Lake Leelanau

An Introduction to Watershed Dynamics

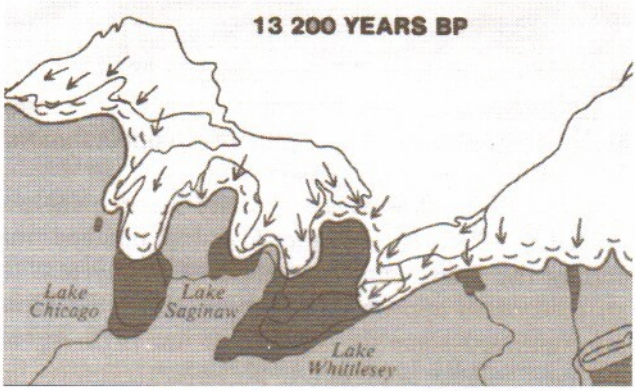
Origins of the Watershed

If you had stood at the narrows between North and South Lake Leelanau at the time of, say. 15,000 B.C., you would have found it a most inhospitable place. Actually, the closest you could have stood to the narrows would have been 300 feet straight up, because the ice covering be area at that time was over a half mile thick. Some tens of thousands of years ago the earth went into a cycle of cold weather. Average temperatures dropped. In the northern reaches of the globe. snow remained throughout the summer months. Each winter season the snow steadily accumulated and the weight of additional snow compacted the lower levels into ice. Thus were born the glaciers.

But the ice was not content to lie still. To escape the increasing assure from all trial weight, the edge of the ice cap began to creep forward. Like most things that flow, the ice sought the paths of least resistance, like river valleys, and dug those depressions even deeper. The ice flows scraped the bedrock and bulldozed huge piles of rocks and sediments into hills called moraines. ne glaciers acted like great primordial plows, hence geologists use the term "till" to describe the heaped-up debris the ice formations left as ridges.

By 10,000 B.C., temperatures were on the rise, and the glaciers had begun to decline. People often refer to the "retreat" of the glaciers but actually glaciers don't retreat. they only advance-and then they just melt away. In the process of melting they created huge lakes in depressions of the earth along with torrents of runoff. As the land was relieved of the great pressure of the glaciers, the ground began to rise. Melt waters saturated the porous layers of glacial till, gravel. and sand, gravitating downward until they met the resistant layers of impermeable clay or bedrock and there the melt water became groundwater.

The levels and shape of the Great Lakes changed frequentlv bv geological standards. as did their direction of flow. In the not In the not so distant past,



The glacial cover of 13,000 years ago set the geological framework for the pristine freshwater lakes we enjoy today.

Lake Leelanau itself was, more or less, a bay of Lake Michigan; as Lake Michigan was once a tributary to the Mississippi River. The Great Lakes' surface levels eventually dropped and began to stabilize and the great body of water that would come to be known as Lake Michigan receded to its present shoreline. The common sand deposits of our region are the remnants of old Great Lakes' shorelines. sand shoals, and well-sorted sands and mucks deposited in the shallows of the ancient lake.

For thousands of years nature was left undisturbed to complete its work. The initial roaring rivers of glacial melt slowed and narrowed to quiet streams and rivers. Finer sediments accumulated and provided plants an opportunity to take root. As plants and animals (in they added nutrients to the ground and their bodies became the building blocks of topsoil. Beech and maple trees claimed the most fertile uplands of the watershed, while hardy oak and pine stands populated tile poorer drought-prone soils. In the wetlands, white cedar, red maple, black spruce, and black ash thrived in the plentiful moisture. And the water changed. the sediments that had been swept off the glacial till by runoff and clouded the glacial rivers, became increasingly trapped by vegetation to aid in the building of soils. Eventually the plant life became a giant living filter, constantly purifying the waters and

The dam, pictured here in 1901, that backed up Lake Leelanau to its present level. Photo courtesy of Leelanau Historical Museum.

and providing a haven for trout and grayling. The watershed remained in this totally natural cycle for thousands of years. Until an epochal event: the arrival of western civilization.

The Historical Era

For thousands of years native Americans lived in a fairly stable balance with the natural systems as hunters, gatherers, and opportunistic farmers – for short periods they impacted areas and then moved on, allowing the ecology to regenerate. The region around Lake Leelanau was exceptional even in that era of general abundance. The first European settlers found a long established naive American village located on the hills above the creek that emptied into Lake Michigan from Lake Leelanau. The abundance of fish and the ease with which the villagers captured them in the shallow water offered a ready food supply. Imagine how the Lake Leelanau basin appeared to the first European settlers. The pristine waters of the lake teemed with an abundance of fish and game. The basin and surrounding hillsides were thick with stands of giant hardwoods. It was a land of opportunity-na land to thrive on. They had traveled through so much equally pristine land on the way here, that they probably believed the forests to go on infinitely. America needed lumber to build, and here were the trees. America needed food and here were the fish and game.

