood to find a place to park.

My visits to the beach these days are not for recreating, but for protecting. Armed with a flashlight, small mirror and a sharp eye, Beach Rangers provide boat inspections to prevent aquatic invasive species infestations in our lake. Aquatic invasive species can be non-native plants, animals or pathogens whose introduction causes economic or environmental harm, or harm to human health. Of special concern are aquatic invasive mussels, which were first documented in Montana in late 2016 east of the Continental Divide.

Hitchhiking in the nooks and crannies of a boat engine or hull, adult mussels can travel undetected to infest another lake. An even more elusive threat, is the larval stage of the mussel which can be transported from an infected waterway to a clean lake in bilge water or ballast tanks. To defend Whitefish Lake, my team of rangers work diligently, oftentimes crawling on their bellies, to inspect boats and ensure they are free of mussels and standing water.

What could a tiny mussel, the size of your pinky fingernail, possibly do to our large, pristine lake? These tiny mussels have proven to be detrimental ecologically, recreation-

ally and economically. Beaches littered with sharp shells, clogged water lines, and decreased tourism are all impacts that threaten our lake, town and livelihoods.

Even with the daily visits to the beach, the scenery never gets old as the light mixing with the sweeping views of water, mountains and sky never fails to impress. The sounds of motor boats in the summer on the lake are quite different than the muffled sounds of gliding through snow in the winter. But for many, the hours spent on the lake provide a solace and relief from busy, stressful lives. We can all do our part to protect Whitefish Lake from AIS and preserve Whitefish Lake's beauty, health and recreational opportunities that we all enjoy.



STELLA HOLT
Co-Owner, Great Northern Cycle & Ski

I was born and raised in Whitefish, moved away for college and quickly returned upon graduation to replant my roots in our beautiful valley. My partner, Willie Hobbs and I own and operate Great Northern Cycle &

Ski in downtown Whitefish and we live just one block back from Whitefish Lake. Living in Whitefish has shaped who I am through great appreciation for the outdoors and the communities that enjoy time in the mountains or on the trails.

I can be found on two wheels throughout the summer, either riding my mountain bike around Whitefish Lake via the Whitefish Trail or on my road bike heading out on East Lake Shore Drive or climbing up the Going-To-The-Sun road.

Regardless of whether I'm riding near the lake or in the opposite direction, my rides almost always finish at City Beach or Les Mason for a quick and refreshing swim or for my favorite view of the sunset on a July evening.

Recreation in and around Whitefish Lake is incredibly important to me for personal enjoyment but also for the visitors that stimulate my business. While I have the pleasure of enjoying our mountains and lakes year round, many of the people I see daily in my shop are only visiting our area for a short time and are always in awe of the beauty of this valley. For them, Whitefish Lake is central to recreation plans and in understanding our landscape and community.

It is so important for us to continue to learn about and in turn educate users of this incredible resource as we all depend on the open access to the clean water in close proximity to our small town and the activities that have drawn us to the area.

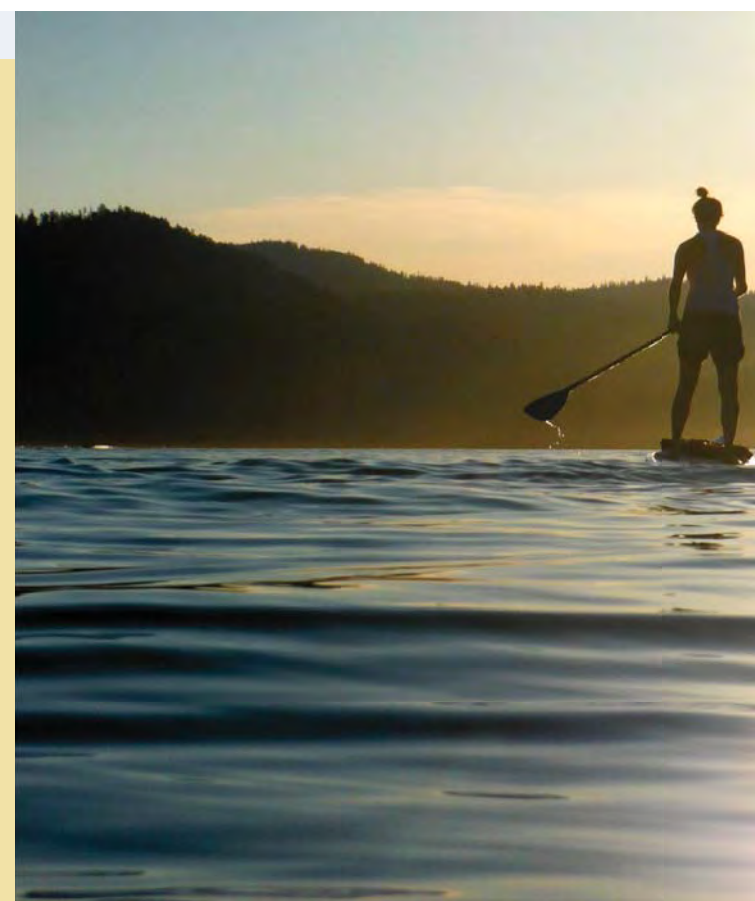


SONNY & KIM SCHIERL Co-Owners Paddlefish Sports

We have enjoyed Whitefish Lake since starting to vacation here in the late 90s. We moved to the area in 2006 and founded Paddlefish Sports in 2012. Loving lakes is a way of life for us, having grown up in central Wisconsin, an area full of lakes. Floating, swimming, fishing, paddling, just relaxing are all things we value the lake for personally, all year round. Professionally, we're happy and proud to be able to provide convenient, affordable paddleboard and kayak rentals to locals and tourists alike, enabling people to easily enjoy the lake.

The lake is a place to gather, to exercise, to have fun, and to create memories. Water itself is very nurturing, it soothes the spirit and stokes the soul! It's a beautiful place to begin or end your day.

There are many possible threats to our lake: AIS, railroad spills/accidents, home septic leaching, and over commercialization. I feel that it is better to be proactive in our care of the lake and its surrounding areas than to try and clean up after-the-fact and fix something which perhaps cannot ever be the same.



Paddleboarding. Photo courtesy Kim Schierl

Boating has a long and storied history on Whitefish Lake. As early as 1904 one of the first boat races was held, and on July 4th, 1907, the first powerboat race took place on the lake. The Whitefish Launch and Boat Club was organized in 1908, paving the way for the formation of the Whitefish Lake Boat Club in the 1930s. The 1934 Whitefish Lake Regatta was the premier boating event on the lake and the longest-running powerboat race in the United States before the event was anchored into the history books some six decades later.



TIM SALT
Owner, Edge Effect
Whitefish, Montana

My story may be different than most. I have not lived in Whitefish all my life and I do not live on the lake. My personal history with the lake and with boating for that matter, is rather recent. My wife, Deb and I took up residence in Whitefish in 2002. The lake was certainly one of the many amenities in the area that convinced us that Whitefish was the place to retire and spend the rest of our lives. But, like many in the community who do not live on the lake, we were limited in our ability to take advantage of this outstanding resource. In 2010 we purchased our first classic wood boat, a 1955 Chris Craft Continental Hardtop, to enjoy Whitefish Lake.

Whitefish Lake has a long and rich boating history. Turn of the century settlers used boats primarily for utilitarian purposes like fishing and transportation. Early passenger boats took patrons to dances, picnics and other celebrations at the pavilions around the lake. The first power boat race took place on Independence Day in 1907. The Whitefish Launch and Boat Club was organized in

1908 and the Whitefish Lake Boat Club in the mid-1930s. The Whitefish Lake Regatta, the longest running power boat race in the United States, began in 1934 and ran for 60 years. During the post war years, recreational uses of the lake took off. Hutchuck Boat Works began building boats in 1946 in what is now the Downtowner Hotel. Over their decade of operation, it is estimated that they produced around 1000 boats for distribution across the Pacific Northwest.

In 2013, the Big Sky Chapter of the Antique and Classic Boat Society (ACBS) held its first classic wood boat show on Whitefish Lake. It seemed a fitting way to honor the long history of wood boats on Whitefish Lake. The event, which marks the unofficial beginning of summer in Whitefish, has evolved into the premier classic boat event of the Pacific Northwest. It is a signature event on the Whitefish summer calendar, attracting award winning boats from across the Northwest and Canada and drawing crowds of over 1000 spectators. The draw; a beautiful setting, a first class venue at the Lodge at Whitefish Lake, pure clear water and good old fashioned Whitefish hospitality.

The future of the lake, and therefore, the event is in peril. Aquatic invasive species, especially zebra mussels, pose a tremendous threat to our lake and to Whitefish Woody Weekend. AIS endanger the pristine waters that are classic boat habitat. A mussel infestation in a 60-80 year old motor would destroy the engine and greatly devalue the classic boat. The fear of encountering invasive species would deter boat owners from outside the valley from participating. The classic boat community is committed to protecting

Whitefish Lake and strongly supports all efforts to keep our lake free of invasive species. Hopefully, with proper vigilance and continued leadership of the Whitefish Lake Institute and the City of Whitefish, we can maintain an AIS free lake for decades to come.



KOEL ABELL
Director, Project Engineering VIZN
Energy, Inc.

Thanks to my parents, my brother and I had a childhood second to none. Having both grown up on the shores of Whitefish Lake themselves, they understood the benefits of raising a family in Whitefish.

Our early years were spent in Monks Bay, and then during our school years we lived at the mouth of the Whitefish River. Starting at an early age, my brother and I took full advantage of our surroundings. We did everything from swim, canoe, sail, skate, fish, ski and even raced boats at over 100 mph on the lake.

Of the great times spent on the lake, there's no question my most important moment

was being married on it. My wife and I were married on a boat in Mackinaw Bay; a place with special meaning as it was just a stone's throw away from my grandfather's childhood cabin on Mackinaw Point.

My earliest memories of swimming in Monks Bay were with my father and uncle. My brother and I would follow them from rock to rock all the way to the sand bar. Now, due to suspended sedimentation from the abundance of large boats planning in the shallow bay, one could swim directly over a rock and never see it. I would like to see Monks Bay be a no-wake zone for all boats over 15 hp.

Bladder boats are also wreaking havoc with shorelines and small boats, not to mention their ability to house AIS. A solution would be to require a maximum planing distance of no more than 100 yds. for all boats.

No one in my family has previously witnessed such low water levels of the lake (see attached picture). I've heard the evaporation excuse, and though the climate has certainly changed, I wonder given to the complexity and variability of the calculation, if the cause could be increased water use; such as irrigating two golf courses and an ever-growing city population. A simple evaporation monitoring station would help investigate this question.

Noise pollution from boats with speakers and live bands or DJ's at beach side events no longer allow for peaceful activities on the

lake or picnics along the shore. By enforcing the decibel law, we could find a better balance for those seeking solace along the lake.

Finally, one of the main reasons Montana Code 75-7-208 was established was to ensure the natural and scenic values of lakes and lakeshores. It is my opinion that the local governing bodies are failing in this respect. I'm not aware of any shoreline gravel application in recent years being denied by anyone other than advisory boards. The sand initially deposited on City Beach has transformed down-current beaches from natural gravel to completely sand-covered. Other private beaches are altering their natural shorelines from rock or silt to unnatural gravel. It is important as a community that we instill value in sustaining the lake's natural and diverse shorelines and work to uphold this code.

Though my wife and I have no children, I'm nonetheless concerned that the wondrous opportunities our precious and pristine lake granted my family, will not be here for other families and future generations. I'd hate to think what the current state and health of our lake would be like today were it not for two local groups. The first was a handful of local lakeshore owners who came together in the mid-1970's and the result was a new Montana law that allowed for the creation of our local Whitefish Lakeshore Regulations. The second of course is the Whitefish Lake Institute.



Lazy Bay, Whitefish Lake. Photo courtesy gravityshots.com

Land Ownership

Land ownership in the Whitefish Lake Watershed includes public and private lands and a variety of protected lands. Over 50 percent of the land ownership is public including more than 40,000 acres of Montana State School Trust lands. Most of the State Trust land is in the northern half of the watershed, with some parcels reaching down to the north end of Whitefish Lake. Over 15,000 acres of United States Forest Service (USFS) land lies in the north and along the eastern boundary, particularly to the northeast of Whitefish Lake, and at higher elevations.

The public land includes two state parks managed by Montana Fish Wildlife & Parks—Les Mason on the east shore and Whitefish Lake State Park on the lower west shore. Flathead County has two small parks on Whitefish Lake. One is an unimproved boat launch with parking off Del Rey Road at the north end of the lake, the other is a walk-in site off Birch Point Drive on the southwest end of Whitefish Lake. Large private lands include acreage owned by Weyerhaeuser and by F.H. Stoltze Land and Lumber. The remaining acreage is privately owned and includes urban, suburban, and rural lands.



FRANCINE ROSTON
**Rabbi, Glacier Jewish Community/
B'nai Shalom**

**Whitefish Lake—a spiritual center for the
Jewish community**

A Jewish community doesn't require much. We don't even need a building. The Glacier Jewish Community/B'nai Shalom is the Jewish congregation in the Flathead Valley meeting at various locations throughout the area. According to the ancient rabbis, though, a Jew is not supposed to move to a community that does not have a "mikvah," or a place in which one can perform ritual immersions.

