

Natural Features

In Michigan communities, especially those surrounded by the Great Lakes, the management of natural resources is essential to the well-being of residents and a prospering local economy. Leelanau Township has a wealth of natural resources, the Lake Michigan shoreline, towering sand dunes, forests, and wetlands. This chapter investigates the community's key natural resources and sets a broad course of action for their continued management.

Water

The prominence of Lake Michigan in the Township and the several inland lakes underscore the importance of water assets. Water assets include lakes, streams, and wetlands. The continued preservation and access to the water assets of Leelanau Township are vital to the future health of the Township and residents agree. When surveyed, 99% of respondents agreed that Lake Michigan is an asset to the community with 92% of those strongly agreeing.

Watershed

A watershed is a geographic basin of water drainage defined by high points in topography and because water and topography does not follow municipal boundaries municipalities are often in more than one watershed. Therefore, land use and pollutants in one watershed can impact multiple communities. This cross-jurisdictional relationship underscores how critical it is to consider how land use impacts water quality because the outcomes of those decisions impact more than just Leelanau Township.

Leelanau Township is separated into two watersheds, the Betsie-Platte and



Map XX: Sub-Watersheds

Boardman-Charlevoix.¹ These watersheds are large areas of drainage, encompassing millions of acres. For example, the Boardman-Charlevoix Watershed’s easternmost point is in Leelanau Township but stretches up to Mackinaw City. Coordinating land use within these large watersheds presents a challenge of geographic scope, but each watershed has defined sub-watersheds within it. Sub-watersheds are smaller drainage basins and are easier to coordinate planning and land use because of their small geographic size. Three sub-watersheds cross Leelanau Township’s boundaries, Shalda Creek, Houdek Creek-Lake Leelanau, and Belangers Creek.² Of these watersheds, two drain into Lake Michigan (Belangers and Shalda) and one drains into Lake Leelanau (Houdek). Map XX: Sub-Watersheds show the three sub-watersheds in relationship to Leelanau Township.

Each of the three watersheds is covered by different watershed protection plan or watershed management plan. A summary of the three plans by watershed is detailed in table XX: Watershed Plan Summaries

	Lake Leelanau Watershed Protection Plan ³	Good Harbor Bay Watershed Protection Plan ⁴	Grand Traverse Bay Watershed Protection Plan ⁵
Watershed	Houdek Creek	Shalda Creek	Belangers Creek
Threats	Loss of habitat, invasive species, nutrient loading	Loss of habitat, invasive species, nutrient loading, altered hydrology	Sediment, nutrient loading, altered hydrology, loss of habitat
Desired Uses	Recreation, aesthetics, human health, ecosystem preservation	Recreation, aesthetics, human health, ecosystem preservation	Recreation, aesthetics, ecosystem preservation
Goals	Protect ecosystems, protect and improve water quality, establish and promote BMPs ⁶ , preserve recreation, establish education programs,	Protect ecosystems, protect quality and quantity of water resources, preserve recreation, promote stewardship, protect public health, protect economic vitality	Protect ecosystems, protect and improve water quality, establish and promote BMPs, preserve and enhance recreation, establish education

¹ “Watershed Boundary 8-Digit”, Michigan Open Data Portal, <https://gis-michigan.opendata.arcgis.com/datasets/egle::watershed-boundary-8-digit/explore?location=44.921595%2C-86.135708%2C7.01>

² “Watershed Boundary 12-Digit”, Michigan Open Data Portal, <https://gis-michigan.opendata.arcgis.com/datasets/midnr::watershed-boundary-12-digit/explore?location=44.899150%2C-85.195550%2C6.82>

³ “Lake Leelanau Watershed Protection Plan”, The Leelanau Conservancy, https://www.michigan.gov/documents/deq/deq-wrd-lake-leelanau-wmp_349239_7.pdf

⁴ “Good Harbor Bay Watershed Protection Plan”, The Leelanau Conservancy, https://www.leelanauconservancy.org/wp-content/uploads/2012/03/Part-1-GHBWatershed-Plan_State-Approved-2016-no-appendices.pdf

⁵ “Grand Traverse Bay Watershed Protection Plan”, The Watershed Center, <https://www.watershedcouncil.org/uploads/7/2/5/1/7251350/gtbayplan2005.pdf>

⁶ BMP is an acronym for Best Management Practices. The specific BMPs are described in the watershed plan.

	preserve watershed character		programs, preserve watershed character
Recommendations applicable to Leelanau Township	Adopt sewer and water provisions, wetland preservation, soil erosion control measures	Adopt sewer and water provisions, wetland preservation, soil erosion control measures	Decrease impervious surfaces, smart growth

Table XX: Watershed Plan Summaries

Common threats in all three watersheds as specified in their respective plans include habitat loss, invasive species, and nutrient loading. To mitigate the threats in each watershed and to achieve the goals specified in each plan recommended actions include adopting water and sewer provisions, wetland preservation, soil erosion control, and decreasing impervious surfaces. The recommendations from all three watershed management plans have been incorporated into the broader recommendations of this master plan.