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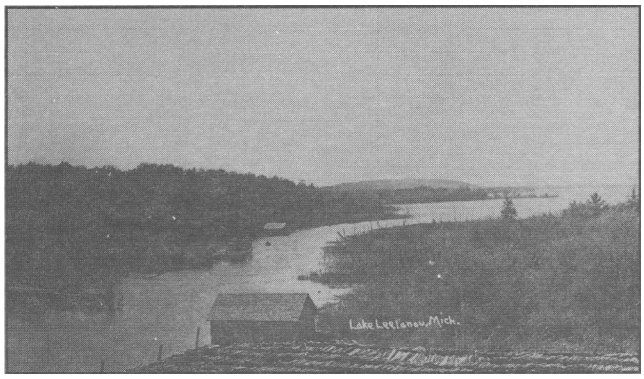
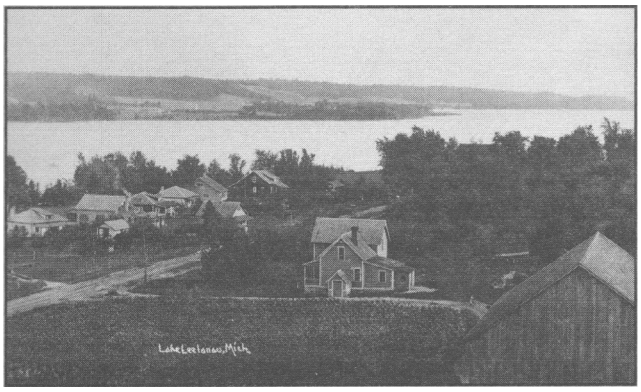
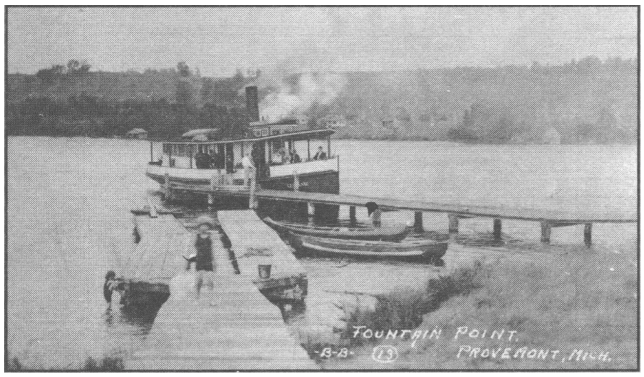






Pictured above (from top), "The Narrows" at the settlement of Lake Leelanau; Provemont (Lake Leelanau) as it looked in 1925; the steamer LEELANAU

The first European settler in the Leelanau watershed thought it would be a great place for a factory. In 1852, Antoine Manseau, a resident of the nearby Manitou Islands, laid claim to thirty acres of land that included the creek that drained Lake Leelanau. The following year. Manseau brought his family to the location and along 'with a handful of others, installed a damn on the creek, turned it into hydraullic power and built the f'irst sawmill. Dozens and then hundreds of settlers soon followed him and founded what is today Leland.

The dam dramatically altered the landscape upstream and down. Prior to Manseau's dam. Lake Leelanau was a chain of three separate lakes. The (obstruction reportedly raised the lake level of the lowest lake by twelve feet and created one large navigable waterway with a narrow' passage at what is today called the Narrows (which the settlers considered an important improvement since it facilitated the movement of sawlogs from the interior to the new shipping wharves at Leland). The new backwaters of the Leland dam became known as Carp Lake. The once lively creek that connected Lake Leelanau's aquatic ecosystem with Lake Michigan was now cut off and named the Carp River.

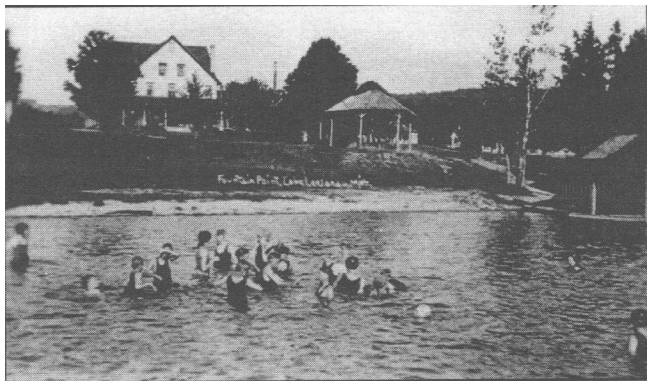
Settlers streamed into the area, cleared the land, and founded the Villages of Leland and Provemont (now Lake Leelanau). Ships dropped off supplies and carted away millions of board feet of lumber from Leland. Eventually, the railroad reached Provemont and a metallic bridge was built across the Narrows.
The hills around Lake Leelanau were a land of plenty. The communities that occupied the watershed generated waste as communities tend to do. The out-houses and garbage dumps introduced new types of nutrients into the watershed that began to change the chemical balance of the water. Certain types of microorganisms became abundant and altered the food chain. Early on, surface water became unsafe to drink. As shallow hand-pump wells became tainted, and

outbreaks of diseases like cholera and polio become more frequent, the fragile dynamics of our water supply began to dawn on people. Deeper wells were drilled, septic tanks were introduced, and health codes established to protect people from themselves. In the wake of the lumbering activity, surface runoff on the denuded land carried huge amounts of sediment into the lake and its tributaries. The altering and damming of the creek had drastically changed the natural dynamics of the lake's ecosystem.