In Jewish tradition water is a source of sanctity. Jewish people immerse in "mayim hayyim" or "living waters" for spiritual cleansing. Whitefish Lake fulfills the requirements of a mikvah. It is a body of water coming from a natural spring, hence "living water". In many ways, Whitefish Lake has become a spiritual center for our Jewish community.

When I first moved to the area, I was approached by a few people who wanted to

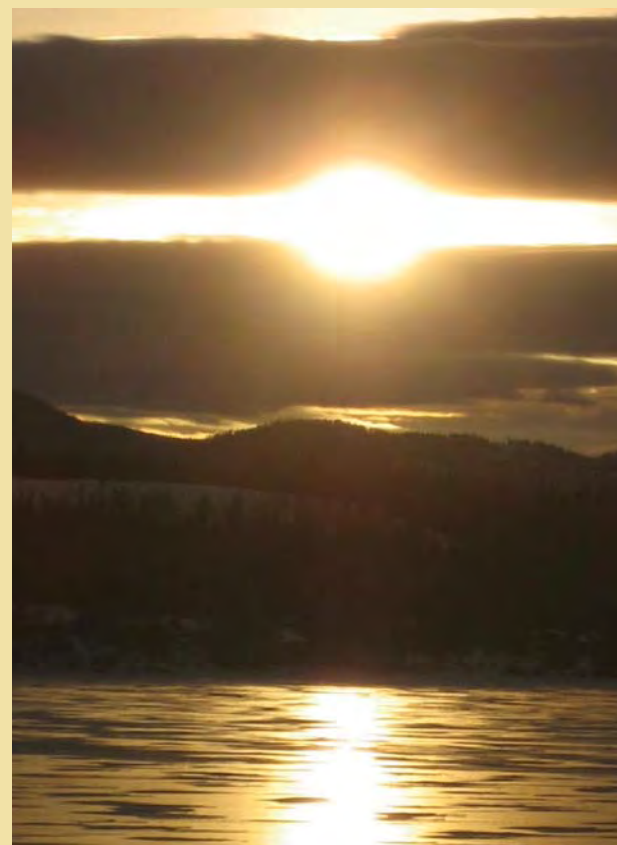
convert to Judaism. After over a year of Jewish studies and observance, three adults were ready for conversion. We scheduled a ceremony for late August, invited local rabbis from Whitefish and Missoula to form a rabbinic court, and we gathered at the lake. After fully immersing in Whitefish Lake, so that the water covers every part of a person's naked body, and uttering blessings, a person converts to Judaism.

There was some trepidation in our party that day in the middle of the lake. The water was a bit chilly! We sought out a private spot on the lake for our religious skinny-dippers. As I witnessed my students and friends immersing in Whitefish Lake, I was overwhelmed with gratitude for the sacred gift of this clean, pure, natural resource. With the assistance of the lake and the blessings of our Jewish community, we were able to guide these three souls to the next stage of their spiritual lives.

The most popular event on our calendar is the annual Sabbath gathering at Whitefish Lake. We grill kosher hotdogs. Everyone brings a dish to share; and we gather together to sing Hebrew blessings over wine and bread to start the Jewish Sabbath at our "ShabbaBQ". After the winter of 2016/17 and neo-Nazi cyberattacks on our community, many Jews were afraid to gather in public. Nonetheless, in the summer of 2017, fifty members of the Jewish community came together in the shelter of a gazebo, on the shores of Whitefish Lake. As we stood at the shore of the lake and watched the exquisite sunset paint orange and pink streaks across

the sky, we felt safe. We felt at home and at peace.

The last spiritual gift the Lake gives us is the opportunity to immerse at any time with the intention of spiritually cleansing our souls. A few of us gathered at the Jewish New Year. We went out to a private corner of the lake, talked about our past year and the emotional dross we hoped to shed. We shared our hopes and dreams for the new Jewish year. And then we jumped in the lake. Covered in blessings. And not much else.



Whitefish Lake sunset. Photo courtesy Whitefish Lake Institute

WATERSHED STEWARDSHIP

A number of diverse stewardship efforts are reversing a trend of significant land fragmentation and are helping to preserve the natural landscape and keep open vital connections to seasonal ranges for wildlife throughout Northwest Montana. The health of the Whitefish Lake Watershed depends on an active and engaged community that balances growth with a requisite level of natural resource protection. Whitefish Lake is the end-point to its watershed and serves as a barometer of our actions and land management decisions. Our history with Whitefish Lake provides many lessons of activities not worth repeating. At the same time, there have been a number of community leaders, groups, and management agencies focused on protecting the lake. Now is the time for a renewed stewardship ethic to reaffirm the value of the lake to us all.



SUE FLETCHER
Retired Geologist; Whitefish Lake
Institute Board Member

We knew we wanted logs. The dream I had had since a young girl was to someday live in a log cabin. In 1991, we built our palace on the north end of Whitefish Lake. The kids were young then and they named our cabin “Peaceful Palace.” The name was fitting. It was modest but spectacular. The setting made it so. The warmth of the logs, the hand chosen rocks for the fireplace and the beautiful reflected light off of the lake made it “Grand” indeed.

The lake was sacred to us. We did not believe in motorboats. Our flotilla was made up of two kayaks, a beat-up red canoe and my rowing scull. Ahhh, let me tell you about my precious scull. It was sixteen feet of perfect harmony. When I was in sync with my body and breath I felt as if I were flying. I would wake up early before the motor boats and “fly” to the north end of the lake to Lazy Bay. I would then rest my wings on the out-rigging and drop into the morning stillness.

I have experienced moments of profound joy in my life but few compare to those mornings where I could not discern separation from my body, lake or sky. We were one.

So the lake is part of me even though I no longer live in the “Peaceful Palace.” The lake, the creatures, the morning light will rest in my soul forever.

I am concerned about the health of the lake. A common companion for me on those quiet mornings were the osprey and bald eagles. I would watch in awe their fishing skills and aerial acrobatics. The eagles remain but the

ospreys are gone. So are the aquatic “flower beds” of delicate water lilies in Lazy Bay. I believe that we must all be stewards of this lake. We must temper our need for cheap thrills. Churning up the water and thereby destroying the flora and fauna is not acceptable to me. Boom boxes blare insults to our ears and scream to the lake “I don’t care about you.” It breaks my heart. Our precious lake will only survive if we can return to a sense of reverence for it.

Stewardship Partners Past and Present

Throughout the history of Whitefish, different groups with various missions have formed to address water quality issues. Some organizations were more successful than others, but the underlying theme is that there have always been citizens actively interested in protecting the aquatic resources around Whitefish. Examples of such groups and their formation dates include the Whitefish Businessmen in 1907, the Whitefish Launch & Boat Club in 1908, Whitefish Rod & Gun Club in 1910, Whitefish Outdoors Unlimited in 1967, Whitefish Basin Project in 1981, Whitefish Lake Advisory Group in 1998, Swift Creek Coalition in 1999, WLI in 2005, and Whitefish Water Quality Advisory Committee in 2007.

Beyond WLI, there remain a number of groups active in protecting water quality. They include the Whitefish Lakeshore Protection Committee which formed as a result of Senate Bill 175 in 1975 (at the same time as the Natural Streambed and Land Preservation Act of 1975). The new law’s purpose was two-fold: (1) To conserve and protect Montana’s natural lakes and their scenic and recreational values; and (2) To provide local

governing bodies with adequate statutory power to protect lake areas. With minor modifications, those regulations were later adopted by the County for all Flathead County lakes. The Whitefish County Water District formed in 1982 by public vote of a 4-1 margin in favor of creating a district to protect local water quality.

The Whitefish School District Project FREEFLOW

(Flathead River Educational Effort for Focused Learning in Our Watershed) formed in 1993 has a mission to provide an opportunity for students to collect scientific data in the area of surface and ground water quality; and to offer an avenue for volunteer students to go beyond the science classroom and obtain field science skills on natural resource issues.

The Friends of Blanchard Lake formed in 1999 to protect and preserve water quality and natural resources, including wildlife habitat and fisheries, within that geographic area appurtenant to Blanchard Lake, its water sources and drainages. The Haskill Basin Watershed Council formed in 2000 to maintain and enhance the chemical, biological and physical integrity of Haskill Creek by a voluntary and cooperative effort.

Protected Lands

Several ecologically important areas of land have been protected through a variety of means in and around the Whitefish Lake Watershed. Included in these lands are wetlands, state trust lands, and conservation easements. Conservation easements are a negotiated agreement between a landowner and a land trust that protects private land in



Photo courtesy Whitefish H.S. FREEFLOW

Whitefish Lake is a beacon.
A basin of memories,
Nestled in the hills,
Guarded by the mountains,
Loved by our people.

We flock to it,
We rely on it.
We cherish it,
And it sustains us.

Whitefish Lake is
The heart of our town ...
Ripples on the turquoise surface,
Emerald droplets on hot rocks,
Long days in the sun, and
Cool evening dips.

It is
Warmth,
Unity,
Diversity,
Peace,
Comfort,
Solitude,
Serenity.

To us, Whitefish Lake is an example of a remaining vital resource.

Whitefish High School FREEFLOW

perpetuity while allowing the landowner to continue owning and managing their property. If the land is in production, the owner may continue to produce crops, hay, livestock, timber, and other commodities. Easements vary based on the landowner's intent, but they typically restrict certain activities such as subdivision for residential or commercial activities, surface mining, and toxic waste dumping. The key organizations managing conservation easements in and around the Whitefish Lake area are Montana Land Reliance, Montana Nature Conservancy, Flathead Land Trust, and the Trust for Public Land.

Averill's Viking Creek Wetland Preserve
WLI owns and manages 28.82 acres of important water-cleansing wetlands and wildlife habitat, protecting it from development and enhancing Whitefish's outdoor amenities. The Preserve was gifted to WLI by the Dan Averill family in 2009 as part of the Viking Creek Development proposal. The primary function of this wetland is water quality buffering and wildlife habitat. Since Viking Creek—one of Whitefish Lake's six tributaries—and the groundwater of the area drain directly into the lake, water quality buffering is vitally important. This publicly accessible Preserve is an excellent example of how citizens and developers can work together to protect the health of the watershed, to provide open space in the wildland/urban interface, and to allow for economic growth in the community.

Living Wetlands Interpretive Trail
WLI opened the *Living Wetlands Interpretive Nature Trail* in the Averill's Viking Creek



DAVID NOFTSINGER
Vice President, Lead Design
Forestation

I grew up in northeast Ohio where green, rolling deciduous forests surrounded sprawling cities. Steel plants and manufacturing factories with their giant, coughing smokestacks dotted the skyline in so many towns between Youngstown and Cleveland. The Cuyahoga River and its tributaries slowly wind their way through this landscape and these communities until they feed Lake Erie.

The Cuyahoga River—polluted by industrial waste—caught fire numerous times over the past century until the fire of 1969 helped to spur environmental and water quality initiatives across the country as well as the creation of the Environmental Protection Agency. Water quality has improved and aquatic life has returned, yet challenges remain.

Though my relatives and heart are still in Ohio, Whitefish, Montana has been my home for the past 15 years. My wife Michelle, our two children, Xochyl and Solas, and I reside a few blocks from downtown.

Michelle and I had initially intended to spend a winter here chasing fresh snowfalls on Big Mountain, but quickly fell in love—as so many do—with the vast, forested landscape, towering peaks, and vibrant community. It was also the gift of fresh water—the many lakes, rivers, and streams and access to them—that simply felt healthy for the body and for the mind. It was hard to believe that flowing right through our small town were some of the first waters west of the Continental Divide - from the snow-covered mountain tops to our cherished Whitefish Lake.

Whitefish Lake has been a great source of fun and recreation for our family and friends over the years. We have spent many great days, swimming, paddle boarding, kayaking, and catching stunning sunsets over the lake.

As I love the water, I also love the land. For me, emotions can range from intrigue to awe while moving through our forests - the plant and animal communities, the silence, the stillness.

Having worked on both the Whitefish Trail and the Living Wetlands Interpretive Nature Trail, I have had the great opportunity to transect large portions of the watershed and its many drainages that surround and feed Whitefish Lake - the high country, the low country, Lazy Creek, Swift Creek, King, Bear, and Taylor Creeks, the Beaver Lakes complex, seeps in hillsides and unexpected dimples in the landscape that act as watering holes and support diversity in the adjacent plant communities.

There are also times when looking out across the valley from a high perch on a hillside where one can see the interaction of the land, the lake, and the bustling communities below. It can sometimes seem like human development is out-pacing preservation.

Intact forest systems that maintain their integrity in the face of development help to filter and purify the water that makes its way to Whitefish Lake and beyond. As Whitefish Lake supports so many natural communities, our community must support Whitefish Lake and the lands that surround it.

So often our acts seem small, but they are cumulative and connected - the many drops that make up the lake that we love.

