CHAPTER 3: BAD AXE - LA CROSSE RIVER BASIN WATER RESOURCES

The Bad Axe - La Crosse River Basin contains over 700 miles of streams and rivers, 408 miles of which are classified as trout streams. The steep topography of the basin creates many high gradient streams fed by cold springs, conditions ideal for trout to thrive. The Bad Axe - La Crosse River Basin is in fact a travel destination for trout anglers from not only Wisconsin but from around the country as well. However, steep stream gradients and steep hillsides also contribute to flash flooding when heavy rainfall or sudden snowmelt occurs in a short time span.

Figure 12. Bad Axe-La Crosse River Basin Stream Classifications

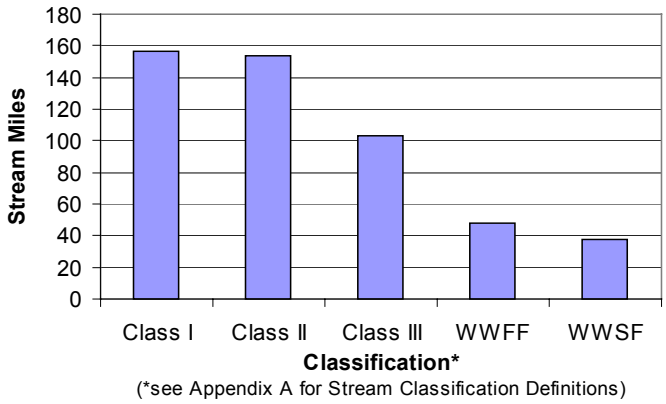


Figure 14: Bad Axe LaCrosse Stream Classifications

Groundwater in the basin is a plentiful resource. It provides drinking water to thousands of people who live and work in the basin. Groundwater provides water for many industrial uses also. Another crucial contribution of groundwater is to the numerous cold water trout streams. A constant influx of groundwater to area streams keeps them cool in the summer and moderates their temperatures in the winter.

SURFACE WATER ISSUES OF THE BAD AXE - LA CROSSE RIVER BASIN

Hydrology of Driftless Area Streams

Hydrology is the study of water - its occurrence, circulation, distribution and properties. Water in driftless area streams is ultimately derived from rainfall and snowmelt that either percolates into the ground or runs off the land. In the most basic sense, the condition of a stream is a reflection of the watershed it drains. This concept is especially true in driftless area streams due to steep gradient, small watershed size and extremely steep hills. To determine the watershed of a driftless area stream, one need look no further than the hillsides on either side of a stream.

Figure 15. Rural subdivision near La Crosse, WI

As rain falls on the land some soaks into the ground, but when the ground becomes saturated with water it then flows downhill over soil, vegetation, decaying leaves, barnyards, rooftops,

roads and anything else found along the way toward the nearest stream. As this water works its way downhill, it has the ability to dissolve some chemicals and carry soil particles. The steep hills found throughout the coulee region can shed water very quickly, consequently the vegetative cover and soil condition of hillsides in the coulee region are vital to the health of adjacent streams. The trees or healthy grasses of these hillsides is what effectively retains water with their roots, leaves and ultimately the soil. This water then slowly moves through the underlying rock layers to become groundwater that is either pumped from wells for consumption or resurfaces as springs. Some springs in the basin flow as if from an underground pipe while others gently bubble up out of the ground. This constant source of water that averages about 50 deg F throughout the year is what keeps dissolved oxygen levels high in the summer and trout eggs developing properly throughout the winter.

Streams rise and fall depending on the saturation of soils, intensity and duration of rainfall, vegetative cover, and slope of the land. The only factor controlled by people to any great degree is vegetative cover. Consider how long it would take to fill a bathtub using a garden hose with a spray nozzle. Keep in mind the steep sides and impervious surface of the tub. Now picture that same bathtub with sponges attached to the steep sides. It would take much longer to fill up the tub with the sponges ability to absorb much of the water. The same concept applies to coulee region watersheds. The greater absorption capacity within a watershed, the more water can percolate into the ground which eventually, but slowly, reaches a stream via clean cool springs. The other scenario is a watershed with little or no absorptive capacity, for example one with acres of concrete, rooftops or soil devoid of vegetation. In such a watershed, rainfall moves quickly over these surfaces to the nearest stream causing flash flooding.