Water Quality

Maintaining and improving water quality is essential to the public and environmental health, local tourism economy, and future growth of the Township. Because so many residents rely on groundwater as their source of water, pollution and contamination in the groundwater is a threat to public health. Additionally, Leelanau County is known for its pristine water assets, tourists are drawn to the water for recreation such as swimming and boating. Degradation of the water quality could pose a threat to the tourism industry as the area would not be as desirable with lesser water quality. Every two years the Michigan Department of Environment, Great Lakes, and Energy (EGLE) creates an EPA integrated assessment of all water bodies and features in Michigan. This report highlights any water features that are at risk of contamination and what water-based activities are prohibited due to the contamination. Table XX highlights the status of the three sub-watersheds in Leelanau Township based on the 2018 integrated assessment report.⁷ As shown in table XX, the activities that were assessed in the report were all “fully supporting”, indicating that there was no contaminant threat to the continuation of activities.

Designated Use	Belangers Creek	Houdek Creek	Shalda Creek
Warm water fishery	Not assessed	Not assessed	Not assessed
Cold water fishery	Not assessed	Not assessed	Not assessed
Fish consumption	Not assessed	Not assessed	Not assessed
Agriculture	Fully supporting	Fully supporting	Fully supporting
Industrial water supply	Fully supporting	Fully supporting	Fully supporting
Navigation	Fully supporting	Fully supporting	Fully supporting
Total body contact	Not assessed	Not assessed	Not assessed
Partial body contact	Not assessed	Not assessed	Not assessed
Other indigenous aquatic and wildlife	Fully supporting	Fully supporting	Fully supporting

Table XX: Designated use assessment by sub-watershed

⁷ “Water Quality and Pollution Control in Michigan”, Michigan Department of Environment, Great Lakes, and Energy, November 2019, https://www.michigan.gov/documents/egle/wrd-sw-as-ir2018-pndraft_659286_7.pdf

Potential pollutant threats to water quality can either be classified as a point source or a nonpoint source pollutant. Point source pollutants are pollutants that originate from one singular location such as a factory. Non-point source pollutants cannot be tied to one location but still pose a threat to water quality, such as urban stormwater runoff. Map XX: Water Resources highlights two types of potential point source pollutant locations. The National Pollutant Discharge Elimination System (NPDES) requires activities that discharge to a water body to register with the state environmental agency and undergo regular monitoring and testing.⁸ There is one facility registered in Leelanau Township under the general NPDES program and an additional facility registered under the NPDES groundwater program. Both of these facilities are permitted by the State to discharge to water. Since their permits have been granted neither facility has committed an environmental violation indicating that their activity is not exceeding the regulations imposed by the State.⁹ These two facilities are currently not threatening the water quality in Leelanau Township. Two additional NPDES facilities are located in the Village of Northport.

Wellhead Preservation Areas

Groundwater is the primary source for public drinking water systems and private wells in most Michigan communities. To promote high-quality drinking water, EGLE administers the Wellhead Protection Program (WHPP). The WHPP requires participating communities to comply with a set of standards to reduce contamination risk in their groundwater. Key to the success of this program are wellhead protection areas (WHPAs). WHPAs are defined as a 10-year travel distance for contaminants around the wellhead. Therefore, the edge of the wellhead protection area is the distance it would take a contaminant to travel to the wellhead over 10 years.¹⁰

As shown on the map “Water Resources”, there are three WHPAs in Leelanau Township, two of which are delineated around wells in the Village of Northport. The two Northport WHPAs cross into Leelanau Township so land use decisions and potential environmental contamination in the Township will impact the Village. To assist communities with their remediation efforts EGLE provides matching grant funding for those communities who enroll in the WHPP. Leelanau Township does not currently participate in the WHPP but doing so would ensure the quality of the Township’s and Northport’s groundwater. The third WHPA, that is delineated around a well in Leelanau Township, is for a private water well servicing Northport Point, a golf course and club. This well receives WHPA delineation from EGLE because of the number of people it supplies water to.

TOST Inspection Ordinances

Due to the rural nature of Leelanau Township, most residents rely on private groundwater wells and septic systems for their water supply and wastewater discharge. Denser communities, such as the Village of Northport, rely on municipal water and wastewater systems as opposed to individual systems. While private water/wastewater systems do not inherently pose a risk, aging systems can experience failure and release biological contamination into the surrounding area including into the

⁸ National Pollutant Discharge Elimination System, Michigan Department of Environment, Great Lakes, and Energy, https://www.michigan.gov/egle/0,9429,7-135-3313_71618_3682_3713---,00.html

⁹ MiWaters, Michigan Department of Environment, Great Lakes, and Energy, <https://miwaters.deq.state.mi.us/nsite/map/results>

¹⁰ “Wellhead Protection”, Michigan Department of Environment, Great Lakes, and Energy, https://www.michigan.gov/egle/0,9429,7-135-3313_3675_3695---,00.html