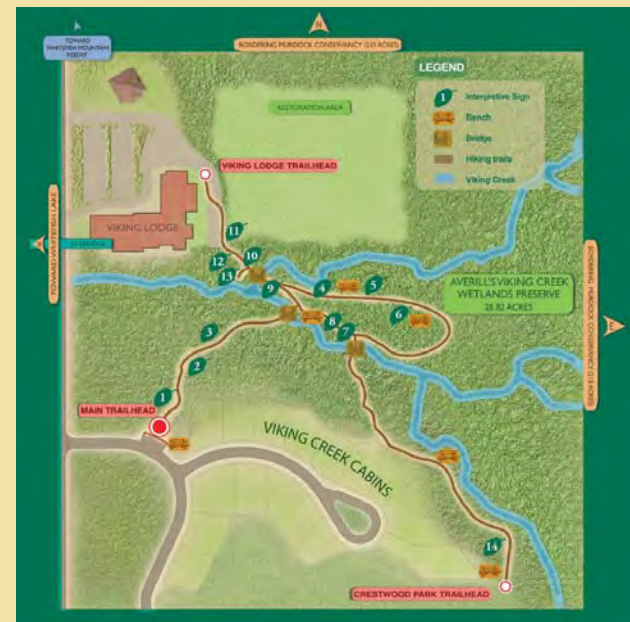


Figure 9. Living Wetlands Interpretive Nature Trail. Courtesy Whitefish Lake Institute

Wetland Preserve in 2013. Our goal in developing this trail and making it available to the public, is to share the history, science, and beauty of the wetland, and to provide a glimpse into the lives of the wildlife with which we share this habitat. The trail offers the closest outdoor natural experience for Whitefish citizens and visitors, extends natural resource education offerings, and enables connectivity to the City of Whitefish bike and pedestrian Path, Crestwood Park, The Lodge at Whitefish Lake, and the Viking Creek subdivision.

Battin Nature Conservancy

The 215-acre Battin Nature Conservancy Easement borders the Whitefish Lake Institute's Preserve on its north and east sides. The easement and the wetland provide a large contiguous area that protects water quality and provides habitat for aquatic, terrestrial and avian wildlife in the heart of Whitefish.



Kellor Sawtelle on Wetland Trail. Photo courtesy Whitefish Lake Institute



SHARLOT BATTIN Owner, Montana Leatherworks and Great Northern Boot; Owner, Battin Nature Conservancy Easement

I am a second generation Whitefish resident. My grandparents homesteaded in Eastern Montana and came here to work on the Great Northern. A lot of the old places and events dim or disappear with age and 71+ years of mileage, but I do remember that the area where Crestwood was built belonged to Maggie Murdock; yes, of the Murdock dairy where Iron Horse is now. We put up hay on the acres that weren't total swamp land. 'Viking Creek' was in a different channel and it didn't have that name. But it was, and is, all swamp on the east side of Wisconsin to Reservoir Road. I believe it was called Creek 1 or 2 on the old maps. But as 'it' runs through my property directly from the Whitefish Reservoir, we knew it as Reservoir 'run off'. It is controlled by some valve or other behind the fence up there. It ran under Wisconsin Ave as well as UNDER what became the A frame

called Viking Lodge. Many times the beavers dammed it up and it ran over the road.

My family owned the land north of the Viking Lodge parking lot and Reservoir Road was dirt. The whole property was fenced. My Grandparents and Bill Murdock ran about 60 head of Hereford cattle together and we would herd them with the horses from the Murdock place (now Iron Horse) over to our property. Yes, ON Wisconsin and Reservoir and all over the place on the way. The cattle were free to wander most of the property according to haying season. There was a huge hay barn in the middle of the field that is bordered by Crestwood on the west and now Hidden Meadow on the south, only there were no neighbors back then. We used work horses as well as a collection of tractors to do the farming.

I had friends on Monk's Bay and other parts of the lake. We spent most of every summer day waterskiing and wading around in the mud and weeds at the east end of Monk's bay or diving off whatever structure was available in the deeper parts of the lake. There were fires on the beach, picnics, peace, and quiet. The biggest boats were Hinderman's and Landau's Chris Craft inboards—no jet skis. For the most part it was quiet, safe, and heavenly. City Beach and Bay Point were also totally accessible to all us crazy kids. I spent the first few years of my life a block from City Beach.

Thirty years ago my Grandmother put an easement on most of our property with The Nature Conservancy, which comes with a lot of restrictions to which we are required to

adhere. With ‘progress’ and much ‘development’ the character of the area has changed considerably. It is becoming increasingly difficult to maintain the property and natural water movement. The unobstructed views, never to be developed have generated higher real estate values, but few people in the area seem to be concerned about the course or quality of the water flowing always into Whitefish Lake.

Haskill Creek Watershed

The City of Whitefish, Montana Fish, Wildlife & Parks, F.H. Stoltze Land and Lumber Co., and the Trust for Public Land worked for almost five years on a conservation easement project that permanently protects 3,020 acres of land in the Haskill Creek Watershed. This deal, completed in 2016, was one of the most complex land swaps in the state’s history and protects 75% of the City of Whitefish’s drinking water supply. The Stoltze family retains the ownership of the land and the management of their timberlands, while providing permanent recreational access and drinking water for the City of Whitefish. In order to complete the purchase of the Haskill easement, Whitefish City voters overwhelmingly approved a 1 percentage point resort tax increase resulting in 7.7 million dollars in local funding.

Swift Creek Watershed

The Trust for Public Land and Montana Fish, Wildlife and Parks have also protected significant Weyerhaeuser timber lands north of Whitefish Lake in the Lazy and Swift Creek Watersheds. The first of three phases protected more than 7,000 acres of crucial Whitefish Lake Watershed from future development. With funds from private partners and the

state and federal government, the Trust for Public Land bought the land from Weyerhaeuser and then Montana Fish, Wildlife and Parks purchased a \$15.5 million conservation easement on the land. The Department of Natural Resources and Conservation then purchased the land, with its easement, from the Trust for Public Land to add to the Stillwater State Forest. Two additional conservation projects in the area are still in progress—3,000-acres of the Lazy Creek watershed and 3,000-acres of Swift Creek Watershed.

Citizen Scientists

Citizen scientists also play an important role in monitoring and protecting water quality. Citizen science is research or monitoring that is conducted in part or in whole by nonprofessional scientists. It was born of the concepts that science should be responsive to citizens’ needs and concerns, that citizens were capable of producing reliable scientific information, and that citizen volunteers could contribute much needed efforts to the body of scientific knowledge.

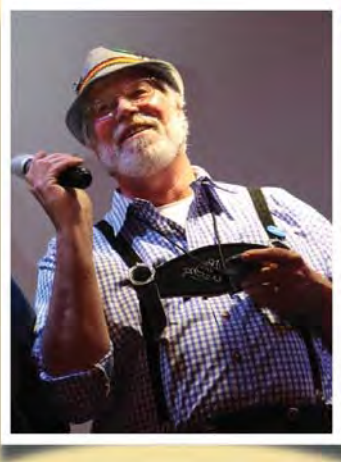
Northwest Montana Lakes Volunteer Monitoring Network

The Northwest Montana Lakes Volunteer Monitoring Network (NWMTLVMN) is a partnership between Montana Fish, Wildlife & Parks and the Whitefish Lake Institute (www.nwmtlvmn.org). The program mission is to recruit and train citizen scientist volunteers to monitor water quality, identify and report AIS and promote watershed stewardship in Northwest Montana (Flathead, Lake, Lincoln, and Missoula counties). Volunteers are generally the first responders to a water

quality issue or an AIS sighting. Through the work of the volunteers in the program, lake data is collected and an annual report is prepared detailing the health and status of these lakes. To date there are over 40 volunteers monitoring more than 50 sites on 40 lakes.



NWMTLVMN Volunteer Linda Sawtelle. Photo courtesy Whitefish Lake Institute



KEVIN GARTLAND
President, Whitefish Chamber of
Commerce

At the Whitefish Chamber of Commerce, we brag on our community as being one of the premier places to “live, work and play” in the Northern Rockies ... if not the country! And there’s little doubt that Whitefish Lake—a clean, healthy, peaceful and accessible Whitefish Lake—is one of the things that makes this so.

Whether we experience the lake from the back porch of our own home or the dockside bar at The Lodge; from the deck of a boat, the edge of a secluded bay or the jam-packed City Beach shoreline on the Fourth of July, Whitefish Lake plays an important part in who we are—and what we stand for—as a community. It’s a critical part of where we live and why we’re here, no matter whether you live on the lake or—like my wife and I—in a downtown neighborhood a mile away.

The lake is a tremendous source of pride for our community ... it’s something we all love to “show off” when friends and family come to visit, and it’s one of the things that local employers tout when trying to attract talented workers. In fact, it’s the first place my official “tour guide” took me nine years ago when I was thinking about taking the Chamber job ... looking back, that was a pretty slick (and successful) tactic!

Our community also feels a tremendous sense of “ownership” in Whitefish Lake, and a shared responsibility to preserve it in as clean, healthy and natural a state as we possibly can. The threats posed by leachate from

the aging private septic systems which encircle the lake are serious, as are those posed by aquatic invasive species such as zebra and quagga mussels.

Whitefish Lake is a critical component of our community’s recreation-based economy, it’s a primary source of drinking water for the City of Whitefish, and it supports a complex web of wildlife ... on, in and off the water.

It’s up to us—the folks who live, work and play here—to protect this valuable resource, and pass it down to future generations in as good—or better—a condition as we found it. Because that’s the Whitefish Way.



City Beach Dock. Photo courtesy Lisa Gunderson

CURRENT & FUTURE CONCERNS

Data shows that Whitefish Lake is nearing a tipping point where, once lost, water quality will be hard—if not impossible—to restore. Concerns for the lake include biological, physical, and chemical issues. While we have little control over some concerns, there are others for which we have great governance. The vision we provide in responding to the water quality issues we face today will define the legacy we leave for future generations.



RYAN RICHARDSON Fluvial Geomorphologist, River Design Group

I live 4.5 miles downstream of the outlet from Whitefish Lake. My connection to Whitefish Lake is a mixture of professional and recreational. I am a fisherman and kayaker turned scientist who works in Whitefish. I love paddling on the lake in my kayak and swimming with my dog at Les Mason State Park. In addition to these activities, I enjoy thinking about a time when the lake was being carved out by glaciers that would have

filled the entire valley bottom. It makes me feel like this whole valley was sculpted by nature for our enjoyment.

Whitefish Lake is important to me because it represents the clean and healthy ecosystem in which I have the privilege to live, work, and play. I am originally from North Carolina where we do not have natural lakes—glaciers never made it that far south—but we have dams that create reservoirs. As a kid I grew up swimming and paddling on these reservoirs and saw first-hand the impacts that humans can have on large water bodies. Fish with too high levels of mercury to eat, algal blooms that burn skin of swimmers, trash and industrial discharge causing horrible smells to surrounding communities, and oil spills from pipelines — these were the headlines I grew up with in the southeast. Whitefish Lake is to me the polar opposite of where I came from where people don't value clean water the way our community does.

Whitefish Lake serves as a primary drinking water source for our city. Our breweries, distilleries, golf courses, backyard gardens/farms, and restaurants all rely on our lake for continued economic growth. Even if you live outside of the city limits and have your own water sources, you still enjoy the many businesses in our community that depend on ample clean water in order to provide good jobs. These businesses are directly impacted from tourists visiting our community to see and interact with the lake and its watershed. From motor boating to stand-up-paddle board yoga, everyone loves to interact with Whitefish Lake. For those of us who live in Whitefish City limits, everything from your morning coffee to your post mountain bike

ride shower depend on clean water from Whitefish Lake.

There are many threats to Whitefish Lake but none that we cannot as a community work to minimize the impact. On a local level, aquatic invasive species, including zebra and quagga mussels, are the greatest short-term threat to our lake. The outcome of an infestation of these to Whitefish Lake would cause significant impacts to recreation, the lake's ecology, and potentially eliminate the ability of our city to use the lake as a municipal water supply. As a geologist, I tend to think a little longer term than most, and despite the threat from AIS, I am most worried about the integrity of our lake's pristine nature from continued residential development and the impacts from climate change. Both of these issues will take enormous effort and will continue for generations into the future.

We are so lucky to have such an amazing water resource in town, why squander it through poor management and pollution. In order to keep our lake healthy, it is important to think about the whole watershed. All of the water that is in Whitefish Lake has traveled as surface water from creeks that feed the lake. The health of these creeks will determine the health of the lake. You can't maintain a healthy Whitefish Lake without healthy creeks, wetlands, and forests in the watershed.

When I moved to Whitefish, after the 14-hour solo drive, the first thing I did once I got to town was drove to the lake, got out and just sat in the sunlight and enjoyed the stillness. After a long journey, I finally felt like I had found a place I could call home.



Photo courtesy The Daily Inter Lake

ADELE AND JEFF SCHOLL Co-Owners, Gravityshots

I have lived and worked in Whitefish for 24 years. Whitefish Lake has been an integral part of my recreation and work, although I do not live on the lake. For over 18 years, GravityShots has specialized in aerial photography focusing on real estate. Through the years, we have photographed many of the properties on Whitefish Lake.

In my mind, Whitefish Lake is one of the central recreation areas for the community. Due to its location in town, it is easy to hit the lake after work for a paddle, float or walk. Looking down on the lake from the ski hill is another added connection to the lake. All winter you can keep an eye on the lake, as it comes in and out of clouds, starts to freeze and thaw, while you navigate your route down the ski hill.

The community gains easy access to the crystal clear waters of Whitefish Lake, perfect for a boat ride, skipping a rock, or just an easy way to relieve the stress of the work week.

Threats to the lake include over use, over development, and contamination of the water. Protection of the watershed is critical for the community. Not only does it affect our quality of life, it also affects our drinking water, and our tourist season.