In a matter of a few decades, the natural bounty of the area was exhausted-and so was the local economy. The communities around Lake Leelanau had seen several industries rise and then self-destruct by over-consumption: first the lumber industry, then the commercial fishing industry, then a charcoal industry that supplied the Leland iron foundry. Each had devastated the very resource that sustained it, and, once depleted, the industry itself wasted away. From a peak prior to the turn of the century, Leelanau County's population gradually dwindled with the fallen fortunes of the local economy.

Since the Lake Leelanau region lay far from the commercial and industrial centers of the new world, in a sense, its downfall was its salvation. The decades of modest farming and sparse population that followed the boom of exploitation allowed the environs of Lake Leelanau to slowly rebound. In some places carefully managed, in some places just left alone, the sparse saplings thickened into mature forests. Many of the animal species migrated back into the area as their natural habitat reestablished itself. Some species that were once relatively minor in the area have seized niches once occupied by other species, such as the whitetail deer that now roam where the woodland elk once dominated. Sadly, not all of the species returned – we will never again see the huge flocks of carrier pigeons, or the schools of shimmering grayling in our streams.

It was soon after the demise of the last sawmill, that the first vacationers began to make their way back north.



Swimmers at Fountain Point. Photo courtesy of the Leelanau Historical Museum.

The swelling number of tourists and seasonal residents parallels the inexpensive and widespread availability of transportation. At first, the travelers trickled in and out by train and ferry. But the great surge of tourism accompanied the spread of the automobile. Over the last few decades, more and more seasonal visitors have sought to become permanent residents. Although the region still relies heavily on tourism, the northwest Michigan economy is becoming increasingly diversified and stable – able to support a larger year around population.

In the 1960s, Leeelanau County surpassed the population peak of the 18th Century and each summer sea- son absorbs many times the official count. How far population growth will go from here is anyone's guess, but the statistical projections are staggering: growth rates in excess of 20% over the next decade (some of the highest in the State). The roads, residential construction, septic fields, etc., necessary to sustain the new growth represents a modern day “boom" for the Lake Leelanau economy.

The fact of the growth is self evident, the effect of the growth is not. Unlike our ancestors who settled this land, we have the knowledge and skill to maintain a high standard of living and at the same time protect the natural systems that make this region a desirable place to live. The quality of our water is the gauge by which we measure our success. As the water quality goes, so

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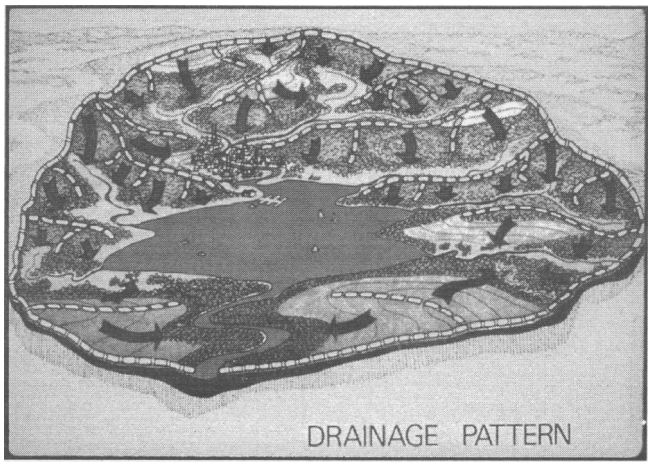
goes the fate of the natural systems. Like the proverbial canary in the mine, Lake Leelanau can tell us about ourselves, the state of our health, and the grave risk of carrying on with the status quo.

Watershed Description

As the combined drainage basins of both North and South Lake Leelanau, the Lake Leelanau watershed is the most prominent geographical feature of the interior of the peninsula. Together, these lakes absorb the runoff of approximately one hundred and forty square miles. The watershed crosses over the political jurisdictions of ten townships, three villages and three counties. The watershed runs primarily north and south for twenty-three miles and is about three times as long as it is wide. (See map on Page 28.)

The lake basins were originally formed by the same glacial forces that carved Torch Lake and Grand Traverse Bay. The glaciers left sandy well-drained soils to dominate the adjacent hills. Over time, muck soils accumulated in the low-lying areas and wetlands. Deep below the surface, a large aquifer of ground water locked in water-bearing sand holds huge amounts of freshwater that constantly replenish the lake and its tributaries.

South Lake Leelanau, at eight ills long and twenty-five miles in circumference is the larger body of water. The south lake's average depth of twenty-three feet dips to sixty-two feet at the deepest. Although smaller in area, at 121 feet in maximum depth, North Lake Leelanau is the deeper of the two. By surface area, North Lake Leelanau (4.6 sq. mi.) is 55% the size of South Lake Leelanau (8.4 sq. mi.); by volume, it's 98% the size of its southern neighbor. The flow between the lakes runs north (South Lake Leelanau is North Lake Leelanau's largest single tributary by way of the Narrows). But in practical terms, the two bodies are one: the lakes share



Watersheds operate on identifiable patterns as illustrated in the above diagram – understanding these patterns is the first step in developing pollution prevention strategies.

the same surface level, and traffic (whether biological or boat) moves unimpeded from one to the other.