The addition of more rural homes and especially rural subdivisions threatens the integrity of some Bad Axe - La Crosse Basin streams. The replacement of vegetation with sidewalks, roads and rooftops begins to mimic the water shedding conditions of the early 20th century brought on by farming practices inappropriate for the coulee region. In order to protect the current conditions of Bad Axe - La Crosse Basin trout streams, developers must seriously consider how to infiltrate stormwater runoff rather than detain it or pipe it directly to the nearest waterway. Only with a better understanding of the vital link between permanent changes to the land in coulee region watersheds and the resultant effects on trout streams will rural homeowners and rural developers consider how to minimize the effects of their presence.

Disturbance of Steep Slopes

Much of the land in the Bad Axe - La Crosse River Basin contains steep sided hillsides. When discussing steep slopes, one must consider how the word steep is generally understood. In Eastern Wisconsin a steep slope may be considered 12%, whereas in Western Wisconsin steep may be considered 30%. These slopes are not only scenic from the valley floor, but they also provide scenic views if one is located on the slope. Herein lies a conflict currently under discussion in several urban areas in the basin. The preservation of steep sided hills for their scenic beauty is favored by some, however building of homes on those slopes is preferred by others.

Many other reasons besides scenic beauty must be considered when determining the ultimate use of steep slopes. One issue regarding development of these steep slopes is the loss of fragile soils that lie atop shallow bedrock. Soil loss during the construction phase of a home can be huge if not properly contained; however, soil loss from construction on steep slopes can be catastrophic for a steep hill. The carving out of a flat area into a steep hillside can destabilize both the remaining slope above and below the building area. This results in much time and money spent by the

homeowner to remove soil and rock from a yard and possibly the township or municipality to remove soil from a roadway. Movement of soil down a steep slope is much accelerated compared to that of gentler slopes. This relatively quick movement of soil not only destabilizes a previously stable hillside, it can also quickly reach the nearest stream, lake or wetland and fill in valuable habitat needed by aquatic animals.

Another concern is the possible loss of vegetation unique to steep hillsides. Depending on the direction a steep hillside is facing, the amount of sun or shade it receives and the prevailing wind direction, a steep hillside can contain numerous unique plant species.

For many of the reasons listed above, the City of La Crosse, the City of Onalaska, and La Crosse County all have ordinances which prohibit the disturbance of slopes steeper than 30%. Vernon, Monroe, and Crawford Counties should also consider ordinances which address disturbance of steep slopes.

Point Sources of Pollution

A point source of pollution is generally described as one where the pollution can be traced to a pipe or some sort of conveyance system. In Wisconsin, a permitting system is in place to eliminate pollution from point source discharges such as municipal wastewater treatment plants or industrial facilities that produce wastewater. The Wisconsin Pollution Discharge Elimination System (WPDES) is administered by the DNR. Depending on the facility, a WPDES permit can include limits of the type and amount of chemicals that can be discharged, reporting requirements, plant operation and/or plant improvement actions, as well as sludge holding and sludge spreading requirements. Regulated discharges include both municipal and industrial treatment plant wastewater and residual solid wastes (sludge). DNR has wastewater engineers dedicated to monitoring compliance of regulated facilities with their permits and inspecting facilities with WPDES permits. Water pollution does not originate from these regulated facilities if they are in compliance with their permit. Since permit compliance is required by law, an enforcement process is in place to deal with those facilities not in compliance.

The solid residual waste that results from treatment of wastewater must be landspread under certain conditions outlined in each WPDES permit. This black, nutrient rich sludge is a valuable source of fertilizer for farmers. WPDES permit requirements for the handling of sludge typically include:

No sludge spreading	✔on frozen ground (resulting in winter storage)
Sludge spreading on land with	✔ appropriate soils ✔ slopes of less than 12% ✔ adequate distance from groundwater ✔ adequate distance from surface water ✔ adequate distance from homes and wells

In the Bad Axe - La Crosse River Basin, 55% of the wastewater treatment plants discharge to either the Mississippi River or the La Crosse River. Municipalities and industries not located near these large rivers either discharge to smaller streams or groundwater. A number of permitted facilities in this basin discharge to dry stream channels where wastewater sinks into the ground before reaching a continuously flowing stream. An in-depth discussion of the concerns WDNR has regarding this type of discharge is found later in this chapter (see Linear Seepage Cells).