People travel from all over the world to see and experience the clear mountain lakes with which we are lucky to surround ourselves.

Whitefish Lake's connection to the community dates back to early settlement of Whitefish and continues to affect the current day community. Through the years, we have seen the community and development grow around the lake, and Whitefish Lake Institute continues to study and help preserve the natural waters.

Biological

Aquatic Invasive Species (AIS)

In 2016, zebra mussels were found in Montana waters east of the Continental Divide. The rapid spread of these mussels in U.S. water bodies shows how profoundly AIS can alter the environment. Human health, ecosystems, recreation, industry, tourism, and the economy are all impacted by the presence of zebra mussels. Watercraft inspections aid in intercepting vessels and equipment that have the potential to spread AIS and allow for decontamination, if necessary, before launching into Whitefish Lake.

Also of concern in the Whitefish Lake Watershed are those AIS which have been found in the Flathead Watershed (Eurasian water-milfoil, curly leaf pondweed, flowering rush, yellow flag iris, and fragrant water lily).

Our Lake Our Future: Whitefish Lake Aquatic Invasive Species Management Program

Since 2013, the City of Whitefish has supported an AIS Management Program as recommended by WLI. The purpose of the program is to prevent the transfer of AIS to local waterbodies through various mechanisms, including; early detection and monitoring, watercraft inspections, and public education. Over time, this program has been successful in preventing the transfer of AIS to local waterbodies while building a stronger coalition of partners to prevent AIS from affecting the ecological integrity of Whitefish Lake, the municipal drinking water supply, and our local economy.



The *Our Lake Our Future: Whitefish Lake Aquatic Invasive Species Management Program* is a partnership between WLI, the City of Whitefish and Montana State Parks. It includes a continuation of an early detection and monitoring effort that has been in place since 2013. It also incorporates a robust watercraft inspection capability at both Whitefish City Beach and Whitefish Lake State Park, a decontamination station for high risk and fouled watercraft, and an online self-certification process for non-motorized, hand-launched watercraft, early morning anglers, and during the off-season.



AIS Decontamination Station. Photo courtesy Whitefish Lake Institute



AIS Inspections. Photo courtesy Nicky Ouellet



Boat Inspection. Photo courtesy Flathead Beacon



Whitefish Community Foundation Major Grant. Photo courtesy Heidi Desch

The program has garnered support from organizations at the state level: the Department of Natural Resources & Conservation; Montana Fish, Wildlife & Parks, and Montana State Parks; the community level: Flathead Chapter of Trout Unlimited, Flathead Conservation District, Whitefish Community Foundation, Whitefish County Water District, and local businesses: Don “K,” The Lodge at Whitefish Lake, Whitefish Marine & Powersports; and WLI members.

Beaver Lake Story

It is rare to hear of an Aquatic Invasive Species eradication “success story,” but the Whitefish Lake Watershed has one of them. In October 2011, Eurasian Watermilfoil



Beaver Lake curtain. Photo courtesy Whitefish Lake Institute

(EWM) was discovered by the Montana Department of Natural Resources and Conservation near the boat ramp on Beaver Lake near Whitefish. Beaver Lake is hydrologically connected to Whitefish Lake and there are numerous methods for the plant to be spread from Beaver Lake to Whitefish Lake. An AIS response team—of which WLI was a member—responded to the discovery for further investigation. Bottom barriers were placed over the identified patch and a control/eradication plan was developed by a multiple agency workgroup in which the City of Whitefish and WLI participated. Since 2012, WLI and the City of Whitefish have taken the lead in addressing the EWM issue as part of the Whitefish AIS Management

Motor-Encrusted Zebra mussels. Photo courtesy U.S. Fish & Wildlife Service

Eurasian Watermilfoil. Photo courtesy U.S. Fish & Wildlife Service

Curly Leaf Pondweed. Photo courtesy MTWeed.org

Fragrant WaterLily. Photo courtesy WA.org

Yellow Flag Iris. Photo courtesy Invasive Species Council, BC

Flowering Rush. Photo courtesy KCW.org



Plan. In 2012, 23.5 pounds of EWM was removed through a suction dredging effort and by 2017, 2 plants were removed. This atypical AIS success story is the result of very early detection coupled with rapid and aggressive eradication techniques. Because of the real threat to Whitefish Lake and the watershed, suction dredging will continue indefinitely until there is confidence that the EWM has been eradicated.



JOHN MUHLFELD
President, River Design Group;
Mayor of Whitefish; Whitefish Lake
Institute Board Member

Growing up on the Connecticut coast, my father would get off work early on Fridays and pack up the family station wagon for our weekend getaways to Upstate New York. Spending our summers on Caroga Lake in the Adirondack State Park were perhaps my fondest childhood years. I would explore the woods with my brothers, play badminton in the front yard, and swim, sail and snorkel the

pristine waters of Caroga Lake. We would end our long days with my mom's cooking celebrating our sense of place with friends and family.

My brothers and I, captained by my father in the early hours of the morning, would often row across the lake fishing for small and large mouth bass. We would dive for freshwater crawdads where the tumbling creek entered Caroga Lake. It was a healthy lake, and we never had a problem bringing mom home a hearty meal for her to prep on the grill.

After childhood, I was fortunate to attend college just a few hours west of Caroga Lake on Seneca Lake in Geneva, New York. I studied water resources and geology, and spent my college years rowing, swimming and enjoying The Finger Lakes Region. It was an easy transition, as it reminded me of where I spent my summers growing up.

During my college years, I often reminisced about the time spent at Caroga Lake. After graduation, my friends and I planned a celebration and gathering at my family's cabin on Caroga Lake. We packed up our gear, said goodbye to our friends, and caravanned two hours to Caroga Lake, which I hadn't visited in over six years.

I knew first hand living on Seneca Lake about the environmental degradation that had occurred throughout Upstate New York and New England – the introduction of zebra mussels, septic leachate contamination, and acid rain impacts. Our post-graduation reunion at Caroga Lake was bittersweet. We were ending a four-year bond that we would all miss, and we celebrated our time togeth-

er. But for me, the changes to my childhood lake were dismaying.

In the late 1980s, zebra mussels were introduced to the United States in the Saint Lawrence seaway. Quickly, the mussels proliferated to most Upstate New York lakes, and Caroga Lake was no exception. Zebra mussels had dramatically changed the ecology of the lake, and combined with failing septic systems, the shoreline that as a child was once gravel-lined was now masked by algae blooms and zebra mussels. The fishery had crashed. And the lake water no longer met drinking standards. And not surprisingly, the town that was once dependent on tourism and recreation was struggling to find a new existence. It was no longer the town I spent my summers enjoying as a child.

I'm glad I had the opportunity to grow up and enjoy the pristine character of my childhood lake. Proactive measures are now being taken in Upstate New York and around the country to reverse the impacts of aquatic invasive species and septic leachate, but the efforts are costly, and oftentimes futile and impactful to local economies.

Whitefish Lake is at a tipping point. We can choose to do nothing or be proactive. As a community, we have a legacy of getting things done. We bond together for common causes that focus more on community and future generations than on ourselves and short-term gain. Let's continue this tradition, and ensure we leave Whitefish Lake and our local area waterbodies in the same pristine state that we found them.



WLI Staff and other AIS Response Team Members at Beaver Lake. Photo courtesy Whitefish Lake Institute

Introduced Species

There have been numerous non-native species introductions to Montana waters over the years. Some of these introductions were done intentionally by resource managers in an attempt to boost fisheries, and others were done illegally by individuals for a variety of personal reasons. Today, we recognize that introduced species have the potential to dramatically and irreversibly alter freshwater ecosystems. They may out-compete native species for food and habitat, carry and spread diseases and parasites to native species, and hybridize (interbreed) with native species, all actions which can alter or destroy fisheries.

There are several examples of planned species introductions that have disturbed or altered freshwater ecosystems over the past 100 years, including rainbow trout and brook

trout, but none has caused a more dramatic shift in the food web than the introduction of *Mysis* shrimp. A native of the North American Great Lakes, *Mysis* introductions were expected to provide a food source for introduced kokanee salmon in Whitefish Lake. Hundreds of other lakes in the western U.S. were also planted with *mysis* to boost sport fisheries.

Beginning in 1968, fishery managers planted *Mysis* shrimp in Whitefish Lake. *Mysis* later drifted downstream to populate Flathead Lake. *Mysis* populations were well established in Whitefish Lake by 1976. The shrimp evolved and adapted a unique survival strategy, moving to dark waters on the lake bottom to avoid predation during the day and migrating up the water column to feed on zooplankton near the water surface at night. These dynamics created two problems: first, the *mysis* were eating the same zooplankton that juvenile westslope cutthroat trout and kokanee relied on as a food source, and sec-



Mysis Shrimp. Photo Courtesy NOAA Great Lakes Environmental Research Lab

ond, the shrimp became food for juvenile introduced bottom dwelling species like lake trout, which as adults eat other fish. The resulting changes to the lake ecosystem were widespread including the disappearance of kokanee salmon, and the extreme reduction in native bull trout and westslope cutthroat trout.

Harmful algal blooms

Harmful algal blooms (HABs) are overgrowths of algae in water. Of particular concern are HABs consisting of blue-green algae (cyanobacteria) that have the potential to create microcystin toxins. Microcystin toxins have been known to kill waterfowl, pets and livestock that consume the water and pose a health risk and irritant to swimmers. The toxins produced during blooms are possible carcinogens to humans and current research is studying the link between certain cyanobacterial toxins and neurological disease. Additionally, cyanotoxins can put drinking water utilities at risk or impart a taste or odor unpleasant to the consumer.

HABs also decrease recreational use and aesthetic value of a waterbody from the vast mats of algae and the smell associated with their decomposition. HABs negatively impact the food web by decreasing the amount of nutrients available to the phytoplankton preferred as a food source by zooplankton. As a result, there are decreased food sources for secondary and tertiary consumers. In addition, the decomposition of the large algal mats leads to decreased dissolved oxygen levels near the benthos.

Physical

Shoreline Development & Recreational Use

The shoreline is where the greatest and most visible impacts of human development to the lake are apparent. Like wetlands, natural shorelines act as buffers between lake water and the land surrounding it. Shoreline vegetation filters nutrients and pollutants, reduces erosion, and provides wildlife habitat. Nearshore development can remove much of the natural vegetation, reducing the cleansing and buffering capacity of the shoreline and decreasing habitat.

The clearing of land to develop residences and neighborhoods also increases the amount of impervious surfaces which in turn increases surface runoff from precipitation to the lake. Fertilizers used to maintain non-native vegetation such as lawns and gardens can also increase the load of nutrients reaching the lake. Lastly, depending on available building sites, many new homes around Whitefish Lake do not have access to the City of Whitefish sewer system, triggering the need for new septic system installations.

Shoreline development along Whitefish Lake dates back to the late 1880s with sporadic cabins along the lake. The townsite of Ramsey appeared in the early 1900s near the Whitefish River outlet. Development around the lake remained restricted until the Civilian Conservation Corps (CCC) constructed a road along the east side of the lake and up the Swift Creek drainage. Yet, development remained slow until the 1970s and 1980s when shoreline development substantially increased. In the mid-1970s as concerns over shoreline development grew, a group

of Whitefish residents were instrumental in passing legislation at the state level which gave local authorities the option of developing local lakeshore regulations.

Shoreline development that protects water quality therefore includes regulations such as development setbacks and impervious surface limits, as well as thoughtful planning such as minimal disturbance, the use of native vegetation, and the limited application of fertilizers, soil amendments, and pesticides.



LINDA ENGH-GRADY President, Whitefish Community Foundation

Our residence is in Northwoods off of Reservoir Road. This area is one of a few critical watershed habitats for spring runoff and city water sources. Our home is located above the City Water Treatment Plant, and many seasonal creeks run through several properties around our land that feed into Haskill Creek drainage.

No one can argue that Whitefish Lake is one of the major draws to our town. To have a beautiful lake situated near town and with a great City Beach is wonderful. The beach and lakeshore are extremely clean compared to other similar lakes thanks to the winter run off that keeps the water cold well into July.

I do not think most visitors or recent transplants understand that the lake is a source of Whitefish's drinking water supply. Our family, like so many others, enjoys the lake for its beauty, recreation and scenery. It is a great place to cool off and relax in the summer months. Our source of enjoyment on Whitefish Lake over the years has included canoeing, swimming, and paddle boarding. Our children learned to swim in the lake, and we spent many a summer afternoon at Les Mason Beach cooling off and enjoying a picnic. I do miss the old Les Mason Beach before it was expanded and became a major tourist spot.

Our town would not be what it is today without the draw of Whitefish Lake. It is known primarily for its beauty and recreation opportunities but not as much for its value as a water source. There are many factors that threaten its quality; from the overabundance of gas and oil use by or leaking from boats; fertilizer and yard chemical run off; leaking septic tanks; and even dog feces. However, the greatest threat to our lake is the potential introduction of invasive species.

I would like to see the community of Whitefish make the "prevention of invasive aquatic species" a major priority and unite to ensure we stop any possible invasion. There are too

many places where people can access the lake. People who live and recreate on the lake need to make a concerted effort to be educated, aware, and even hypersensitive to what watercraft are going into the lake. Any boat, kayak, paddle board, wake board or related items can carry these invasive species; even our shoes and sandals can be vectors for spreading these insidious creatures! People accessing our surrounding lakes also need to be aware of what aquatic species live in those lakes as well as how easy it is to unknowingly spread species from one lake to another.

