

## Appendix B

# ENVIRONMENTAL FEATURES

### Geology & Topography

During the Paleozoic era of geological history, Huron County and the state as a whole was inundated by successive warm, shallow seas during which large amounts of sediment were deposited. These deposits subsequently lithified to form bedrock. Lake Township sits upon two principal bedrock formations, generally defined by a diagonal line extending from its northwest corner to the southeast corner. The Marshall Foundation is the primary bedrock to the southwest of this diagonal line, and the Michigan Formation is the primary bedrock to the northeast. The Michigan Formation bedrock is comprised principally of shale, along with interbedded sandstone, limestone, dolomite and anhydrite. The Marshall Formation is comprised principally of sandstone. The Ice Age brought four successive continental glaciers across the Great Lakes area. As these ice sheets moved southward from Canada, they scoured and abraded the surface of the land leaving behind deeper valleys and more rounded hilltops. The advancing glaciers carried large quantities of rock materials scraped and gouged from the land's surface. These materials were then deposited during the melting of the ice to form drift materials covering the bedrock below. While the depth to bedrock exceeds 800 feet in some parts of Michigan, the depth of the drift layer in Lake Township does not typically exceed 40' in depth.

The topography of Lake Township can be described as level to nearly level, exhibiting grades of 6% or less with isolated areas where the topographic relief is more evident. Those areas exhibiting greater topographic relief are principally along segments of the Lake Huron shoreline and within 500' of the shoreline, where grades frequently approach 10% to 15%.

The township ranges from approximately 580' to 625' above sea level, with the majority of the township being 600' to 620' above sea level. Generally, the township's surface elevation falls as one moves south to north toward Lake Huron, and all water courses in the township drain to the north into Lake Huron. . The approximate mean Lake Huron elevation is 581 feet above sea level.

The character of an area's geology and topography has bearing on development and land use planning. As surface grades increase in severity, significant challenges arise for septic systems and there is an increased potential for soil erosion and sedimentation of water courses and wetlands. Construction costs frequently increase as well. Slopes exceeding 7% present special challenges in this regard. It is generally recommended that development be restricted in intensity where grades exceed approximately 12%, and be strongly discouraged where grades exceed 18%.

## Drainage and Water Courses

Drainage in Lake Township is facilitated by several systems. Perhaps most significantly is the very permeable nature of its sandy and gravelly soils that dominate in its northern half, allowing rainwater to seep into the ground below. Much of the surface runoff that does occur finds its way to one of two major wetlands. Rush Lake, near the center of the township, is comprised of about 100 acres of open water and approximately 1,350 acres of wetlands. A second wetland extends more than two miles long to the north and northeast of Rush Lake and includes approximately 1,400 acres of wetlands. Rush Lake is the only lake in the township in excess of ten acres, excluding Lake Huron.

Also facilitating drainage are the township's two primary drainage courses – the Pigeon River and Pinnebog River. The Pigeon River cuts through the southwest tip of the township before exiting one-half mile north of W. Kinde Road and flowing to Caseville where it empties into Lake Huron. The Pinnebog River travels along the township's east edge before it exits a quarter mile south of McIlhargie Road and flows northeast before emptying into Lake Huron at Port Crescent State Park.

Lands abutting or in close proximity to drainage courses are subject to flood conditions where the drainage courses do not have the capacity to accommodate the rate of runoff from a single heavy rainfall or numerous lighter rainfalls over a relatively short period of time. Serious flooding has not been an occurrence in Lake Township. This is due in large part to the comparatively limited development (impervious surfaces) throughout most of the township, the presence of Lake Huron adjacent to those areas most heavily developed, and the network of drainage courses and wetlands that carry and store runoff. The Federal Emergency Management Agency (FEMA) completed a floodplain study for the Lake Township and surrounding areas in 2008. The study identifies those areas of the township that are subject to a flood event that has a 1% chance of happening in any single year, commonly referred to as the 100-year flood.

Township areas that would be subject to such flood conditions are principally limited to the following:

- Saginaw Bay/Lake Huron Shoreline, up to an elevation of 584' above sea level, which commonly extends inward from the shoreline approximately 25' to 75'.
- The Rush Lake area including associated wetlands extending south of Etzler Road, and along the Musselman Drain corridor to the northeast and south along the Champagne Road corridor for approximately one mile.
- The Pigeon River corridor and extending approximately one-half mile to the north and east in the area where the river exits the township at the southwest tip of Section 30.
- Certain other road segments, typically extending no more than 500' from their centerlines.

Although Lake Township may be relatively free of any regular threat of flooding, improperly managed land development practices can impact flood conditions locally and in neighboring communities and locations further downstream.