The Bad Axe - La Crosse River Basin contains 23 municipal and 10 industrial discharges that are covered by WPDES permits. Appendix C contains a table of the WPDES permitted wastewater treatment plants in the Bad Axe - La Crosse River Basin. Each permitted facility is responsible for meeting the water quality limits, sludge spreading conditions, and facility maintenance and upgrades outlined in their permit. Nearly all facilities in the Bad Axe - La Crosse River Basin are in compliance with their WPDES permits. However, all facilities in the basin which discharge to dry creek channels (linear seepage cells) will have groundwater limits put into their permits. Some facilities already have groundwater limits in their permits. This change in chemical limits has caused these facilities to evaluate alternatives for wastewater treatment since their current wastewater treatment plant cannot treat wastewater well enough to meet groundwater limits.

Non-Point Sources of Pollution

Urban

The most common non-point sources of pollution found in urban areas of the Bad Axe - La Crosse River Basin include increased water runoff volumes and erosion of construction sites. The conversion of hayfields and cropland to houses with roads, driveways and sidewalks creates increased volume of runoff during rain events. This increased volume of water results from the addition of impervious surfaces that don't allow water to infiltrate the ground. Increased water volumes conveyed to the nearest stream can result in scour of the channel which exacerbates streambank erosion and reduces in-stream habitat for fish. When formerly vegetated areas are disturbed for construction activities, rain can quickly erode soil and move it off site if erosion control measures are not adequately installed and maintained. Some counties, cities and villages have erosion control ordinances, however many do not. Enforcement of existing ordinances and adoption of new ordinances throughout the basin would benefit the water resources of the Bad Axe - La Crosse River Basin.

Rural

The most common non-point sources of pollution found in the rural areas of the Bad Axe - La Crosse River Basin include streambank erosion, cropland erosion and inadequate management of manure. Streambanks devoid of plants are obvious sources of soil to the adjacent stream. Many eroding streambanks in the basin are due to historical sediment deposits in a valley that erode during times of high flow. Many other stretches of streambank in the basin contain exposed soil due to over grazing and trampling by livestock. Many crop fields are located immediately adjacent to streams because of relatively level terrain. Exposed soil during certain months of the year leave the field vulnerable to soil loss during rainstorms. Despite the source, addition of soil into a stream can put a healthy trout population at risk. The reproductive success of a trout population depends on clean gravel areas where fertilized eggs incubate from fall through early spring. If soil settles into these gravel areas, the eggs become buried and consequently unable to hatch. Deep pools are also a vital type of in-stream habitat which adult fish use for feeding and hiding from predators. The addition of sediment to a stream threatens the number and quality of pools found in a stream.

Manure from hogs, beef cattle or dairy cows contains both nitrogen and phosphorus which are valuable nutrients for crops. However, if these nutrients make their way to the nearest stream, lake or groundwater, problems can result. High nitrate levels in groundwater can be dangerous for infants and pregnant women. Too much nitrogen and phosphorus in a stream or lake can cause excess plant or algae growth. Consequently, too many plants in a waterbody can cause wide

fluctuations in oxygen levels that affect sensitive fish and aquatic insects. Bacteria associated with manure also finds it's way into streams and lakes. Many streams in the basin contain high enough levels of bacteria to render the water unsafe for wading or swimming.

Barnyards, livestock feeding areas and pastures contain concentrated amounts of manure. Manure spread on fields throughout the year can also temporarily contain concentrated amounts of manure. None of these situations create problems for water quality unless the manure actually reaches the stream, usually from rain or snowmelt. A properly maintained manure storage pit, barnyard, and pasture can reduce or eliminate movement of manure to an adjacent stream. Immediately incorporating newly spread manure into the ground and watching weather forecasts to avoid spreading before predicted rain events also reduces the likelihood of problems for an adjacent stream.