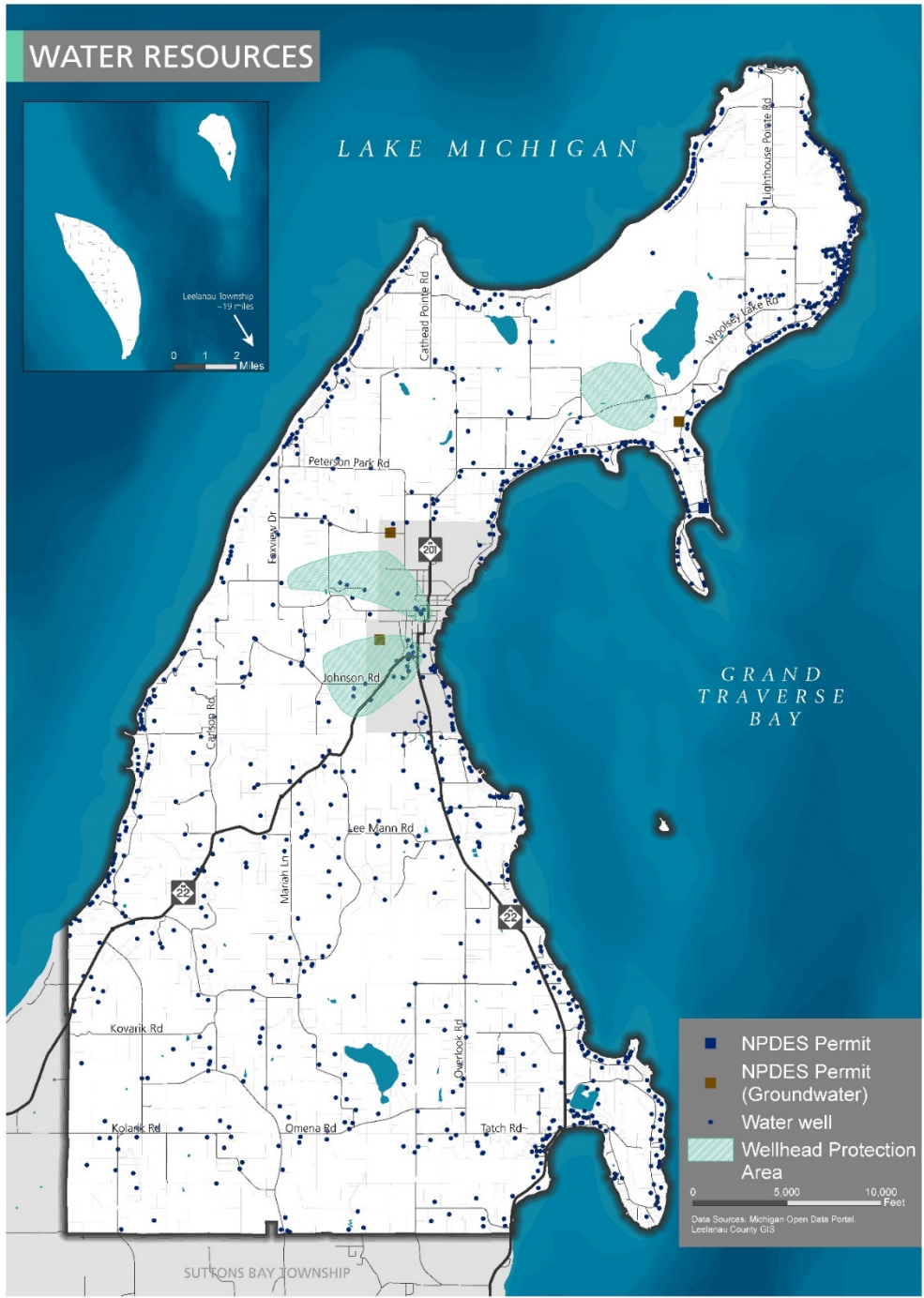
nearby groundwater or surface water. Leakage can be exacerbated by heavy participation and as storms become more severe and frequent, private systems are an increasing threat to water quality.¹¹ While there is no state database for private septic systems, wells are tracked by EGLE. The “Water Resources” map shows the location of all water wells in the Township, it can be assumed that each well also has a septic system nearby.

Currently, Michigan is the only state in the U.S. that does not have a statewide septic code meaning that each local health department is responsible for septic codes and inspections.¹² Additionally, there is no existing mechanism in Leelanau Township for septic or well systems to be inspected. Often when a property is sold the buyer can request an inspection of the well and septic system, but an inspection is not required in the property sale/transfer process. However, local communities do have the authority to adopt police power ordinances that require inspections of the well and septic system when a property is transferred to a new owner. These ordinances are commonly referred to as Time of Sale or Transfer (TOST) Inspection Ordinances. Three townships in Leelanau County have adopted TOST ordinances, Empire, Glen Arbor, and Cleveland, in addition to the Village of Empire which does not have a municipal septic system.¹³ TOST Inspection Ordinances offer an additional layer of protection over local water resources. When surveyed, a majority of respondents (67%) agreed that Leelanau Township should adopt a TOST Ordinance and only a small minority (11%) disagreed.

¹¹ “A Changing Climate: Managing Water for Health”, Michigan Department of Health and Human Services, https://www.managingwaterforhealth.org/wp-content/uploads/Managing_Water_for_Health_March-5.pdf

¹² “Managing Water for Health”, Michigan Department of Health and Human Services, https://www.managingwaterforhealth.org/wp-content/uploads/Managing_Water_for_Health_March-5.pdf