The lake waters should be ideal habitat for cold water fish species such as trout. Nevertheless, the trout populations fluctuate measurably, and the ability of the trout to sustain themselves by natural propagation is doubtful-probably due to the gradual change in the lake habitat. The DNR plants lake trout, brown trout and walleye on a regular basis. In addition, and with little need of help, the lake supports healthy populations of pike, bass and panfish – species that adapt well to seedbeds and thrive in nutrient-rich environments.

Roughly forty percent of the watershed landscape is forested and another quarter is agricultural. The agricultural areas are about two thirds cropland and pasture, and one-third orchard. Wetlands and swamps make up the next dominant land cover-most of the South Lake Leelanau shoreline was once comprised of wetland and much of it still is.

One cannot overstate the importance of the wetlands in the watershed to maintain water quality. For instance, some 75% of the total surface runoff into the lake originates from two tributaries: the Cedar River (a.k.a. Victoria Creek) and Cedar Run Creek. On the way into the lake, both water courses pass through Solon Swamp at the southwestern corner of South Lake Leelanau. There, wetlands act as giant filters that extract nutrients in the runoff before they enter the lake waters. Left unchecked, nutrients would create havoc in the natural hydrologic system.

Presently, Lake Leelanau is classified as "oligotrophic," characterized by crystal clear water and low amounts of aquatic plant and algae growth. The classification represents a rating of nutrient levels and biological activity in the water. In recent years, the lake has edged closer to the next category, "mesotrophic," which residents can observe in the form of larger weed beds and murkier water. The cause for the deterioration in water quality is an increase in the nutrient load a nutrient load directly related to the increase of human activity and development in the lake basin.

To understand causes and remedies to the deterioration of the water quality first we need to understand how a watershed system works.

The Watershed System

Michigan is blessed with an abundance of fresh water that most people in the world can only dream about. Northwest Michigan's position on the eastern shore of Lake Michigan exposes it to a constant supply of lake effect rain and snow riding the prevailing westerly winds and dropping on the forests and melds of the countryside. From the moment those raindrops strike the earth they continue to seek out the path of least resistance and move downhill under the invisible force of gravity. But each raindrop could end up taking any number of routes to a variety of destinations. In the Lake Leelanau watershed, all routes lead eventually to the lake.

The rain that strikes the ground in a light spring shower may fall among the foliage and seep into the ground. There it will probably be absorbed by the root system of some thirsty plant. Or, it may flow a short while until it reaches a depression where othe raindrops gather with it, and together they form a wetland. There, if it once again avoids the ever drinking roots of plant life, it will work its way below the root zone into the subsoil where it will continue a very slow downward migration into the groundwater system. Eventually, the raindrop and its fellow travelers will strike a dense clay level which the groundwater cannot easily permeate. The water flow will then accumulate until the pressure pushes the flow horizontally through the porous gravel and sand formations. These formations, called "water bearing sand" are the target of well drillers on the surface, and indeed, at this point the raindrop could very well be sucked into the intake end of a household well pump.

More likely, the raindrop will remain in the groundwater for years, possibly hundreds or thousands of years, slowly moving further and further down into the bottom of the groundwater basin. The final destination will usually be an underground seepage into the bottom of a spring-fed lake, stream or river. Either there, or farther downstream, the raindrop will eventually evaporate back into the atmosphere and start the trip all over again.

During a heavy rainstorm, instead of soaking into the ground, the raindrop may flow further over the surface of the ground, join with others of its kind and form rivulets of run-off. The rainwater run-off will hurry downhill and join with other rivulets to form small tributaries, which in turn begin to join together, and before long the flow becomes a stream and then a full-fledged river. In a pristine Michigan woodland environment, the raindrop would likely dodge and weave through vegetation on its entire route to the river, and would reach the watercourse virtually crystal clear. Unfortunately, with the increase in human activity, that voyage is more likely to include a road