Outstanding and Exceptional Resource Waters

The creation of Chapter NR207 "Water Quality Antidegradation" and changes to NR102 "Water Quality Standards for Wisconsin Surface Waters", (Wisconsin Administrative Code) allows the Department of Natural Resources to determine which waterbodies, because of their particular resource values and water quality, are most vital to protect for the citizens of Wisconsin. When coupled with other administrative codes, NR207 protects surface waters and reflects their values and priorities when determining what kind of environmental safeguards are applied to new or increased wastewater discharges. The purpose of the antidegradation policy is to increase protection for high quality streams and lakes in the state. To achieve this, the antidegradation classification system includes outstanding resource waters (ORW) and exceptional resource waters (ERW).

Table 1. Outstanding and Exceptional Resource Waters of the Bad Axe - La Crosse River Basin

Stream	ORW ERW	County	Watershed
All Class I Trout Streams in WI Trout Streams (WDNR, 1980)	ERW	All	Entire Basin
Berge Coulee Creek	ORW	La Crosse	Coon Creek
Bostwick Creek	ERW	La Crosse	Lower La Crosse River
Coon Creek (from Chaseburg upstream)	ERW	La Crosse, Vernon	Coon Creek
Copper Creek	ERW	Crawford	Rush Creek
Farmers Valley Creek (+ all tributaries)	ERW	Monroe	Little La Crosse River
Frohock Valley Creek	ERW	Vernon	Bad Axe River
Hornby Creek	ERW	Vernon	Bad Axe River
Rullands Coulee Creek	ORW	Monroe, Vernon	Coon Creek
Spring Coulee Creek	ORW	Vernon	Coon Creek
Sugar Creek	ERW	Crawford	Rush Creek
Timber Coulee Creek	ORW	Vernon	Coon Creek

An outstanding or exceptional resource water is a surface water which provides valuable fisheries, hydrologically or geologically unique features, outstanding recreational opportunities, unique environmental settings and which is not significantly impacted by human activities. The outstanding and exceptional resource water distinction requires that all new permitted discharges

to these waters are comparable to or better than the existing water quality in that waterbody. However, a new discharge to an exceptional resource water is allowable to correct an environmental problem. An example of this would be a groundwater contamination problem that requires the pumping and treatment of groundwater, then discharging it to surface water. The official statewide listing with designated reach descriptions of these waters is found in NR 102, Water Quality Standards for Wisconsin Surface Waters. More information regarding condition of or threats to these waterbodies may be found in their respective watershed narratives.

The Bad Axe - La Crosse River Basin contains 31 streams totaling 123.9 miles of exceptional resource waters and four streams totaling 20.2 miles of outstanding resource waters. Table 1 lists the Bad Axe - La Crosse River Basin waterbodies, or portions thereof, which are designated as outstanding resource waters (ORW) or exceptional resource waters (ERW) in the February 1998 revision of NR102.

Impaired Waters (303(d) List)

As required in the Clean Water Act (s. 303(d)), the Department of Natural Resources submitted a list of impaired waters to the U.S. Environmental Protection Agency in 1998. Additions to this list occurred in 2000. The list identifies waters that are not meeting water quality standards, including both water quality criteria for specific substances and designated biological uses. The DNR will identify, attempt to quantify, then reduce or eliminate the causes of water quality impairments which are preventing the waterbodies from meeting standards. One process to achieve this goal is the development of a Total Maximum Daily Load (TMDL), as outlined in section 303(d)(1)(C) of the Clean Water Act. The total maximum daily load of the pollutants causing the impairment would be calculated for each waterbody on the impaired waters list. Various categories of factors causing water quality impairment include point source dominated, nonpoint source dominated, point source/nonpont source combination, contaminated sediment, atmospheric deposition dominated, habitat/physical impairment, and other factors. The 303(d) listed waterbodies in the Bad Axe - La Crosse River Basin fall into the atmospheric deposition (fish consumption advisory), habitat/physical impairment, nonpoint source dominated, and point source/nonpoint source combination categories. Table 2 lists the 5.7 miles of streams and two lakes in the Bad Axe - La Crosse River Basin found on the Wisconsin impaired waters list.