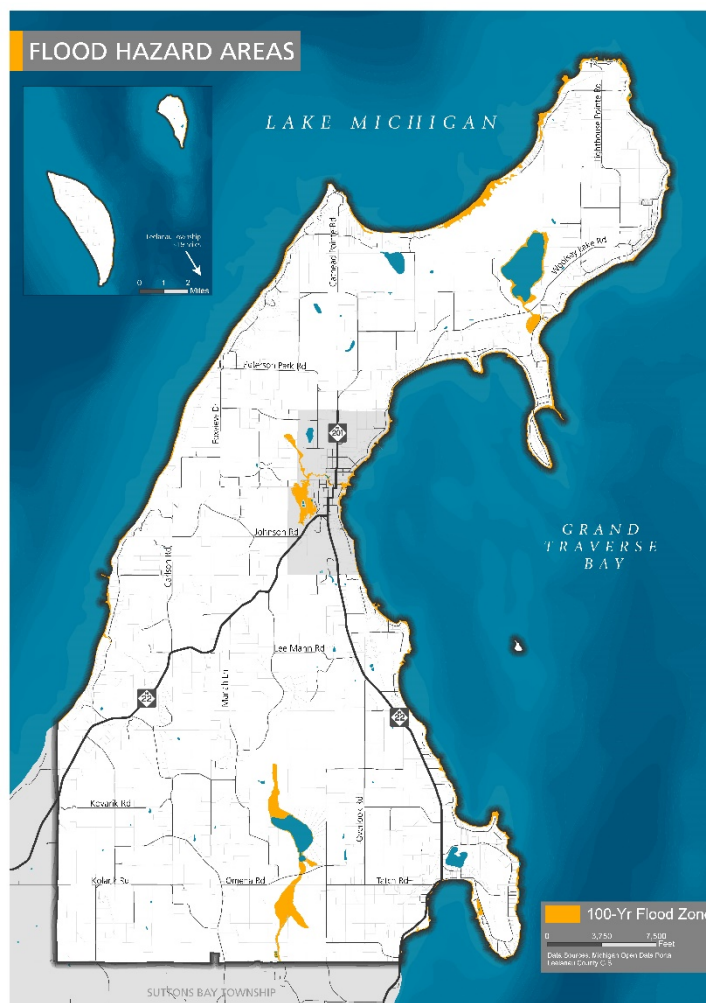
¹³ Ibid.



Map XX: Water Resources

Flooding

As natural areas are developed by structures and impervious surfaces flooding becomes more frequent and severe. Flooding is a natural process where the volume of water moving through streams and lakes exceeds the capacity of those features. To help communities understand what areas are at risk of flooding the Federal Emergency Management Agency (FEMA) designates flood hazard areas. These areas generally fall into one of three categories, the floodway, the 100-year flood area, or the 500-year flood area.¹⁴ The floodway is the channel directly adjacent to a body of water that is above water during periods of normal water elevation. The fringe areas of the floodplain (the entire area at risk of flooding) are either the 100-year flood area or the 500-year flood area (see figure XX: floodway v. floodplain). These areas would be inundated with water during a 100-year or a 500-year flood event. In other terms, land in the 100-year flood area has an annual flood risk of 1% and land in the 500-year has an annual risk of 0.2%. However, as precipitation events become more frequent and more severe the number of 100-year and 500-year storms will increase as will the annual risk of flooding. As evident by the “Flood Hazard Areas” map, there is relatively inland little flood risk in Leelanau Township. The inland areas that are within the 100-year flood plain are undeveloped and contained to wetlands and streams.



Map XX: Flood Hazard Areas

¹⁴ “Flood Zones”, Federal Emergency Management Administration, <https://www.fema.gov/glossary/flood-zones>

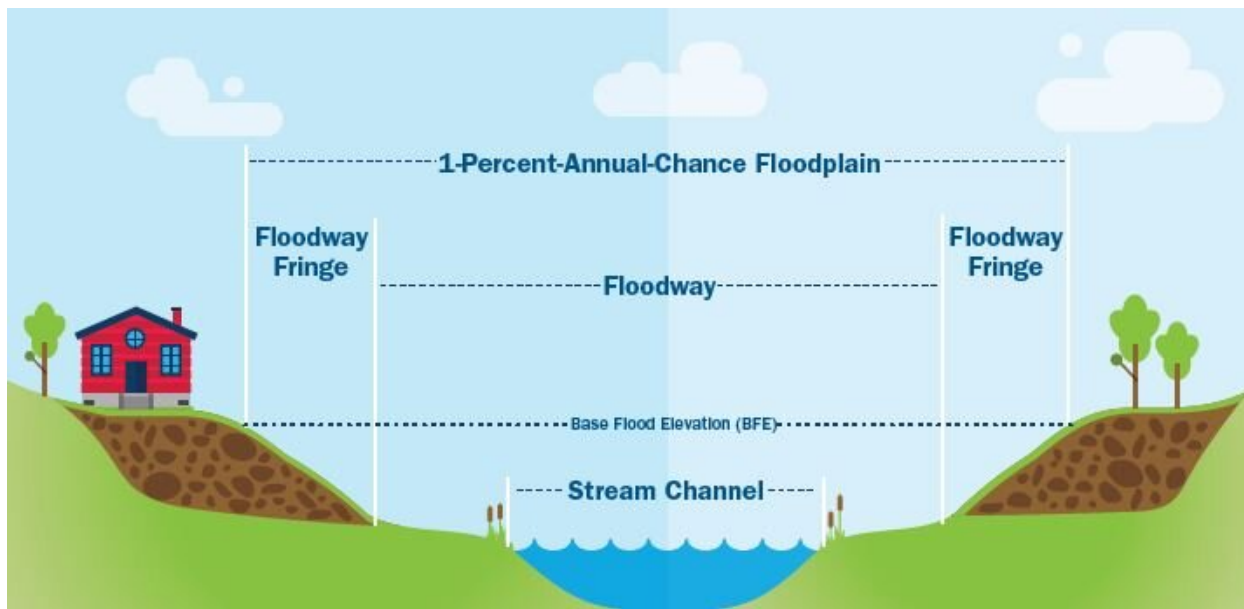


Figure XX: Floodway v. floodplain¹⁵

Coastal Flooding

As opposed to inland flooding which is a result of heavy precipitation and surface water flowing over land, coastal flooding is a result of extreme wave action and storm surges. Coastal flooding presents many challenges and threats to coastal assets, properties, and infrastructure. The following chapter Coastal Resiliency explores the dynamics of coastal flooding and highlights that coastal flooding is more of a threat to Leelanau Township than inland flooding.