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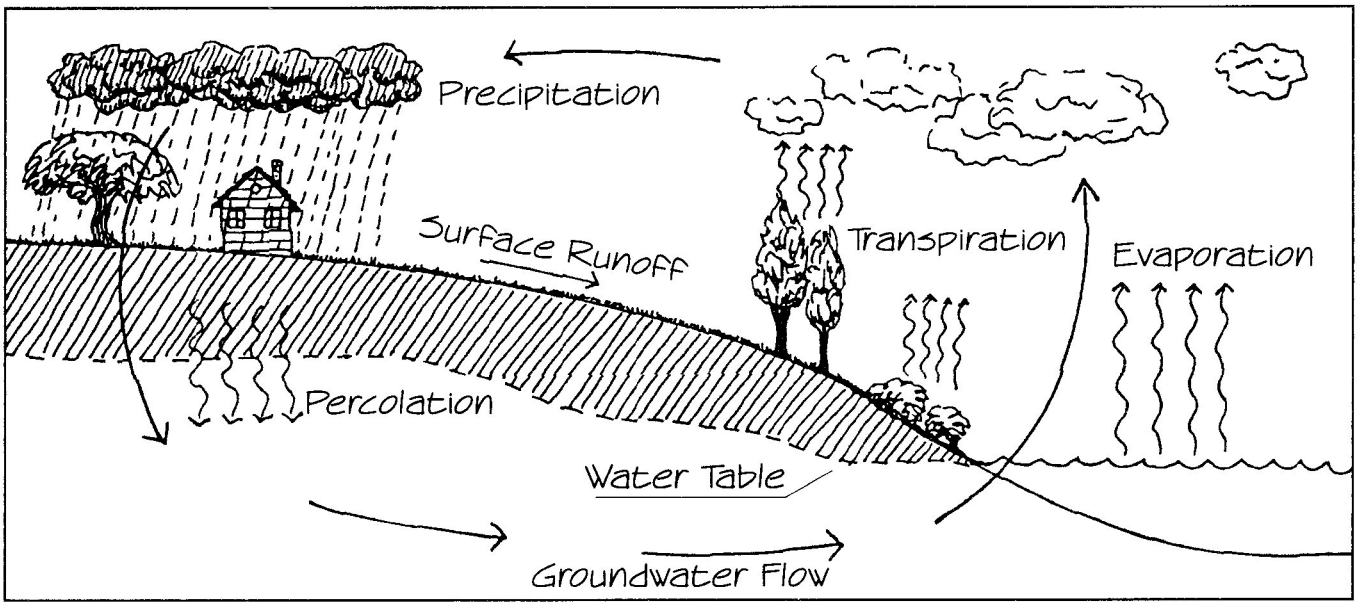


The above diagram shows the typical hydrological cycle. Much of our precipitation soaks into the ground and may spend decades in a slow migration to large bodies of surface water.

a run through a construction site, or a dash across a recently fertilized lawn.

Where the ground is disturbed or bare, the rainwater will accumulate tiny particles of sand, soil, and nutrients that roll along with the flow and, like the raindrops, gradually acculturate into massive quantities. When they reach a deeper. slower current, the heavier particles settle to the bottom of the stream or lake and coat the gravel, making life impossible for the creatures that live among the stones. Aquatic plants and bacteria that play relatively minor roles in the natural ecosystem discover the new nutrients and gorge themselves into grossly unnatural size and numbers. Weedbeds begin to appear where none were before and existing seedbeds expand. The dead and decaying bodies of organic matter cloud the once clear lake water. In extreme cases, the daily passage of sunshine can feed the biological activity to a point where oxygen levels swing wildly between daylight and darkness and suffocate fish.

A watershed comprises the complete system of surface water and groundwater, taking in the entire drainage basin for a main watercourse. Watersheds obey only gravity and the movement of water. They ignore the boundaries of man. Since water is so critical to life, watersheds provided the basis of empires and defined cultures. The Lake Leelanau watershed includes all the land areas that drain into Lake Leelanau, and in turn is a subwatershed to Lake Michigan. Lake Michigan and its tributaries comprise a portion of the Great Lakes watershed. The Great Lakes watershed joins forces with other rivers from eastern North America and finishes its trip to the Atlantic Ocean through the St. Lawrence River watershed.

Watersheds define communities. As Lake Leelanau connects us to places as far flung as the ocean, so it connects us in a special way with our neighbors. Caring for the watershed is a community responsibility the result of one's actions impact everyone downstream. As goes the quality of Lake Leelanau so goes Lake

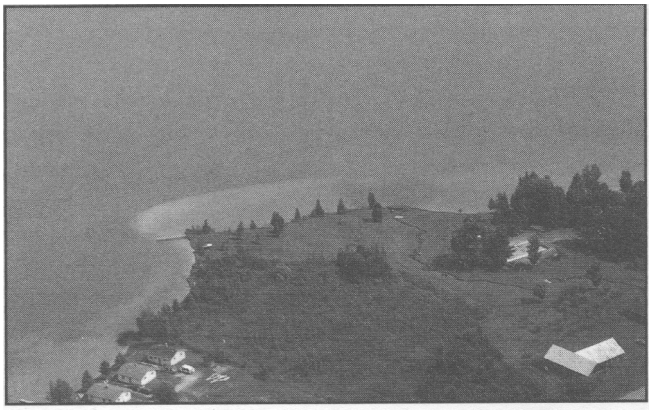
individual to use this precious watershed responsibly and protect the lifeblood of the community.

Natural Pollution

Ecosystems (the relationship between organisms and their environment) and watersheds are, by definition, systems of checks and balances. Each element, from the inorganic rocks in the stream bed, to the deer grazing in the streamside meadow, plays an important role in the system. In the natural order, when one member of the system becomes too numerous, nature has its own checks and balances to restore order. A principal objective of long-term water quality management is to keep the natural systems intact and make use of nature's tremendous capacity to clean itself'.