## Groundwater

As runoff flows across land surfaces and travels through drainage courses, a portion of the runoff seeps into the ground through gravitational forces and collects in great quantities in the underlying soils (drift) and deeper bedrock. *Groundwater* is a term that is generally used to describe this subsurface water below the water table in soils and bedrock. The reservoirs of groundwater are referred to as *aquifers* and serve as the sources of drinking water for nearly all residents of Lake Township. Aquifers are geological formations that are capable of yielding a significant amount of water to a well or spring. The water drawn from the Marshall Formation bedrock aquifer, the sandstone bedrock underlying most of the southwest half of the township, is considered to be of very good quality. The Michigan Formation

shale bedrock underlying the majority of the northeast half of the township is considered a lesser source of potable water. Shale, the principal component of the Michigan Formation, typically provides a higher quality of water but the shale significantly restricts the rate at which the water can be drawn due to its comparatively limited permeability. Aside from the potential for high-iron content, common throughout Michigan, the quality of Lake Township's groundwater is generally considered to be satisfactory. There have been recorded instances in the township, and Huron County as a whole, where nitrate and arsenic levels in the ground water exceed those determined to be safe by the U.S. Environmental Protection Agency.

Aquifers can be "*confined*" or "*unconfined*" systems. Confined systems have an impermeable soil layer (typically clay) above them which acts to confine the aquifer and protect the aquifer from contaminants seeping into the subsurface above the confining soil layer (petroleum products, fertilizers, improperly disposed household liquids, etc.). Unconfined systems do not have this protective layer of clay soil and are much more prone to contamination. Even confined systems can be contaminated due to hazardous material entering the groundwater as a result of groundwater flows from nearby and/or more distant non-confined aquifers and improperly constructed and/or abandoned wells.

A random survey of well records for Lake Township suggests that the majority of wells in the township extend to the bedrock below, typically between 90' to 150' in depth. Local well logs suggest there is virtually no confining layer of clay across the township's northern half, thereby increasing the potential for groundwater contamination. The common sandy and graveling soil conditions in this part of the township encourage comparatively fast seepage of contaminants to the aquifers below. Well logs suggest there is a confining layer of clay across much of the township's southern half though its fragmented pattern lessens its effectiveness in protecting groundwater sources.

Contamination of ground water resources can originate from a number of sources including poorly operating septic drain fields, floor drains that discharge to the outdoors, the storage of hazardous and toxic substances without the necessary safeguards, the improper disposal of fuels and oils, excessive use of fertilizers, and improper disposal of wastes by industrial, commercial and residential activities.

## Vegetation

The predominant vegetative cover of Lake Township can be divided into three principal types. The largest is that of the agricultural fields that cover about 58% of the Township's area (about 7,630 acres) and nearly the entire southern two-thirds. Woodland and wetland vegetation accounts for approximately 26% of the township's area. The balance of the vegetative cover is characterized principally by lawn areas associated with residences and road rights-of-way.

**Upland Woodlands.** Upland woodlands are comparatively limited in Lake Township and are principally found along the upland areas that run generally parallel to the Lake Huron shoreline within a mile of the shoreline. These upland areas are intermixed among lowland woodlands comprising wetland environments (described below in more detail). Tree species in the upland forests include red oak, white oak, sugar maple, red maple, black cherry, beech, basswood, and ash. Upland woodlands provide multiple benefits including the slowing of surface run-off flow to allow for greater water infiltration, reducing air pollutants through absorption, minimizing soil erosion and sedimentation of water courses, providing special habitats for wildlife and shaping the community's visual character.

**Wetlands.** Wetlands can generally be described as land where water is found, either on the surface or near the surface and for all or portions of a year, so as to result in the lack of oxygen in the soil and a distinct set of plant species. Wetland soils are typically dark and high in organic content. Wetlands are commonly referred to as swamps, marshes and bogs, with swamps being of a more wooded character. There are approximately 3,090 acres of wetlands in Lake Township and they are nearly entirely

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comprised of two expansive areas in association with the Rush Lake State Game Area and Sleeper State Park.

The Rush Lake wetland areas are comprised principally of shrub and emergent herbaceous non-woody plant material. Emergent wetlands tend to be more open in character and are commonly referred to as marshes, where shallow waters are present throughout the year or for extended periods of the year, and are commonly characterized by cattails, cranberry, fens and sedges. The Sleeper State Park wetland areas are comprised principally of lowland forest and shrub environments such as red and silver maples, cottonwood, cedar, green ash, basswood, willow, and dogwoods.