The thought of Whitefish Lake being compromised by invasive species is truly sickening and life would not be the same without our clean and beautiful lake. If every person considers how their actions affect the lake, we could be reasonably assured that our lake will still be pristine 30 to 40 years from now.

The urgency to protect our lake is high, and we must use all available resources to educate people about the danger and address directly cavalier attitudes that foster a “it doesn’t apply to me” response. It applies to everyone who uses the lake, otherwise the question is not IF but rather WHEN will we be invaded by these aquatic species.



Hellroaring Erosion. Photo courtesy Whitefish Lake Institute

Swift Creek Delrey Bridge. Photo courtesy Whitefish Lake Institute

Sedimentation and Flooding

The impacts of urbanization in the Whitefish Lake Watershed can be seen in many forms, including the building and widening of roads, shoreline development, increased human access to once wild areas, and the extension of municipal services. A noticeable and in some areas more measurable result of this urbanization is the increase in sedimentation to waterbodies.

Weathering and erosion of land and sediment transportation through waterbodies are natural processes. However, excessive erosion can cause increased suspended sediment that impacts water quality. Suspended sediment can reduce the amount of light that penetrates water. This consequentially can reduce plant and aquatic insect populations which in turn limit food sources for fish and therefore fish populations.

Sediment that reaches the bottom of a waterbody can also envelop invertebrate habitat and food sources, impair reproduction of aquatic organisms, and smother eggs and newly hatched fish. In addition to impacts to the ecology of waterbodies, concentrated sediment can result in increased drinking water treatment costs, and decreased aesthetics and recreational opportunities.

Natural disturbances such as fires and floods, as well as human activities such as railroad building and timber harvesting all have the potential to contribute sediment to the watershed. Research has shown that natural disturbances—if looked at independently of other factors—appear to have little influence on overall sedimentation rates in the lake. By contrast, correlations between human activities and an unnatural amount of sediment to the lake are more readily apparent.

WHITEFISH LAKE SEDIMENTATION 1885-1990

Year	Major Watershed Events
1880- 1885	European Settlement began with a few homesteads built around the lake.
1886-1900	Flood of 1894- highest magnitude flood in recorded history. Logging of shoreline areas began. Dam constructed at outlet of lake by Boston & Montana Commercial Company.
Early 1900-1902	Clearing of railway grade on southern aspect of lake 1901-1904.
1902-1908	Several sawmills in the area with timber harvest for railroad ties and a growing Whitefish community. Timber harvest still remained close to the lake but select trees were skidded to the lake. Boston & Montana Commercial Company Dam blown up by a group of citizens.
1908-1912	Somers Lumber Company built a new dam near the Columbia Avenue Bridge. Timber harvest continued. Fire of 1910- 6.7% (5562 acres) of Whitefish Lake catchment burned
1912-1922	Timber around lake depleted. Logging operations moved to other areas in valley. Fire of 1919- 3.0% (2,458 acres) of Whitefish Lake catchment burned
Mid/late 1920s	Fire of 1926- 3.7% (3,036 acres) of Whitefish Lake catchment burned
Early 1930's	Extensive logging activities in the Lazy Creek and Swift Creek drainages. Associated road building and rail spur on Lazy Creek. Rail spur removed in 1932. Logs were then trucked out.
Mid/late 1930's	Decline in timber harvest. East Lakeshore Drive / Swift Creek Road Constructed. Fire of 1937- 0.9% (750 acres) of Whitefish Lake catchment burned.
1940's	Decline in timber harvest and associated road building
1948-1950	Harvest activities and road building commenced again in the Swift Creek drainage. Railroad switched from coal burners to diesel in 1950.
Mid 1950's	Harvest activity declined.
Mid 1960's	Harvest activity increased. Flood of 1964- second largest in recorded history. Paving of East Lakeshore Drive completed.
1967-1971	Harvest activity declined.
1971-1983	Fluctuating harvest activity mainly in bottom lands. Initiation of Best Management Practices by governmental agencies and private timber companies. Flood of 1974- third largest in recorded history.
1983-1990	Timber harvest increase. Increase in lakeshore development. 1980's with relatively mild run-off years.

Figure 10. Sediment Chart. Courtesy Spencer, C.N. as adapted by Whitefish Lake Institute

Temperature Change and Lake Ice

Aquatic ecosystems are highly sensitive to climate change. Mean annual air temperature is a variable that can affect a number of lake and stream dynamics including heat balance, temperature profiles, and vertical mixing. Warming atmospheric temperatures will increase lake surface temperatures and decrease ice-cover, affect nutrient fluxes, alter the productivity and composition of lake plankton, and decrease dissolved oxygen levels for all aquatic life. Also, any tempera-

ture increase is key to creating conditions in which algae thrive, and when coupled with increased nitrogen and phosphorous loading could create accelerated eutrophication.

Years with more extreme weather conditions and shorter ice cover duration have become more common. Lake ice trend data from around the world is showing later ice on dates and earlier ice off dates. From 1914 to 1962 Whitefish Lake completely froze in the winter 92% of the time. No data exists

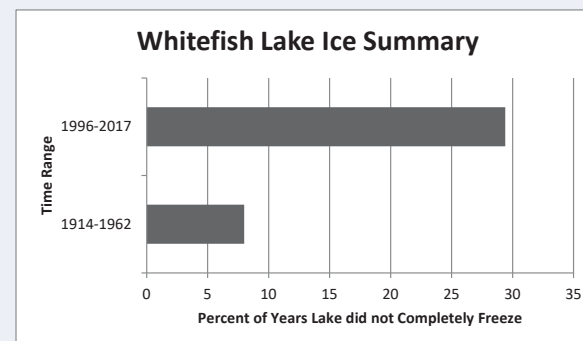


Figure 11. Lake Ice. Courtesy Whitefish Lake Institute

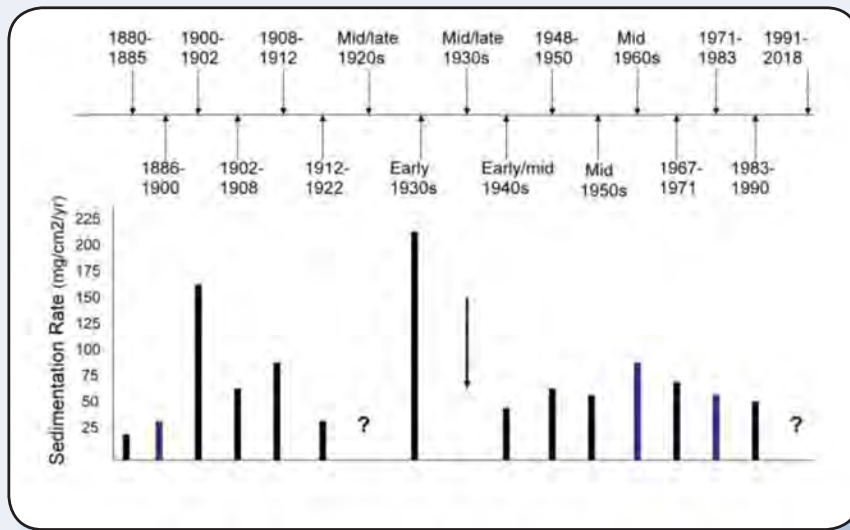


Figure 12. Whitefish Lake Sedimentation 1885-2013. Courtesy Whitefish Lake Institute

Figure 12 represents a brief narrative of historic land use practices. Prior to European settlement, the Whitefish Lake Watershed was subject only to natural fire and flood events. The highest magnitude flood event in recorded history for the area occurred in 1894, but lake sediment rates increased little from background levels. At that time, the well vegetated, intact watershed buffered the effects of the flood. At the turn of the 20th Century, railroad grade clearing and timber harvest around the lake caused an increase in sedimentation rates.

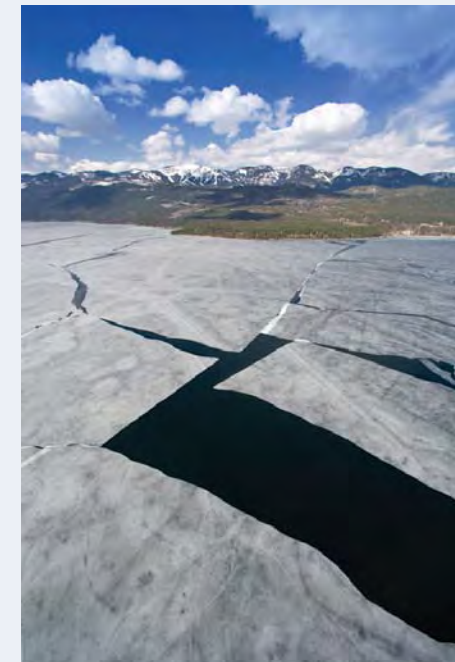
The highest rates were recorded in the early 1930s when the first large-scale timber harvest and road building occurred in the Lazy Creek and Swift Creek drainages. In 1964 and 1974, the third and second highest magnitude flood events were recorded for the area, but the sedimentation rate was higher than in 1894. By that time, the watershed had been disturbed and lost some buffering

capacity. Best Management Practices (BMPs) implemented in the 1970s may have contributed to the reduction in sediment rates through 1990. Unfortunately, sedimentation rates for 1991-2018 were not available to include in this graphic.

In 2013, 1.12 inches of rain fell in a 24 hour period causing numerous mudslides, breaching a private pond off Big Mountain Road, and sending muddy water across East Lakeshore Drive toward Les Mason Park and Whitefish Lake. The river of water was a few hundred yards wide and carried debris through the Les Mason Park parking area and the surrounding forest. There were numerous smaller mudslides on East Lakeshore Drive that day, and a rock retaining wall on Rest Haven Drive gave way and hit a nearby carport. The storm also caused some erosion along unmaintained trails on the Toni Matt and Big Ravine slopes of Big Mountain at Whitefish Mountain Resort.



Mike Koopal on Whitefish Lake. Photo courtesy Whitefish Lake Institute



Ice break-up on Whitefish Lake. Photo courtesy gravityshots.com



STEVE THOMPSON
Chair, Climate Smart Glacier County

Many people don't appreciate a bitter wind blowing across a frozen plain, and most of them don't spend February in Whitefish. Few of those who do winter here ever venture onto the icy wilderness of Whitefish Lake.

But for those few, gliding across a frozen Whitefish Lake is the highlight of our year. We are fishermen and wild ice skaters, skiers and paragliders, dog walkers and the occasional mountain biker. Sometimes we spot each other from afar, and sometimes we speak about the ice or weather. Mostly we're by ourselves in the wild open of a glaciated valley.

In February 2018, there was a splendid convergence. Word has gotten out about ideal conditions and people gathered in small groups at Les Mason State Park. A couple of groups slapped pucks across long expanses of flawless ice. Several ice fishermen drilled their holes. Solitary skaters dared themselves to cross the lake.

My ice watching habit started more than 20 years ago. From an old crumbling cabin on Ramsey Avenue, I liked to observe the daily moods of the lake in all seasons. From that spectacular vantage, I weathered the winter of 1996-97. Today, I'm back on Ramsey, 300 yards further down the road, in a slightly newer home that also has a good view of the lake. The scenery is most dramatic at the onset of ice, typically in early January, and during spring break up.

Unfortunately, the onset of ice has become less reliable. The lake freezes most years, but I'm seeing more years where the ice stalls at City Beach and much of the lake remains open. My observation is backed up by a more reliable accounting by the Whitefish Lake Institute, which has two sets of ice records going back to 1914. Until 1962, ice failed to cover the lake only four times, or about 8 percent of the winters. Between 1996 and 2017, the lake failed to completely freeze nearly 30 percent of the time.

Future prospects for wild ice skaters on Whitefish Lake are not bright.

A new study by climate scientist Anne Nolin at Oregon State University indicates warmer winters in our future. She shared a preliminary analysis with the City of Whitefish in early 2018 that evaluates past and future frequency of warm winter months. She counts a winter as warm if a single month between December and February averages above freezing.

Between 1970 and 1999, not one winter met Dr. Nolin's definition of warm. Employing the best climate model available for the

Northwest, she found that Whitefish would experience warm winters one-third of the time by mid-century. By 2100, 93 percent of winters would be warm. That's if humanity continues emitting earth-warming gases at our current trajectory. If we all move quickly to embrace clean energy and stabilize global temperatures, nearly half of Whitefish winters will still be warm by 2100.

The lessons to me are clear: Get out on that ice today, if you can. And join your many neighbors in Whitefish who individually and collectively are doing their part for a safe climate tomorrow.

from 1963-1995, but from 1996 to 2016 the rate at which Whitefish Lake completely froze decreased to 75% of the time.

Railway Transportation

The Great Northern Railway was built through Whitefish, then known as Stumptown, in 1904. The name Stumptown was a result of the stumps that were left in town from the timber-clearing effort to build the railroad and the town. The railroad has historically been an economic blessing to the City of Whitefish, but it has also caused a chronic legacy of pollution. The clearing of the railroad grade along the lake contributed large amounts of fine sediment to Whitefish Lake. Spills, leaks and oily discharge at the 78-acre rail yard facility, which has been in operation since 1903, have caused soil and shallow groundwater contamination from petroleum products (primarily diesel), polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) volatile organic compounds (VOCs), and heavy metals.