As we have seen time and again, humans usually don't encounter the natural checks and balances to their activities until long after the damage has been done. In effect, humans must be self-regulating in order to protect the very land and water from which they derive their sustenance. Hence, the origin of the Hea1th Department, the Food and Drug Administration, the Environmental Protection Agency, and the myriad of other regulatory agencies charged with the protection of our health and welfare. Nowhere is this tendency better demonstrated than in the context of a watershed, and Lake Leelanau in particular.

The principal threat to Lake Leelanau's water quality begins with three primary sources: phosphorus, nitrogen, and ordinary sediments. A1l three of these culprits are naturally occurring and familiar materials in the ecosystem. Phosphorous and nitrogen are critical nutrients for life forms, and sediments are the building blocks of soil. A1l three are also common by-products of human activity. Problems begin when they enter the ecosystem in exaggerated quantities and throw the natural balance out of kilter. Let's examine each contaminant in detail.



An aerial view of a tributary flowing into Lake Lee-lanau. The dark areas are sediment laden currents that carry nutrients and contribute to water quality problems in the lake.

Phosphorus: The Growth Regulator

A little bit of phosphorus goes a long way – which is a good thing for life on earth. The element is not especially plentiful and yet, plant and animal growth rates are directly related to the amount of available phosphorus. Too low phosphorus levels in soil will result in stunted plant growth. Each time a crop is harvested from a field, or grass mowed and collected from a lawn, a certain amount of the phosphorus is removed with it. To replenish the supply of available phosphorus, farmers and home gardeners spread fertilizers and manures. In addition to fertilizer. an array of household, office and factory chemicals from matchheads to detergent contain phosphorous compounds as an ingredient. Eventually, through overuse or improper disposal, much of this phosphorus will attach itself to sediments and hitch a ride in rainwater run-off or wind, and eventually work its way into the lake.

As phosphorus makes its way into the lake, it will do what it does well encourage growth of alga and weeds.

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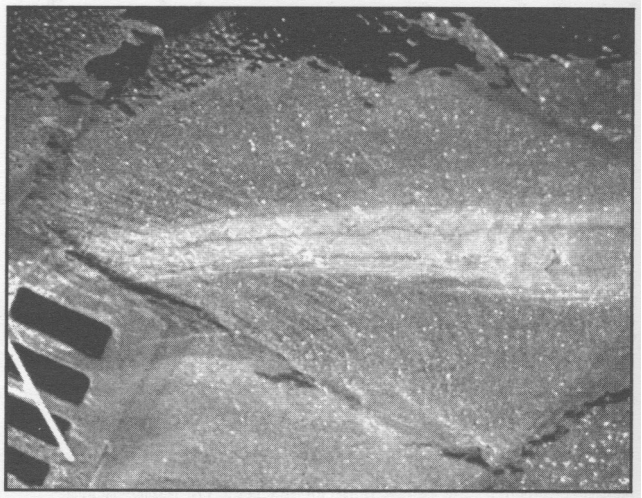
and weeds. To a point, growth is good, since it produces oxygen for animal life and shelter for small fish. It becomes a problem when dense aquatic plant growth blocks the sunlight needed for species that produce oxygen at deeper water levels. The heavy weed growth generates residue as plants die off in natural cycles. The decaying process on the lake bottom absorbs large amounts of oxygen, recycles phosphorus back into the food chain and, in turn, invigorates more plant growth. The only way to avoid the spiral of growth is to minimize the release of phosphorus into the lake in the first place.

Phosphorus levels in lakes vary from the surface to the bottom and seasonally throughout the year due to cyclical biological activity. Accurate measurements of average phosphorus concentration are best taken during the spring and fall when lake waters are well mixed. The table below offers a comparison of Lake Leelanau to a number of other Michigan lakes. South Lake Leelanau is well within the less than 10 ppb (parts per billion) "safe" range of phosphorus that minimizes weed growth. Only continued effort will maintain this favorable condition.

Phosphorous Levels in South Lake Leelanau and other Selected Lakes

Lake	County	Year Tested	Phosphor. in ppb
South Lake Leelanau	Leelanau	1990	4
"	"	1991	4
"	"	1992	4
"	"	1993	4
"	"	1994	5
"	"	1995	5
North Lake Leelanau	Leelanau	1995	7
Glen Lake	Leelanau	1995	4
Crystal Lake	Benzie	1995	7
Higgins Lake	Roscommon	1995	6
Indian Lake	Kalamazoo	1995	11
Ore Lake	Livingston	1995	18
Robinson Lake	Newaygo	1995	32



Stormwater runoff carries all kinds of pollutants into the water system. Here the film of oil will eventually become part of the lake waters.

Sediments: The Telltale of Erosion

We've all seen the chalky or muddy colored runoff streaming down the edge of a roadway after a rainstorm. Race the path of the runoff all the way upstream and you will be certain to find some type of disturbed ground at its origin: a construction site, a newly plowed field, or maybe an exposed bank. Muddy water is the telltale sign of erosion. And muddy water is an enemy of life in a watercourse.