Table 2. Impaired Waters (303(d)) of the Bad Axe - La Crosse River Basin

Stream/Lake	County	Watershed	ATM DEP	HABITAT DOM	NPS DOM	NPS/PS BLEND
Adams Valley Creek	La Crosse	Lower La Crosse River		x	x	
Angelo Pond	Monroe	Upper La Crosse River	x		x	
Gills Coulee Creek	La Crosse	Lower La Crosse River			x	
Lake Neshonoc	La Crosse	Little La Crosse River			x	x

The La Crosse County Land Conservation Department is currently working with landowners in the Adams Valley Creek and neighboring Burns Creek watersheds to reduce sediment and nutrients to both streams. The project is funded by La Crosse County and a Targeted Runoff Management grant from the Wisconsin DNR. After the two year project ends, surveys to determine changes to the habitat, biology and water quality will be conducted on both streams. The goal is to improve Adams Valley Creek enough to remove it from the impaired waters list.

Reintroduction of Native Brook Trout

Brook trout, the only inland trout species native to Wisconsin, flourished in Bad Axe - La Crosse basin streams prior to European settlement. The loss of not only in-stream habitat, but also cold water springs, and food caused the native fishery to decline to the point of near extinction in the basin. As land management and streams improved throughout the 20th century, brown trout - originally from Germany - were stocked in coulee streams. These fish survived well in the relatively warmer streams which contained many forage fish species to feed on. In fact, they survived so well that numerous coulee streams now contain naturally reproducing brown trout populations. Brook trout require colder water than brown trout and their food base is largely comprised of aquatic insects. When both brown and brook trout are found in the same stream, brown trout usually tend to out compete the brook trout because of their larger size and piscivorous nature. However, with the return of natural spring flow, stable streambanks, in-stream habitat and reliable food base, remnant brook trout populations were recently documented in some coulee streams.

Figure 16. Brook Trout

In 1995, some Wisconsin DNR fish hatcheries began to raise wild brook trout for eventual release in Wisconsin streams. Previously only hatchery bred and raised trout, also known as domestic trout, were stocked in Wisconsin streams. These domestic trout were easily caught by anglers, did not exhibit a fear of predators, and did not successfully reproduce in streams. To improve survival rates in the wild and promote naturally reproducing trout populations, healthy adult wild brook trout are removed from Wisconsin streams and transported to hatcheries for breeding. These adults are then returned to their native streams while the offspring are raised in the hatchery with methods that reduce human exposure. The young wild brook trout are then stocked in streams with appropriate water temperatures, habitat, food availability and lack of brown trout. A year or two after a stream is stocked with wild brook trout, an assessment is done to determine the health and size of the population.

Many streams in the Bad Axe - La Crosse River Basin now contain self-sustaining wild brook trout populations, some of which were aided by the stocking of hatchery raised wild brook trout. Successful establishment of self-sustaining populations of brook trout in the basin has restored part of Wisconsin's natural heritage.

Cranberry Cultivation

Compared to other parts of Wisconsin, the number of cranberry operations in the Bad Axe - La Crosse River Basin is not significant. However if the industry continues to expand, this basin may be affected. Soil conditions in this basin are not as favorable to successful cranberry crops as other parts of the state, but many cranberry operations reside in the neighboring Black River Basin and Lower Wisconsin River Basin.

The large volume of water required to grow and harvest cranberries necessitates growers to locate where water is readily available. A stream with reliable flow usually does not contain enough volume for the culture of cranberries, so streams are routinely impounded to provide enough water for irrigation, frost protection, and berry harvesting. If a cold water stream is impounded, conversion to a warm water stream may result. Solar radiation warms the impounded water. Once returned to the stream, the increased water temperature can strongly influence a stream's ecology. These changes can occur on any cold water stream which is impounded, regardless of the impoundment's use. The DNR has documented changes to some Bad Axe - La Crosse River Basin stream classifications after the creation of impoundments.