Burlington Northern (BN) installed a lagoon system to contain and treat oily wastewater in the 1960s, and in 1973 began recovering free petroleum from shallow groundwater through an interception trench just above the Whitefish River.

In 1994 the facility was designated a Montana State Superfund site, and in 1998 the railroad company, now Burlington Northern Santa Fe (BNSF), was notified that it was liable for cleanup at the facility. From 2006 to 2008, BNSF implemented a number of improvements and controls in the rail facility. Since 1991, approximately 15,105 gallons of free product have been recovered from the interceptor trench and 743 gallons from recover wells. BNSF was also responsible for cleaning up the Whitefish River along the Whitefish West rail yard. From 2009 to 2013, they removed 26,000 cubic yards of contaminated sediment and backfilled it with river rock.

Mackinaw Bay 1989 Train Derailment

On July 31, 1989, a BNSF freight train derailed and four diesel-filled tank cars slid down the slope below the track on the west shore of Whitefish Lake at Mackinaw Bay. Three of the four cars leaked between 20,000 and 25,000 gallons of diesel onto the shoreline and



Train derailment. Photo courtesy Charlie Abell

into the lake. Due to the health risk associated with the benzene, toluene, ethylbenzene (BTEX) contamination from the spill, the governor of Montana declared a state of emergency and the lake was temporarily closed to the public. Clean up efforts at the time included the upland areas and floating petroleum. Two weeks after the spill, with much of the surface water contamination contained or removed, contaminated shoreline soils were excavated and land-farmed at BNSF's Whitefish yard. Additional clean-up efforts were conducted in 1991 and 1992 at the appearance of an oily sheen on the lake surface. There was no removal of submerged petroleum from the lake sediment at that time.

In 2009—the 20th anniversary of the spill—a report of residual sheen and petroleum hydrocarbons was made by a Whitefish citizen to WLI. WLI conducted an investigation and confirmed the existence of the contamination, then engaged the EPA, DEQ, the City of Whitefish, and BNSF to further study and arrange for additional cleanup. Testing by WLI confirmed that extractable petroleum hydrocarbon (EPH) contaminant levels in the lake were 16.8 times higher than the federal maximum contaminate level for drinking water standards and 8.65 times higher in the surrounding soils.



Whitefish Lake Beaver Creek. Photo courtesy gravityshots.com

In May 2012, BNSF and its contractors, under the direction of the EPA, began a cleanup effort that included removing approximately 400 cubic yards of contaminated sediment from the bay. A barge-mounted excavator moved sediments from the lake to rail cars which were ferried to the Whitefish City Beach boat ramp, from which they were trucked to the BNSF Whitefish facility and then transported to a licensed waste facility in North Dakota. The effort, which removed approximately 97% of the contamination was completed on June 25, 2012.

Although Amtrak and BNSF continue to work hard to maintain their safety records, there remain concerns related to railway transportation, mainly related to oil and coal and other hazardous materials, and the effects of vibration on infrastructure. Today, the town of Whitefish is considered one of Amtrak's top ten spots with service by two daily passenger trains, and is a stop on Amtrak's *Empire Builder*. Built in 1928, the depot was rehabilitated in the 1990s by the

Stumptown Historical Society which owns the building and parking lot, and runs a historical museum next to the ticket office and waiting area.

Chemical

Nutrient Loading

Nutrient loading describes the widely accepted concept that the quantity and type of nutrients (such as nitrogen and phosphorus) entering a lake directly affects its health. These nutrients occur naturally in the environment, but their concentrations can increase beyond natural levels due to human activity such as decreasing or eradicating natural lakeside and streamside vegetation, over-fertilizing agricultural lands and lawns, and raising livestock too close to lakes and streams. Additional sources of nutrient pollution include septic leachate, stormwater, and dog waste. Hard surfaces near waterbodies, such as sidewalks, driveways, and rooftops, also increase nutrient loads by preventing run-off from soaking into the ground naturally.

The two main categories of pollution are *point source*, such as municipal and industrial waste that comes from a pipe, and *diffuse non-point source* such as agricultural, domestic, and industrial run-off, stormwater, and septic system leaching. The origination of point source nutrients can generally be easily identified and monitored while non-point source pollutants tend to be spread broadly and difficult if impossible to pin-point or monitor. Since the 1970s phasing out of phosphate-containing detergents in Flathead County, the main sources of phosphates and

nitrites tend to come from improperly managed agricultural, domestic, and industrial run-off, and aging and failing septic and sewer systems. Because some phosphates adhere to soil, they are transported downstream to water bodies through erosion, and released slowly into the water. Atmospheric deposition of nutrients and pollutants to waterbodies can also travel from great distances.

Excess nutrients are a major threat to lake water quality. Nutrients in the water feed microscopic plant-like organisms called algae, which can quickly overload lakes and negatively impact their aquatic life. Healthy lakes need algae since they are important primary producers for the lake and are the bottom of the lake's food chain. However, excessive nutrients accelerate algal growth, which reduces water clarity and can lead to unpleasant odors. As algae die, they fall to the bottom of the lake and are decomposed by bacteria. As the bacteria consume the dead algae they deplete the oxygen levels in the surrounding water. Decreased oxygen levels make it difficult for fish and other aquatic animals to survive.

Knowledge and understanding of lake water quality and the pollutants affecting it helps to preserve our lake systems. Ongoing efforts to quantify and understand nutrient loading continue today. Important factors in reducing or buffering nutrient loading include laws to regulate the quantity of pollutants being added to the environment, increased implementation of sustainable practices, and maintenance and restoration of water cleansing buffer and wetlands.

Mercury

Mercury is a naturally occurring element in the earth's crust that is present in our air, soil, and water. Human sources include fuels, raw materials, and waste from industrial processes. Because mercury is re-emitted into the environment from land and water, some of the mercury circulating throughout the environment today was released years ago. Exposure to mercury can harm human organs and affect the nervous system.

Coal-burning power plants account for 50 percent of all human sources of mercury emissions to the air in the United States. Airborne mercury eventually settles directly into waterways or on the land where it can be washed into water. Once it enters a waterbody, microorganisms change it into highly toxic methyl mercury, which then bioaccumulates in fish and shellfish that eat the microorganisms and remains toxic to humans and wildlife that eat the polluted fish.

There is a fish consumption advisory warning for Whitefish Lake. Montana Fish, Wildlife & Parks publishes the Montana Sport Fish Consumption Guidelines. The Guidelines describes the benefits and dangers of consumption of fish from Montana waters and identifies how safe particular fish are to include in human diets. While fish consumption may contribute good proteins low in saturated fats our diets, it can also expose us to more methyl mercury (causes damage to the nervous system), PCBs (developmental and immune system damage), and other pollutants than the human body can tolerate.

2014 Montana Sport Fish Consumption Guidelines											
Updated January 5, 2015											
<p>These charts will help you plan meals, with advice for individuals at increased risk</p> <p>Children age six and younger, nursing mothers, and women who are pregnant, or might become pregnant, are at greatest risk of adverse health effects, and should be more conservative in the fish-eating habits.</p>											
Whitefish Lake M = Men & Women (not child-bearing age) WC = Women (child-bearing age) & children  = Fish are safe to eat 11 = # of safe meals per month	Lake trout	M					8			Hg	
		WC	11	11	5	3				Hg	
	Northern pike	M									Hg
		WC				10	10	9			Hg
	Lake whitefish	M									
		WC				6					Hg
	Cutthroat trout	M									
		WC									

Figure 13. Fish Consumption Cart. Courtesy Montana Fish, Wildlife & Parks as adapted by Whitefish Lake Institute

Pharmaceuticals and Personal Care Products (PPCPs)

Pharmaceuticals and Personal Care Products (PPCPs) is a category of naturally occurring and synthetic compounds found in prescription and over-the-counter drugs for humans and domesticated animals, nutritional supplements, medical diagnostic agents, cosmetics, fragrances, sunscreen, and insect repellent, and other products. PPCPs enter terrestrial and aquatic environments through a number of direct and indirect means including natural human processes. On a larger scale, they travel through industrial effluent, animal feedlots, wastewater effluent, septic leachate, landfill leachate, and sewer overflows. Other methods of introduction include improper disposal of PPCPs, such as flushing expired or unused pharmaceuticals down the toilet or pouring them down a sink drain, and through the improper discharge of commercial wastes.

PPCPs have and continue to be detected in groundwater, streams, rivers, lakes and reservoirs. The compounds can have human health impacts, as well as impacts on aquatic ecosystems with such results as adverse effects on invertebrates; and changes in fish sex ratios, changes in fish nesting behavior, and the development of female characteristics in male fish. The full scope of the presence of PPCPs and the toxicological significance to humans or terrestrial and aquatic ecosystems is far from understood, however, certain compounds are gaining attention. Today, conventional drinking water and wastewater treatment processes may reduce some PPCPs, but they do not remove them from water.

Locally, the Whitefish Police Department, in partnership with the Northwest Drug Task Force and Citizens for a Better Flathead developed the *Waste Not* program through which pharmaceutical products can be disposed of safely at the Whitefish Police Department.

Benzene, toluene, ethylbenzene and xylene BTEX

Benzene, toluene, ethylbenzene and xylene (BTEX) are volatile organic compounds (VOCs) known for their potential to cause numerous human and ecosystem health problems. While short-term exposure can cause central nervous system issues such as dizziness, exhaustion, and loss of coordination, as well as respiratory issues, long-term exposure can affect the kidneys, liver, and blood systems and lead to leukemia and various cancers.

Benzene is found in petroleum products such as gasoline, as well as many common household products such as paints, dyes, resins, furniture polish, detergents, insecticides, and cosmetics. Toluene is found in petroleum products, paint solvents, gums, oils, and resins. Ethylbenzene is mostly used as an additive to gasoline and aviation fuel, but may be present in some paints, inks, and pesticides. Xylene is found in gasoline and is used as a solvent in the printing industry. BTEX exposure can occur by ingestion (drinking contaminated water), inhalation (breathing contaminated air), or absorption of polluted air or water through the skin.

In 2005, WLI analyzed the levels of BTEX at City Beach. WLI concluded that the main mechanism for the high levels of benzene was from boat owners pulling their transom plugs on the boat ramp allowing petroleum effluent to enter the lake adjacent to the swimming area. WLI recommended the installation of a catchment system to collect the effluent. The Whitefish City Council approved financing for the project which was completed in 2013.



Interceptor Trench. Photo courtesy Whitefish Lake Institute

Perchlorates

One of Whitefish's popular events is Independence Day—Fourth of July Fireworks on Whitefish Lake. Unfortunately, along with the celebration of our independence, standard fireworks often bring carcinogens and hormone-disrupting substances to our waterways. One of the greatest concerns related to water quality is the use in fireworks of *perchlorates*, a highly water soluble propellant that can affect the functioning of the metabolism-regulating thyroid gland. The Center for Disease Control warns that perchlorate exposure can result in thyroid damage and hinder brain development in infants. Studies have shown that perchlorates are found in waterbodies and water supply wells near fireworks displays and that perchlorate levels rise up

to 1,000 times from pre-fireworks measurements and can take months to dissipate.

The good news is that there are safer alternatives to perchlorate for fireworks. Researchers have developed replacements for perchlorate in fireworks and other pyrotechnics. The fireworks burn cleaner and produce less smoke. Alkali metal and alkaline earth metal salts found in these materials have been found to be environmentally friendly. These materials also reduce amounts of heavy metals, lowering their toxic effects. These safer fireworks are—at face value—often more expensive, however, pollution cleanup and effects on human health dramatically increase the cost of standard fireworks, making the alternatives far more appealing.



Fireworks at Whitefish Lake. Photo courtesy Lori Curtis



MATTHEW PESCHEL **Third generation Whitefish resident;** **Seventh grader at Whitefish Middle** **School**

Whitefish Lake is important to my family because we have family and friends that live on the lake. In the morning when they grab their coffees and sit on their decks, they want to see this beautiful lake. Lots of times our family goes to my grandparents' house on the lake, and we go on their boat and go swimming. It's a great way to cool off and spend our summer having fun! The lake also has a peaceful aspect to it. You can sit on a calm boat alone and chill, then you can read a book, go fishing, and much more!

Whitefish Lake is important to our community because this wonderful lake provides many resources for people in town, like fishing, water to maintain our luscious gardens, and most importantly, fresh clean water to drink! At first thought, you might think the water is dirty, but the City filters the water before we drink it. This lake also

provides some fun like diving under the water and finding cool rocks or simply exploring. Whitefish Lake Golf Course pumps water from the lake to water the wonderful golf course greens and fairways to keep it a great attraction. When tourists come to see Whitefish they will most likely want to see the awesome lake. This might increase their interest in coming back to Whitefish again or potentially buy a place here. These tourists will spend money in Whitefish, which is good for the community. There is also a nice beach called 'City Beach' where people can sit and enjoy the lake. Whitefish community members gain a lot from Whitefish Lake.

There are many threats to Whitefish Lake. When people want to put any kind of boat in the lake, they have to go to a special place where they get their boat checked for invasive species, which I think are a big threat to the lake. There also some fish that people bring from other lakes to put into our lake. I also think it would be bad if there is an oil spill from the railroad.