¹⁵ Floodway v. floodplain, Tulsa Engineering & Planning, <https://www.tulsaengineering.com/our-news/2021/1/22/floodway-vs-floodplain>

Land

Wetlands

Wetlands are one of the most valuable and sensitive natural features in Michigan due to the ecosystem services that they provide. Wetlands have the ability to absorb excess water and act as a filtration device. They capture water flowing over the land and slowly infiltrate it into the groundwater. Wetlands also provide a unique ecosystem habitat for flora and fauna that cannot live in other types of ecosystems making them essential for the healthy biodiversity of a community.¹⁶ Wetlands also provide recreational benefits, especially when incorporated into larger recreational areas.

There are two main types of wetlands, freshwater emergent wetlands and shrub/forested wetlands. The distinction between the two wetlands is made based on the amount/type of vegetation and the water saturation of the soil. Table XX: Wetlands outlines the types and sizes of wetlands in Leelanau Township.

MICHIGAN MONKEY FLOWER

The Michigan monkey flower is an endangered species in Leelanau County. The plant can be found in wetlands and cold flowing streams. Therefore, wetland preservation and restoration are key to the survival of the species.



Wetland Type	Acres	Percent of Total
Freshwater Emergent	119.2	6%
Forested/Shrub	1,921.0	94%
Total of Existing	2,040.0	-
Restorative Wetlands	1,697.4	-
Total	3,737.6	-

Table XX: Wetlands¹⁷

In addition to identifying existing wetlands, EGLE also identifies areas where wetland restoration is feasible. Areas where wetlands were historically located and have since disappeared, likely due to agricultural or residential development, are considered restorative. As table XX shows, almost half of the Township's wetlands have disappeared, making their continued preservation a priority. Currently, 26% of the Township's wetlands are in public or conservancy land indicating that the majority of wetlands are not under preservation ownership and can still be developed.¹⁸ However, developing in a wetland over 5 acres requires a permit from EGLE. The Township does have the authority to adopt regulations on wetlands beyond State protections. While the Township's sensitive features ordinance does cover wetlands it could be strengthened by adding setback requirements from all wetlands, regardless of size. In the community survey residents expressed a

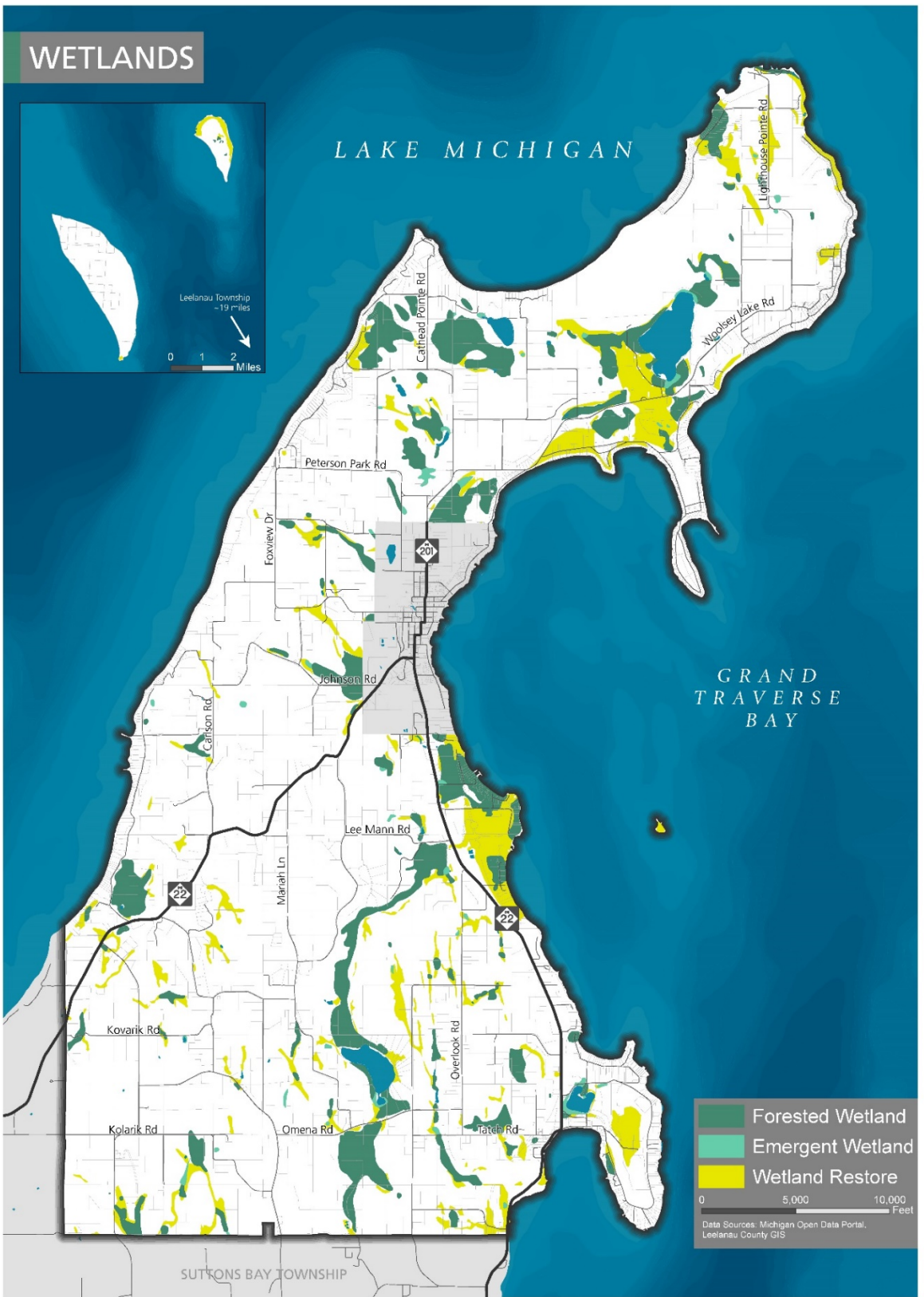
¹⁶ *Wetland Identification and Delineation*. Tip of the Mitt Watershed Council, www.watershedcouncil.org/wetland-identification.html.