The "mud" in muddy water is sediments, a mixed bag of soil components: particles of sand, clay, and bits of organic material, that have been dislodged from the ground and carried away by running water. When the sediments enter the creek, the sand and clay settle to the bottom and, over time, can accumulate in thick layers on the creek bottom. The sand and clay seals off the natural gravel streambed that is the critical habitat for the aquatic plants, insects and other creatures that make up the basis for the watershed's food chain. Eventually, with the heavy accumulation

of sediments in a stream or lake, fish and other animal populations will diminish and the stream will become a virtual aquatic desert.

In heavy concentrations sediments can obstruct critical sunlight for aquatic plants, ruin fish spawning areas, clog the gills of fish, and reduce the amount of dissolved oxygen in the water. Sediment particles also pick up hitchhikers, like phosphorus and various chemicals, which will be deposited in the lake with the other particles.

Increased traffic and construction activity in the Lake Leelanau watershed has intensified the effects of sedimentation. Road crossings, storm drains, driveways, and other impervious surfaces all accelerate the speed and amount of runoff and introduce more opportunities for erosion problems. Due to the tendency of phosphorus compounds to attach themselves to other materials, sedimentation and phosphorus problems are closely related—as go the erosion and sedimentation, so goes the phosphorus.

Nitrogen: Too Much of a Good Thing

Off all the non-point source pollutants, nitrogen clearly poses the most serious and immediate threat to people. Many forms of nitrogen, such as nitrates, are water-soluble and can easily move with surface and ground waters. Once in the groundwater, the nitrates will eventually be pumped back to the surface through wells and used in the home. When consumed by infants and you children, nitrates can build up to toxic levels in their small bodies and interfere with the blood's ability to absorb oxygen. Hence, ther term "blue baby syndrome" for nitrate toxicity, a very dangerous condition that can lead to permanent damage or even death. In adults, nitrates can cause stomach and intestinal problems, diarrhea, and diuretic effects.

Health department officials have known of the dangers of nitrogen poisoning for years and have enforced strict standards for drinking water purity. All new water wells to be used fro drinking should be tested for nitrate content and approved. Drinking water wells are generally located away from septic fields to avoid seepage of wastewater along the well shaft. Septic field placement and construction standards are aimed at keeping nitrate leaching to a minimum.

Although one of the most common elements (it comprises 79% of our air), nitrogen remains one of the most elusive of elements. Plant life needs large amounts to build cell tissue, but can only use certain forms of the element. Gardeners and farmers never seem to have enough nitrogen in their soil, because one of the forms most available to plants, nitrate, is also very soluble in water. Thus, the available nitrate can be easily leached from the upper levels of soil or swept away in runoff. Habitual removal of crops from the field or grass clippings from the lawn also depletes the available nitrogen. As a result, farmers and homeowners apply nitrogen fertilizers to increase crop yields and maintain lush green lawns.

Household and industrial wastewater also contain large amounts of nitrogen compounds. Septic fields can be a major source of nitrates in groundwater, especially in the residential areas surrounding Lake Leelanau. The sandy soils that commonly underlie northwest Michigan accelerate the leaching of wastewater into the groundwater and make proper septic field maintenance especially important in the Lake Leelanau watershed..

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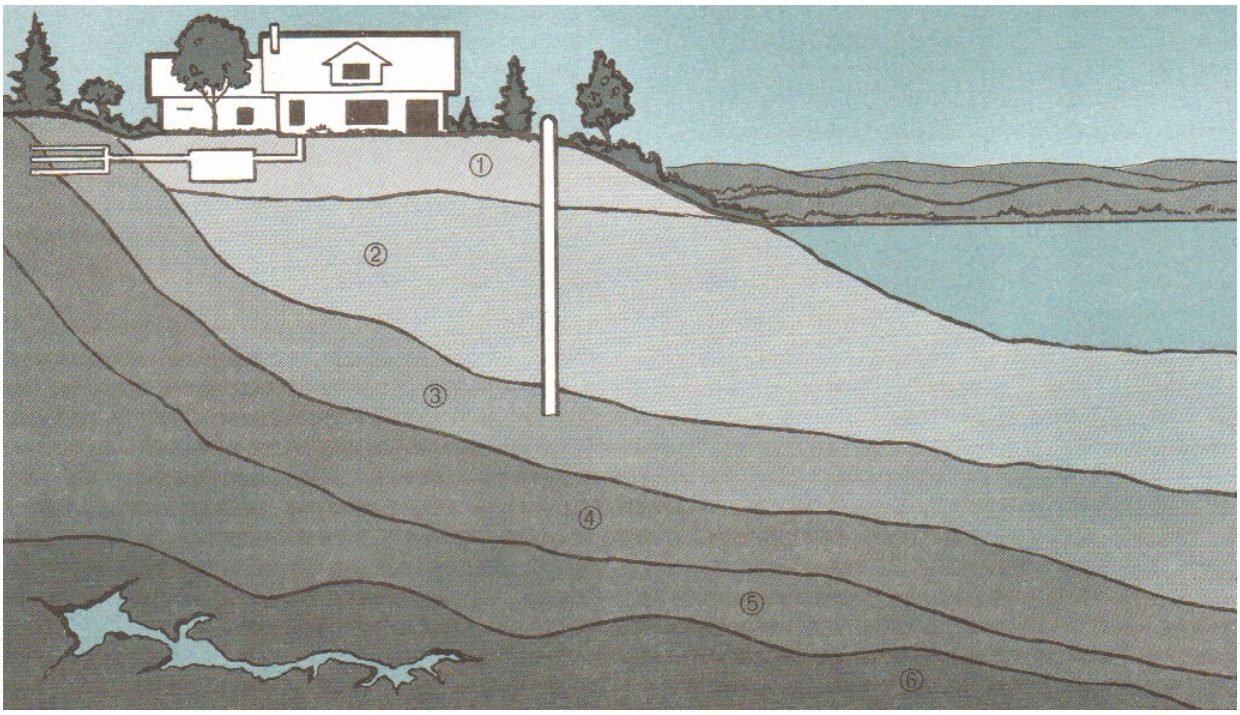