Whitefish Lake should be protected in order to keep a clean lake for people to enjoy. We can do it by not littering, and we also need to protect it from development. We need to keep the houses away from the water because it could pollute the water by having a whole house and humans right next to it.

A Lasting Tribute

From 2010 to 2015, WLI hosted the *Whitefish Wine Auction* fundraiser to support management of its Averill's Viking Creek Wetland Preserve and for internal WLI programming. In support of the fundraiser, Chris Ruffatto's high school industrial arts class volunteered to make auction paddles for the event. They cut "whitefish" out of metal using their new plasma cutter, and painted each fish white. The paddles were then individually numbered. The unique whitefish paddles *jumped* from the attendees hands during lively bidding of auction items and added a nice flair to the event. With the retiring of the Whitefish Wine Auction, WLI donated the whitefish paddles back to the school district for a 2nd grade pond unit art project. The intent is to have each second grader decorate the iconic fish species of Whitefish with their own artistic touch, and for them to be displayed in celebration of the new Center for Sustainability and Entrepreneurship. Below is a prototype by 2nd grader Case Koopal.



Whitefish Wine Auction. Photo courtesy Whitefish Lake Institute

WHITEFISH LAKE INSTITUTE STAFF

Mike Koopal

Mike is the founder and executive director of WLI. With a biology degree from Luther College, Mike's professional career began in the fisheries division of the Montana Department of Fish, Wildlife and Parks working in the Clark Fork and Blackfoot River drainages.

Mike studied Lahontan Cutthroat trout for the Summit Lake Paiute Tribe in Nevada, and worked with sockeye salmon for the Prince William Sound Aquaculture Corporation in Alaska. He was a partner at Watershed Consulting for eight years where he specialized in fisheries related issues in Montana, Idaho and Nevada. Mike is the Chair of the AIS Early Detection & Monitoring Committee on the Upper Columbia Conservation Commission (UC3), serves on the Flathead Basin Commission Executive Committee, the Whitefish Climate Action Plan Committee, and provided technical assistance to the Bigfork Stormwater Advisory Committee.

He was a co-coordinator of the second and third editions of the Montana Lake Book. He co-authored the *Whitefish Water Resources Report: A Status of the Whitefish Lake Watershed* (2015) and is an author of the *Investigation of Septic Leachate to the Shoreline Area of Whitefish Lake* (2012). Mike is also a Level II trained Aquatic Invasive Species Inspector/Decontaminator. Mike is a past recipient of the Individual Achievement Award by the Montana Chapter of the American Fisheries Society for his outstanding contribution to the protection and enhancement of fisheries resources in Montana.

Lori Curtis

As Science and Education Director, Lori ensures that Whitefish Lake Institute's science and educational programs perform to their potential. She has a Master of Science in Environmental Studies from Green Mountain College and has contributed to research in aquatic and terrestrial ecosystems in California, Colorado, and Montana. Her career includes diverse management roles across a variety of disciplines.

Lori is the author of the *Flathead Watershed Sourcebook: A Guide to an Extraordinary Place*, a book and companion website that illustrates the natural and cultural histories of the Flathead Watershed, details its biodiversity, water quality, land management, agricultural production, and economics. She was a co-coordinator of the third edition of the Montana Lake Book. Lori co-authored the *Whitefish Water Resources Report: A Status of the Whitefish Lake Watershed* (2015) and was lead author on the *Investigation of Septic Leachate to the Shoreline Area of Whitefish Lake* (2012).

Lori serves as the Chair of the Upper Columbia Conservation Commission (UC3), on which she represents the Conservation Districts of Montana. She also serves as a Supervisor on the Flathead Conservation District Board, and is a Master's Adjunct Instructor and Thesis Advisor for Green Mountain College. Lori is a Level II trained Invasive Species Inspector/Decontaminator. She is a past recipient of the Outstanding Writer Award from the Montana Chapter of the American Fisheries Society and the Partner of the Year award from the Northwest Regional RC&D.

Cynthia Ingelfinger

Cynthia is the Science & Education Coordinator for the Whitefish Lake Institute, where she coordinates the Northwest Montana Lakes Volunteer Monitoring Network—the long-standing citizen science program managed by WLI and funded by Montana Fish, Wildlife & Parks. She also conducts educational programs and baseline field work for WLI.

Cynthia joined WLI from the Flathead Conservation District where she was the Assistant Conservationist. She earned a Bachelor of Arts degree in Environmental Studies from Brown University, a Master of Science in the Field Naturalist Program from the University of Vermont, and completed a one year Professional Residency in Environmental Education at the Teton Science School. Prior to her work at the Conservation District, Cynthia was an Outreach Coordinator for the Ipswich River Watershed Association and prior to that, a Research Associate for the Wilderness Society—both in Massachusetts. Cynthia is knowledgeable about scientific research processes and has experience integrating science, fieldwork, critical thinking and public outreach.

Shawn Devlin

Shawn Devlin is a part-time Aquatic Ecologist for WLI and an Assistant Research Professor for Aquatic Ecology at the University of Montana Flathead Lake Biological Station (FLBS).

Shawn is helping WLI to expand its scientific research capacity and the collaborative partnership between WLI and FLBS. Devlin's efforts at the FLBS encompass work with a sophisticated computer model and the extensive dataset collected on Flathead Lake by FLBS researchers over the past 35 years. The model helps frame the questions of how climate change or introduced species like zebra mussels may affect the lake's biogeochemistry and thermal dynamics, and how increased nutrient loading and changes in land use may affect primary production and water clarity.

Shawn earned his Ph.D. from Wright State University in Dayton, Ohio and a B.Sc. in Environmental Biology from Unity College in Unity Maine. He conducted postdoctoral research at the University of Jyväskylä, Finland prior to coming to work at the FLBS. Shawn received the 2017 Raymond B. Lindeman Award from the Association for the Sciences of Limnology and Oceanography (ASLO), one of the world's largest and most prestigious international societies for water scientists. The Lindeman Award recognizes his paper "[Top Consumer Abundance Influences Lake Methane Efflux](#)" published in the journal *Nature Communications*, which showed that methane released from a lake was greatly influenced by the presence or absence of fish.

Devlin was also the lead author on "[Spatial and Temporal Dynamics of Invasive Freshwater Shrimp \(*Mysis Diluviana*\): Long-Term Effects on Ecosystem Properties in a Large Oligotrophic Lake](#)" published in the journal *Ecosystems*."



Big Mountain in December. Photo courtesy Lori Curtis

ABOUT WLI

Founded in 2005, WLI is a science, education, and community stewardship based nonprofit committed to protecting and improving Whitefish Lake and Whitefish area water resources today, while providing a collective vision for tomorrow. Through our **Scientific Research** program, we collect trend data over time and assess lake health. Over the years, we have provided our scientific findings to community leaders and management agencies, resulting in numerous projects that have benefited water quality and provided the community and resource managers information to make informed decisions. Through our **Education and Outreach** program, we connect students of all ages—from kindergarten through College, and the senior community—to the outdoors. Our **Community Stewardship** program engages citizens to enjoy and protect the lake through activities and citizen science pursuits. WLI also partners with other organizations to creatively fund research and develop programs that benefit Whitefish Lake and other local water resources.



WLI Board of Directors

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CYNTHIA INGELFINGER
Science and Education Coordinator,
Whitefish Lake Institute

Whitefish Lake is the centerpiece of our community. Whether from the chairlift at Big Mountain, nordic trails at the golf course, bike path near City Beach, or the Whitefish Trails, whenever Whitefish Lake comes into view, I immediately feel a sense of place and a connection to our community. Whitefish Lake is as much a part of our quality of life as it is the landscape. The lake provides a meeting place for my family to swim, play, or paddle with friends, and one glimpse of its blue waters can put my stress at ease. More than a beautiful backdrop, the lake is a source of clean drinking water and an economic driver of the community.

I am grateful for the opportunity to work towards protecting this vital community resource every day. The health of Whitefish Lake and our community are inextricably

linked. My hope is that by helping people notice where their daily paths cross with the lake and our water resources, the more they will care about what might be affecting our waters and be willing to take actions to improve the health of the lake.

I am especially grateful to everyone who contributed to this publication and lent their voice to the protection of this vital resource. Ultimately, it is through efforts of individuals joined in a common cause that change happens.

WLI PROGRAMS

Scientific Research

WLI's Scientific Research program is designed to provide a comprehensive understanding of the Whitefish Lake Watershed

Education & Outreach

The staff of WLI believes it is important to reach citizens of all ages in Whitefish and its surrounding communities about water ecology. Education programs include classroom visits and outdoor education programs at our living Wetlands Interpretive Nature Trail, high school job shadowing opportunities, college internships, graduate thesis support, educator in-service training, and presentations to civic groups. We have published educational materials for use at the Nature Trail such as a Trail Guide, Bird Guide, Discovery Guide for middle school student, and workbooks for kindergartners and second graders.



Lori Curtis teaching field journaling



Senior program on the lake



FREEFLOW GIS students



FREEFLOW student at Viking Creek

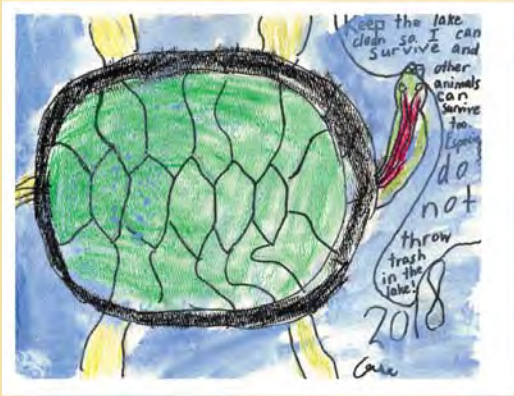


Interns monitoring Whitefish Lake



Intern monitoring Whitefish Lake

WLI at Work. Photos courtesy Whitefish Lake Institute



CASE KOOPAL
Second grader, Muldown Elementary

My dad Mike Koopal is a great guy. He helps keep lakes clean. He is the leader of the Whitefish Lake Institute. My dad does research on the lake, he has to go to a lot of meetings and rides in lots of boats. I hope one day he is able to get everything good so I get to go swimming and tubing on Whitefish Lake.

- Whitefish Lake
- High Waters
- In the Mountains
- Terrific
- Elegant
- Fabulous
- I Love It
- Swimming
- Help...

- Land Around the Lake
- Awesome
- Kickstart Your Motor
- Everyone's Lake

Community Stewardship

WLI engages a Citizens Advisory Committee (CAC) which enables diverse community involvement and participation in support of its science and education goals. The CAC provides a forum for the exchange of information between citizens and WLI, conducts community outreach, and provides opportunities for learning about—and engaging in—Whitefish Lake Watershed issues.

Committee members also come together each year to make recommendations for the annual Stewardship Award(s) and the Chris Ruffatto Excellence in Education Award. Each year, the Stewardship Award recognizes individuals or groups that take extraordinary measures to protect water quality in the Whitefish area, and the Chris Ruffatto Excellence in Education Award recognizes and honors educators (traditional and non-traditional) who dedicate their lives to engaging the next generation of environmental stewards.

WLI staff participates in numerous committees including: Flathead Basin Commission, Flathead Conservation District, Flathead Community of Resource Educators (CORE), Flathead Roundtable, Haskill Basin Watershed Group, Upper Columbia Conservation Commission, and the Whitefish Climate Action Plan Commission. WLI is a member of the American Fisheries Society, the American Water Resources Association, the North American Lake Management Society, and the Whitefish Chamber of Commerce.

WLI is most proud of its *Living Wetlands Interpretive Nature Trail*, a community amenity born of an unusual partnership. As part of the Viking Creek Development proposal, the Dan Averill family in 2009 gifted a 28.83 land parcel to WLI. The Averill's Viking Creek Wetland Preserve—owned and managed by WLI—is now home to the *Living Wetlands Interpretive Nature Trail* where community

members and visitors share the history, science, and beauty of the wetland, and are provided a glimpse into the lives of the wildlife with which we share this habitat.

The trail offers the closest outdoor natural experience for Whitefish citizens and visitors, extends natural resource education offerings, and enables connectivity to the City of White-

fish bike and pedestrian path, Crestwood Park, The Lodge at Whitefish Lake, and the Viking Creek subdivision.