¹⁷ "National Wetland Inventory 2005", Michigan Open Data Portal, <https://gis-michigan.opendata.arcgis.com/datasets/egle::national-wetland-inventory-nwi-2005/explore?location=44.729900%2C-86.315500%2C7.00>

¹⁸ Leelanau County Equalization Department, <https://www.leelanau.gov/equalization.asp>

desire for additional setback requirements with 29.5% desiring increased wetland setbacks, 29.9% expressing no opinion, and 22.4% stating that the current regulations are adequate. An additional 18.2% were unsure.

DRAFT



Map XX: Wetlands

Forests

One of the greatest environmental assets is trees. Trees have countless benefits from improving air quality to reducing stormwater runoff. The United States Department of Agriculture (USDA) assesses the forests in each sub-wetland nationwide. This assesses the importance of the forests to the production of water, the quality of water produced, and potential future threats to the forest. Table XX highlights a few key statistics from the USDA.¹⁹

	Belangers Creek	Houdek Creek	Shalda Creek
Percent forest cover	47.16%	38.02%	59.07%
Percent of forest cover that is protected	3.47%	1.26%	20.00%
Ability to produce clean water	33 / 100	53 / 100	63 / 100
Importance of forests to drinking water	76 / 100	0 / 100	77 / 100
Percent of forest at risk from insect and disease	2%	2%	5%
Percent of forest at risk from development by 2040	29.6%	25.1%	21.4%

Table XX: Forests to Faucets key statistics

As shown in table XX, there is a strong relationship between the forests and water. The forests in both Belangers and Shalda Creek sub-watershed have high importance to the drinking water, yet relatively little forest land is protected. The greatest threat to the forests in each of the watersheds is development pressure. By 2040 almost a quarter of the forests in each of the sub-watersheds could be gone. This presents a challenge for the continued health and quality of the ground and surface water, which so many residents rely on. Non-profit organizations, such as the Leelanau Conservancy, play an important role in the preservation of natural features by purchasing land and holding it in a state of continued preservation. Other strategies to preserve the forests include conservation easements with individual property owners or regulations that limit the number of trees that can be cleared or mandate planting requirements.

Coastlands

The coastland is one of Leelanau Township's most unique features, but it is also the most sensitive natural features. The development pressure, rising lake levels, and erosion all threaten the long-term stability of the coastland. The following chapter Coastal Resiliency provides a more in-depth look at the challenges along the coast.

Dunes

The symbol of Northern Michigan living, sand dunes are an important part of the identity and function of the area. Leelanau Township has 10,664 acres of dunes, all of which are classified by

¹⁹ Forests to Faucets, United States Department of Agriculture, https://www.fs.fed.us/ecosystemservices/FS_Efforts/forests2faucets.shtml

the Michigan Department of Environment, Great Lakes, and Energy (EGLE) as critical dunes.²⁰ Critical dune status means that the dunes are regulated under the Natural Resources and Environmental Protection Act. Development in a critical dune requires obtaining a permit from EGLE in addition to fulfilling local regulations. Despite State protection, local governments have the authority to adopt stronger preservation regulations.

Leelanau Township has two of the three dune types, dune fields, and parabolic dunes. The map “Dunes” shows the location of the dunes in Leelanau Township. Within each dune type, dunes can be vegetated or perched. Vegetated indicating a presence of vegetation and perched indicating the dune is located on steep slopes.