The figure above shows a typical glacial geology that concentrates groundwater into an aquifer and how a household water well and septic system interact with the reservoir of fresh water. Precipitation descends through permeable layers (1 & 2) and encounters an impermeable strata of clay (3). Thus, the groundwater in layer 2 is called an unconfined aquifer and feeds surface waters through springs and seeps. Under the clay layer (3), a confined aquifer of groundwater resides in a strata of sandstone (4), slowly replenished from precipitation in the uplands and impeded from further downward migration by impermeable strata of shale (5) and limestone (6). An improperly constructed water well shaft can become a virtual highway for pollutants seeping into the groundwater system. Improperly functioning septic fields can dump nutrients into the groundwater system and render them useless for household use.

Hazardous Chemicals: Little Goes a Long Way

Although the most common and destructive pollutants in the Lake Leelanau watershed are not the notorious compounds that go by the names like DDT, PCB or strings of syllables that end in "ene," these chemicals have become so common in everyday use that they deserve mention. These toxic substances, many of which are carcinogenic (cancer causing) in tiny amounts, have begun to permeate our surface and groundwater in significant quantities.

One gallon of waste motor oil (which contains an array of toxic chemicals) poured into the soil and making its way into the groundwater supply can contaminate thousands of gallons of groundwater, ruin water wells, and take hundreds of years to work its way out of the system. Most of these chemicals pose highly technical and expensive

Oil, gasoline, antifreeze, batteries, and old paint are just a few examples of the many hazardous chemicals found in almost any home or garage in the Lake Leelanau watershed. When these chemicals are disposed of with other household garbage, they are carted off to the landfill and buried, where eventually they too, can enter the groundwater. Even worse, many of these chemicals enter the water system unobstructed, as homeowners pour oil on gravel driveways to keep the dust down, or simply pour these chemicals down the drain and into the septic system.

So where to you dispose of this stuff? Leelanau Planning Department sponsors the household hazardous waste collection program twice a year. See page 36 for details.

The Powerful Medicine Of Common Sense:
Best Management Practices (BMPs)

We call pollutants such as phosphorous, nitrogen and sediment "non-point source pollutants." Scientists coined the term "non-point source" to distinguish these substances from "point source" pollutants. Point source pollutants are the classic smoking gun: e.g., an industrial waste pipe emptying chemicals into a river. Non-point source pollutants become a problem because of the cumulative effect of many different sources—anyone of which, by itself, appears to be a minor threat to the watershed.

Non-point source pollutants can be reduced by the simplest of means: a change in personal habit, or maybe some landscaping. Yet in practical terms, they can pose the most difficult problems to solve. Taken as an isolated incident, it may be hard to believe that the little bit of fertilizer we spread on the lawn near the shore to boost the growth of the grass could be harmful. Multiply that activity by a hundred homeowners, or a thousand, and soon the cumulative effect will be disastrous. Each one of those homeowners will need to be reached, informed, and most importantly, convinced, on an individual basis, to change their habits.

Luckily, the available remedies to these non-point source pollutants are fairly simple to understand and appeal to common sense. And with your cooperation, the impact of non-point source problems can be dramatically reduced.

Best Management Practices, or BMPs, are simple actions that any landowner can take to reduce the impact of human activities on the environment. Like most good management techniques, BMPs will benefit you in more ways than one. Besides protecting the environment, you will reduce waste, improve the looks and value of your property, and save yourself money.

An important point to keep in mind—by definition, non-point source pollutants are carried by water. Water runoff and erosion carry them into groundwater or surface water system, where they then become pollutants. Therefore, any place where there is a movement of water is a potential problem area. They key is either not to allow the pollutants to enter the water system at all, or to slow down the runoff of water and allow natural filtration systems to remove the pollutants before they enter the surface or groundwater. Much of Lake Leelanau's source flow originates from groundwater springs. To preserve those sources, we must channel as much runoff as possible into the groundwater system.

As you read on and learn about basic BMPs, think carefully about your property – you may be able to apply a few simple principles and develop your own BMP. Then, share your solutions with your neighbors. It will take community effort to effectively reduce non-point source pollution in the Lake Leelanau watershed.