Chris Ruffatto receiving award. Photo courtesy Whitefish Lake Institute



Second graders at Wetland. Photo courtesy Whitefish Lake Institute



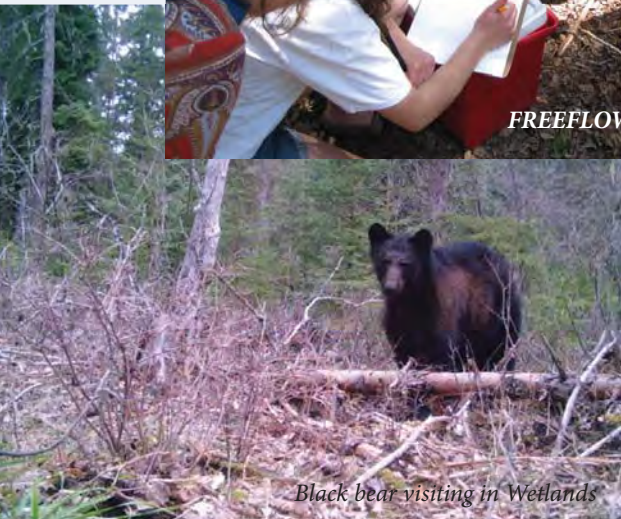
Mike Koopal with students at interpretive station



Fawn resting in Wetlands



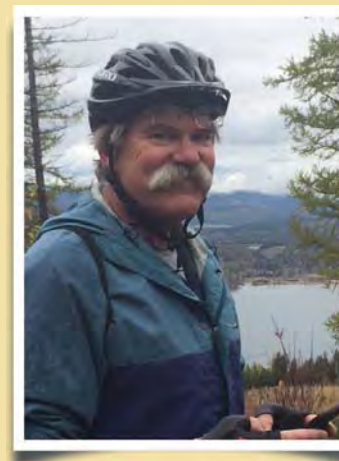
FREEFLOW students on Viking Creek



Black bear visiting in Wetlands



Mountain lion stalking in Wetlands



CHRIS RUFFATTO
Retired educator;
Whitefish Lake Institute Volunteer

My experience with Whitefish Lake began on June 7, 1985. Upon finishing my interview for a job teaching Earth Science at Whitefish High School, and *accepting* the position, I returned to my vehicle to wait for my heart rate to settle. It was a clear and very warm day so I decided to drive by Whitefish Lake to check things out. It wasn't long before I jumped in to cool off for the drive home. One dip told me that this lake was a beautiful and high quality resource that we would be so lucky to enjoy as members of the Whitefish community.

It was easy to see that Whitefish Lake was a summer mecca with all kinds of recreational opportunities in a very clean and healthful environment. What an idyllic setting. And then, one day, in the summer of 1989 there was a wake-up call. A derailment on the west side of the lake had discharged thousands

Wetlands. Photos courtesy Whitefish Lake Institute

of gallons of diesel into the lake prompting a quarantine on swimming and boating for two weeks. What happened to my precious resource? What else could affect the quality of this lake?

Within five years we had built a home (unbelievably with lake access!) and despite the oil spill, I became even more enamored with the clear cool waters of Whitefish Lake. I could go on for hours about special days we had on the lake but suffice to say...my kids had a very memorable childhood swimming, fishing, diving, catching crawdads and surfing behind boats with outdated gear. We didn't have much, just starting out on a teacher's salary, but we really had fun. Things weren't nearly as expensive as they are today - as the lot for our house cost only \$9,500!

Over the years my Earth Science program at Whitefish High School matured and I offered an extracurricular science activity to my students. The program focused on water quality in Haskill Creek (half of our public water supply). It was called FREEFLOW (Flathead River Educational Effort for Focused Learning in Our Watershed) and was founded by Don Slaybaugh, Tom Berquist and me. It became very successful, and over time we developed working relationships with Montana Fish Wildlife & Parks and a new organization, the Whitefish Lake Institute.

While working with the Whitefish Lake Institute, I was able to expand the FREEFLOW program to include lake ecology. What an opportunity to teach both students and teachers about the chemical, physical, and biological status of Whitefish Lake! Prior experience had shown me that education

was usually the answer when it came to the appreciation and protection of natural resources.

I feel it is important that our community place a value on Whitefish Lake. Not necessarily a monetary value but an emotional value. For example, I would often take students, teachers, and community members (on the Whitefish Lake Institute research vessel) to a pipeline that extends hundreds of feet out into Monks Bay. The passengers would wonder... "What is this pipeline for?" After some discussion they would eventually answer their own question... "Is this where the other part of our public water supply comes from?!" The quality and value of Whitefish Lake suddenly became far more tangible as we recognized we all had a little of Whitefish Lake in us at that moment. Good thing it's clean! The stage was set for what I refer to as emotional value. It's difficult to put a price on but immensely important...enough to be willing to defend it.

The value of Whitefish Lake is hard to measure. The economic, environmental, recreational and aesthetic qualities of the lake are difficult (if not impossible) to quantify. I suppose this is when the term "priceless" is used to describe something that is precious and irreplaceable. As is the case with all resources that experience the pressures of population, Whitefish Lake is vulnerable.

Scientific research over the past 40 years shows that the lake has experienced measurable impacts compared to its pristine condition roughly 150 years ago. It is imperative that we as citizens have some concept of these impacts so that efforts to remedi-

ate them and avoid future consequences can gain public support. Without scientific knowledge, citizens cannot know what to protect. And fixing aquatic degradation is always far more time consuming and expensive once the damage is done. Ask lakeshore property owners from New York to Washington state where there is a long history of "fixing" public health threats in lakes - to the tune of millions of dollars per community.

Everyone loves the lake for its relatively "natural" condition. If we plan to enjoy this condition in the future, we must be vigilant. Understanding and enhancing the processes that allowed the lake to take care of itself for the past 8,000-10,000 years is a good place to start. This requires data collection and scientific analysis followed up with professional assessment. At that point, best management practices can be implemented but only if we have the knowledge and scientific competency to "buy in."

Obviously the most cost effective best management practices are those that are *preventative* in nature. In other words, why create a problem if you can avoid it? We just need to know what to avoid...Zebra mussels anyone?

One hundred years from today I hope that this "priceless" resource is in as good or better condition than we enjoy today. The chemical, physical, and biological quality of the lake depends on our knowledge *and* emotional value system to protect it.

Really...what is Whitefish Lake worth?



ERICA PICHETCHAIYAKUI
Co-Owner, Sunti's World Art Gallery

It's no wonder that the aesthetic charm of Whitefish Lake is an artist's muse. Its fresh, pristine waters surrounded by vast, authoritative mountains conjure an emotional and mesmerizing affinity with nature, and summon a humbling reminder of our higher power. Indeed, Whitefish Lake is the subject of many beautiful photographs and paintings, and a destination where sculptors can draw equal inspiration from the Lake's sheer beauty and magnificence.

It is this creative stimulation that attracts Thai sculptor, Sunti Pichetchaiyakul, to Whitefish Lake, where the mindfulness he experiences prepares him for his sculpting sessions at his studio in downtown Whitefish.

"It's an earthly paradise.... our favorite way to wind down and appreciate life. Every visit is a spiritual journey for me; a step closer to self-discovery."

Sunti's kinship with the tranquil waters of Whitefish Lake are reflective of his Theravada Buddhist culture, where water is symbolic of clarity, purity, and stillness. Buddhist legends make frequent analogies of awakening and introspection through the reflection of water, and depict tales of ascetics acquiring wisdom by listening to a river. In fact, Buddhist temples are often surrounded by lakes or ponds and garnished with lotus flowers to bring peace to its residents and visitors.

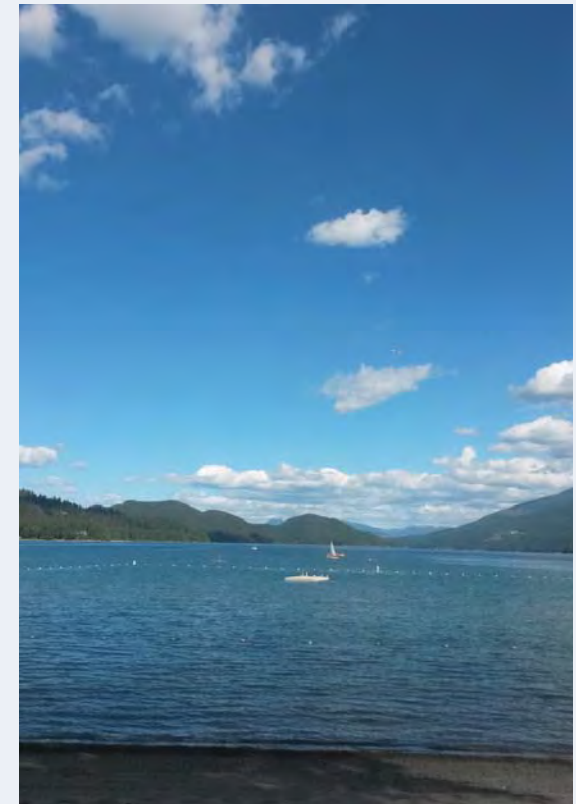
As an art student in Thailand, where Sunti was trained in meditation, the development of patience, concentration, and inner calmness is still embraced among visual artists. Sunti learned that mindfulness is the portal to creativity as well as the method for refining one's awareness and attention to detail. It is this training that, for Sunti, is enhanced before a placid body of water.

"Whitefish Lake is an artist's sanctuary," Sunti explains. "It is rejuvenating and serene. It allows me to experience presence, where I can take a step back and put life back in perspective."

Sunti articulates that his ability to create is contingent upon a blissful state of mind. Over the last five years, Sunti's schedule has become a densely-packed balancing act between Asia and North America, and he turns to Whitefish Lake to fuel his artistic energies. The sculptor admits that being mindful amid international travel and bustling cities is a never-ending challenge. Naturally, Sunti is always relieved to return to Whitefish, where he is proud to call home, and restore his inner peace at beautiful Whitefish Lake.

Yet apart from revitalizing his artistic mind, Sunti imparts that the highlight of his summers is wrapped around the Lake, where he and his family enjoy swimming, canoeing, sunset picnics, and Fourth of July fireworks. Indeed, the Pichetchaiyakul family escapes from it all by cycling just a few miles to the Lake.

"It is imperative that this precious, picturesque jewel be treasured and preserved so that it may continue to instill inner peace and inspiration in our children for many generations to come."



Whitefish Lake. Photo courtesy Lori Curtis

COOL STUFF

WLI has several items available that are fun to own and that make great gifts. We welcome visitors to our office to purchase items or pick up free material and avoid shipping costs. Please remember to call first as we are often in the field conducting research and running educational programs. You may also order all of these items on our website www.whitefishlake.org – just click on Cool Stuff.



Whitefish Lake Institute License Plate

Your purchase of a Whitefish Lake Institute plate will provide you with a beautiful license plate and will support the only organization that's sole purpose is protecting Whitefish Lake. This specialty plate may be used on any registered vehicle with the exception of trailers, motorcycles and ATVs. Available only at Flathead County vehicle registration for **\$25** plus a **one-time \$10 fee** to cover administration costs.

Bathymetric Map of Whitefish Lake

This map is the submerged equivalent of a terrestrial topographic map. It presents an accurate, measurable description as well as a visual presentation of the submerged terrain.

\$15 plus \$3 shipping



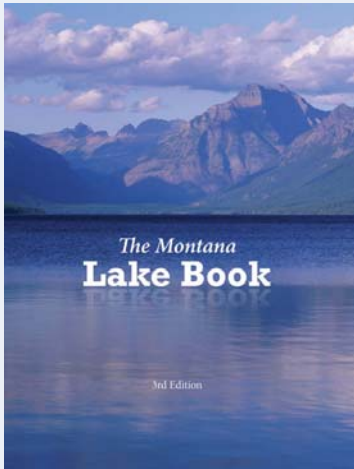
Whitefish Lake Map

The Whitefish Lake map was produced in cooperation between WLI and the Flathead Lake Biological Station. This beautifully detailed and richly colorful 18"x24" map is based on satellite imagery. It communicates many natural features such as nearby lakes, the Whitefish River outlet, and Whitefish Lake's six tributaries; as well as Whitefish Mountain Resort, boat launches on the lake, and the City of Whitefish.

All proceeds from map sales go toward WLI's ongoing research, education, and community stewardship programs.

\$25 plus \$3 shipping

MORE COOL STUFF!!



Montana Lake Book

This beautiful, full-color book is a great resource about how lakes function, what threatens their health, and how they can be protected. The publication was funded by partners including the Flathead Basin Commission, Flathead Conservation District, Flathead Lake Biological Station, Flathead Lakers, Flathead National Forest, Montana Department of Environmental Quality, Montana Fish, Wildlife & Parks, and the Whitefish Lake Institute.

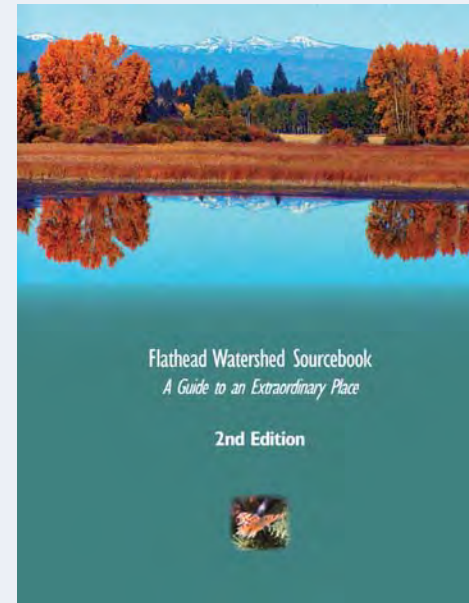
Free plus \$3 shipping



Protect Whitefish Lake Bumper Stickers

The attractive stickers read “Protect Whitefish Lake: You Drink it” and include the WLI logo and web address.

Free plus \$.50 shipping



Flathead Watershed Sourcebook

A 248 page book filled with photos and details of the geography, cultures, natural history and economics of the Flathead Watershed. Over 50 contributors provided personal content for this interesting place-based publication.

Free plus \$7.00 shipping

Flathead Watershed Sourcebook CD

CD of the 248 page book filled with photos and details of the geography, cultures, natural history and economics of the Flathead Watershed. Over 50 contributors provided personal content for this interesting place-based publication.

Free plus \$2.50 shipping