Wetlands also provide vital roles in flood control, runoff filtering and purification, groundwater recharge, wildlife habitats, recreational opportunities, and supporting the rural character of the township. The length of the township's interconnected wetlands, and their interface with adjoining upland woodlands, enhance their value for flora, fauna and recreation.

Wetlands are environmentally sensitive resources and can experience degradation and destruction due to changes in water levels, erosion and sedimentation, filling, dredging, and draining. The degradation or pollution of a wetland area can have a destructive impact upon wetlands and related woodland resources distances away due to the frequent physical linkages between these resource areas. In addition to the environmental constraints wetlands pose for development, they present severe physical constraints for land development due to flooding and instability of soils.

Because of the important environmental role of wetlands, they are protected by the Michigan Environmental and Natural Resources Protection Act, Part 303. Wetlands are regulated by the state if they meet any of the established criteria including, but not limited to, wetlands connected to one of the Great Lakes or located within 1,000 feet of one of the Great Lakes, wetlands located within 500 feet of an inland lake, pond, river or stream, and other wetlands of five acres or more in area. The law requires a permit be obtained from the state for depositing fill in a wetland, dredging or removing soil from a wetland, constructing or operating a use in a wetland, or draining surface water from a wetland. The Michigan Department of Environmental Quality will not issue a permit unless it finds, in part, that there would be no unacceptable disruption to aquatic resources and that the proposed activity is wetland dependent or no feasible and prudent alternatives exist.

## Soils

The U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), has prepared a soil survey for Huron County. According to the survey, nearly all acreage in Lake Township is characterized by loam, sand or muck soils. Loam soils are most dominant in the southern two-thirds of the township, in the more agricultural areas of the community. Soils classified as "loam" typically have near equal proportions of sand, silt and clay. The majority of the balance of the soils, and the dominant soils in the northern third of the township, are classified as sand. Soils classified as sand have a sand composition of 85% or greater. Muck soils are commonly described as being a soil consisting of fairly well decomposed organic material that is relatively high in mineral content, fine in texture and dark in color. Muck soils are commonly associated with wetland environments.

Approximately 79% of the soils in the township are also classified as "hydric" soils. Hydric soils are generally described as soils formed under conditions of saturation, flooding or ponding for periods long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile. Hydric soils have a particularly high moisture content, are typically poorly drained, and are commonly associated with wetlands as well as other less evident soil environments. Approximately 79% of the township area is classified as hydric soils.

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The character of soils can have a profound impact upon the suitability of future land uses such as in the case of construction projects, on-site sewage disposal, and agricultural productivity. The NRCS has identified specific individual soil units throughout the county based upon the characteristics of the upper soil layers (approximately five feet in depth) that provides a reliable basis for township planning purposes. For example, hydric soils commonly present significant obstacles to construction or otherwise can substantially increase construction costs due to the special measures that must be taken to combat the high moisture content and resulting challenges for stable building foundations.

**Septic Systems:** According to the NRCS, all or nearly all land in Lake Township is classified as “very limited” in regard to its natural compatibility with septic systems. The NRCS describes a soil as being “very limited” when the soil has one or more features that are unfavorable for a septic drain field. A primary concern is the soil’s ability to absorb and break down the leachate from the septic drain fields before it reaches underground water supplies. The soil limitations generally cannot be overcome without major soil reclamation, special system designs, and/or comparatively expensive installation procedures. Poor performance and high maintenance can be expected. In the case of Lake Township, these features pertain to such things as poor soil filtering characteristics, ponding of water, a high water table, and slow or rapid percolation rates.

The Huron County Public Health Department is responsible for issuing permits for on-site sewage disposal. A permit will not be issued unless all county requirements have been met. Under typical conditions including the absence of wetlands, sites approaching one to two acres are generally adequate to meet the Health Department’s requirements for effective septic systems, including a back-up area should the initial drain field fail. Sites of one acre or less must meet more stringent standards and may not be able to do so due to soil conditions. Development at this density may require a sewer system.

It should be noted that while a site may be classified by the NRCS as presenting limitations to septic systems and building construction, on-site investigation may show the classification to be less than fully accurate and/or show that the deeper soils (more than five feet deep) present different characteristics from the upper layer soils and thus, varying limitations. Detailed on-site investigation is critical to determine opportunities and constraints the soils may present.

**Prime Farmland:** The NRCS classifies approximately 60% of the township’s land area as “*prime farmland*” if adequately drained, and the southern two-thirds of the township is comprised nearly entirely of *prime farmland* (if adequately drained). The NRCS generally defines *prime farmland* as land that is, under proper management, particularly well-suited for food, feed, forage, fiber, and oilseed crops and is capable of producing sustained high yields. Nearly all acreage currently under crop production is classified as “prime farmland” (if adequately drained).