Dune fields are classified as the transition between other dune types. Characteristics of a dune field include large, elevated dunes with relatively little elevation variation within the dune field. The Dune Climb in Sleeping Bear National Lakeshore is an iconic example of a dune field, see figure XX. These dunes are one of the rarest types of dunes. Unlike other dune types, dune fields are more resistant to erosion however wind erosion can still present a challenge to property owners near dunes fields, as sand blowing off the dune can bury infrastructure or other structures.²¹



Figure XX: Sleeping Bear Dune Climb. Source: Wapiti Travel

Parabolic dunes were formed by strong winds or storms depositing large amounts of sand along stabilized sand dunes. Parabolic sand dunes are some of the most common dunes in Northwest Michigan and are characterized by high ridges that are vegetated with grasses, shrubs, and trees, see figure XX. Parabolic dunes are always changing, presenting a challenge for development and infrastructure in the parabolic dunes.²²

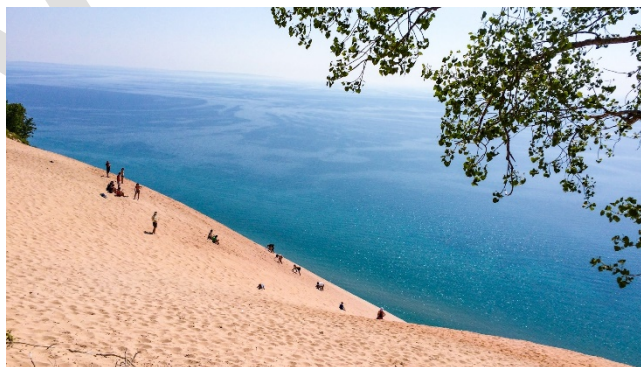


Figure XX: Pierce Stocking Dune Overlook. Source: Conde Nast

Development should be discouraged in parabolic dunes to preserve natural beauty and integrity. However, if development does occur in parabolic dunes, rigorous site plan standards should be applied to ensure that the development accounts for the shifting dune and will not adversely impact the natural landscape.

²⁰ “Critical Dunes”, Michigan Open Data Portal, <https://gis-michigan.opendata.arcgis.com/datasets/egle::critical-dune-areas/explore?location=44.605000%2C-86.505200%2C7.38>

²¹ “Planning for Coastal Resiliency in Northwest Michigan’s Dunes”, Networks Northwest, <https://www.networksnorthwest.org/userfiles/filemanager/5808/>

²² Ibid.

One strategy to preserve dunes is the adoption of zoning regulations that balance development and environmental preservation. Leelanau Township's Environmental Sensitive Areas section of the zoning ordinance has strict requirements for developing in the designated sensitive dunes. The ordinance determines setbacks from shoreline by the bluff height and grade. These setbacks are

83% of those surveyed agreed or strongly agreed that Leelanau Township should be more aggressive/proactive in protecting sand dunes and bluffs.

intended to protect the stability of the bluff and reduce erosion. Additionally, the ordinance requires developments of three or more residences in an environmentally sensitive area to go through an environmental review. It is recommended that this is reduced to one residence to ensure that all development on dunes goes through an environmental review by the Planning Commission.

Coastal Zone Management Program

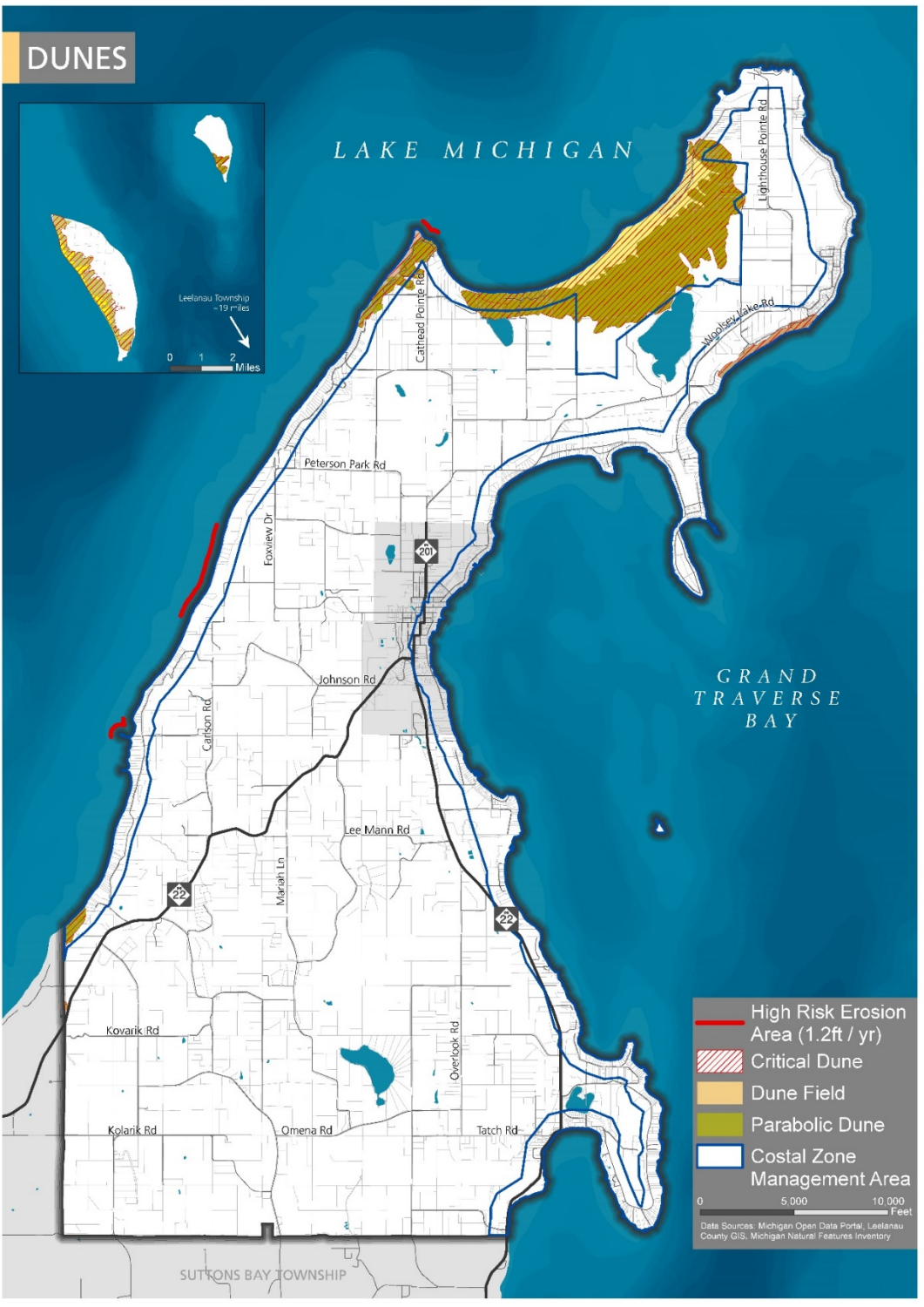
The Coastal Zone Management Program (CZMP) was established in 1978 and provides technical assistance and grant funding for coastal communities. Generally, 1,000ft inland from the shoreline is considered to be under the purview of the CZMP however other high value coastal lands may be covered under the CZMP. The "Dunes" map shows which areas in Leelanau Township are under the jurisdiction of the CZMP.²³ The CZMP offers funding support for five focus areas:

- Improving public access,
- Community development,
- Habitat restoration/preservation,
- Water quality, and
- Hazard mitigation.

Any projects that Leelanau Township will pursue in the future that fall under one of the focus areas and are within the CZMP boundary are eligible for matching grant funding from the CZMP. Potential projects include beach improvement and stabilization and additional coastal planning. Leelanau Township should aggressively pursue CZMP funding when the opportunity arises. Projects receiving funding in 2021 include the St. Clair Waterfront Redevelopment Plan (\$25,000), Weko Beach Dune Restoration and Stabilization (\$75,000), Grand Haven Lighthouse Restoration (\$37,879).²⁴

²³ "Coastal Zone Management Areas", Michigan Open Data Portal, <https://gis-michigan.opendata.arcgis.com/datasets/egle::coastal-zone-management-areas/explore?location=44.921595%2C-86.135708%2C7.01>

²⁴ 2021 Grant Awards, Michigan Coastal Zone Management Plan, https://www.michigan.gov/documents/egle/wrd-cm-2021-Coastal-Grants-Awarded_723785_7.pdf



Map XX: Dunes

Dark Sky

The term “dark sky” refers to a place where the stars and night sky are vibrant and extremely visible. Light pollution from urban areas and artificial light sources decreases the night sky visibility

making it harder to view the stars. The majority of the Township is in the “rural sky” class of the Bortle Dark Sky classification.²⁵ Complex galactic structures and stars are visible in this class and light pollution is only evident on the horizon (see figure XX). Given the Township’s current level of development the dark sky cannot be improved from its current state. Dark sky measures should be focused on preserving the current level of sky darkness. Where the Township borders Northport the dark sky classification decreases to a “rural/suburban transition” classification. The light pollution from Northport decreases night sky visibility and only large galactic structures are visible. Reducing the impact of light pollution in and around Northport will require coordination with the Village. When surveyed, 81% of respondents agreed that Leelanau Township should continue with its dark sky preservation.

Common strategies to reduce light pollution include adopting lighting ordinances that specify what exterior lights are permitted. While the Village and Township have mention of reducing light spillage in their respective zoning ordinances the ordinances do not specify lighting fixture or bulb types, adding these specifications or adopting a separate lighting ordinance would strengthen dark sky protection. The International Dark Sky Association has model ordinances and other resources that can be used to draft impactful light pollution control regulations.



²⁵ Falchi, F., “Supplement to the New World Atlas of Artificial Night Sky Brightness. GFZ Data Services. <https://www.lightpollutionmap.info/#zoom=5.94&lat=45.0772&lon=-81.9066&layers=B0FFFFFFTTTTTTTTTT>

Figure XX: Bortle Dark Sky Classifications²⁶

Actions

- Strengthen wetland preservation by adopting a wetland setback requirement in Section 15.5 Special Requirements of the Township Zoning Ordinance.
- Assess the need for enrollment in the Wellhead Protection Program through the Michigan Department of Environment, Great Lakes, and Energy.
- Adopt a TOST Inspection Ordinance.
- Continue to work with the Leelanau Conservancy to identify properties for preservation
- Explore the inclusion of tree preservation language in the zoning ordinance.
- Aggressively pursue funding from the Michigan Coastal Zone Management Program for applicable projects.
- Reduce Section 15.6(B)(1) Environmental Review and Assessment – Initial Environmental Review requirements from developments of three (3) or more residences to one (1) or more residences in the Township Zoning Ordinance.
- Collaborate with Northport on strengthening light pollution control measures such as adopting a light ordinance.

²⁶ Brian Devonshire, “Make Rim Country a Dark Sky Community”, <https://www.briandevonshire.com/blog/rim-country-dark-sky>