As in many methods of food production, fertilizers, herbicides and insecticides are used in the cranberry growing industry. Special concern exists over their use in cranberry production due to the potential release of some chemicals directly to surface waters. This concern resulted in a biomonitoring study conducted in 1992 above and below two cranberry marshes in Jackson County. Mortality to two aquatic insect species on one of three randomly chosen sample dates may be explained by diazanon (an insecticide) concentrations found in the water sample. Elevated water temperatures were also documented below cranberry marsh discharges to a cold water stream.

A study conducted in Black River basin streams between 1996-97 documented significant increases of temperature and nitrogen concentrations below both cranberry and recreational impoundments, and significant increases in ammonium and total phosphorus were documented below the cranberry impoundment. Extremely low dissolved oxygen was also documented in the stream below the cranberry impoundment. Since only one cranberry impoundment was monitored, additional studies to examine the effects of impoundments were recommended.

In light of these studies, new cranberry growing operations in the Bad Axe - La Crosse River Basin should avoid locating on coldwater trout streams and consider options such as warm water streams, closed systems, and/or upland sites. Additionally, all dam owners on coldwater streams in the basin should give serious consideration to modifying the dam discharge to draw cold water from deeper portions of the impoundment and/or removal of their dam.

Floodplain and Shoreland Zoning

Lands within 1,000 feet of the ordinary high water mark of a lake, pond or flowage are designated as shorelands. Also, lands within 300 feet of the ordinary high water mark or the landward edge of the floodplain of a navigable river or stream (whichever is greater) are designated as shorelands. The ordinary high water mark (OHWM) is the point of a streambank or lakeshore where the presence or action of water occurs often enough that the lake or stream bed can be distinguished from the upland. The OWHM, determined individually for each waterbody, can be defined by a change in vegetation, erosion , or other indicators. This OHWM forms the boundary

between public and private ownership on natural lakes. The people of Wisconsin own the beds of natural lakes, which are held in trust by the State. On streams, the riparian landowner owns the bed to the center of the stream, however the public has the right to use the water for water dependent activities as long as the users are in the water.

Shorelands are usually considered prime residential building areas because of their scenic beauty; however, shorelands provide valuable habitat for both aquatic and terrestrial animals and vegetation. Shorelands also act as buffers and thus serve to protect water quality. Wisconsin requires counties to protect and prevent the loss and erosion of these valuable resources by adopting and enforcing a shoreland ordinance. The authority to enact and enforce this provision comes from Chapter 59.69 of the Wisconsin Statutes. Wisconsin Administrative Code NR115 dictates the shoreland management program. County ordinances can be more, but not less, stringent than NR115.

Counties, cities and villages are required to implement floodplain zoning via authority from Wisconsin Statute 87.30(1). The purpose of Wisconsin Administrative Code NR116, Floodplain Management Program, is the protection of life, property and public investments from the effects of flooding.

Effective administration of floodplain and shoreland zoning ordinances is necessary to protect life, health, property and the natural values of shorelands. The demand for administrative services related to these ordinances will continue to increase as the trend in rural shoreline development continues. Individual counties must be aware of these needs and allocate staff accordingly.

Education of the waterfront property owner before problems arise is an important component of ensuring compliance with floodplain and shoreland zoning ordinances. The University of Wisconsin – Extension has a comprehensive publication addressing waterfront property ownership. Life on the Edge...Owning Waterfront Property contains chapters on choosing property, landscaping, shoreline erosion, the role of aquatic plants, public and private rights regarding water, floodplains, wetlands, piers, docks, etc. This 95 page publication is available from local county UW-Extension offices.

GROUNDWATER ISSUES OF THE BAD AXE - LA CROSSE RIVER BASIN

Groundwater is the primary source of potable water in this basin. Industrial uses of groundwater include source water for the beverage industry and the geothermal heating and cooling of buildings. Groundwater wells vary from very shallow sandpoints to wells over 600 feet deep. Artesian wells are also common at lower elevations. Groundwater in this basin is generally of high quality, but in some locations high iron dissolving out of sandstone formations causes aesthetic and nuisance problems requiring filters to remedy. Hardness is also a problem in certain localities.

Aquifers

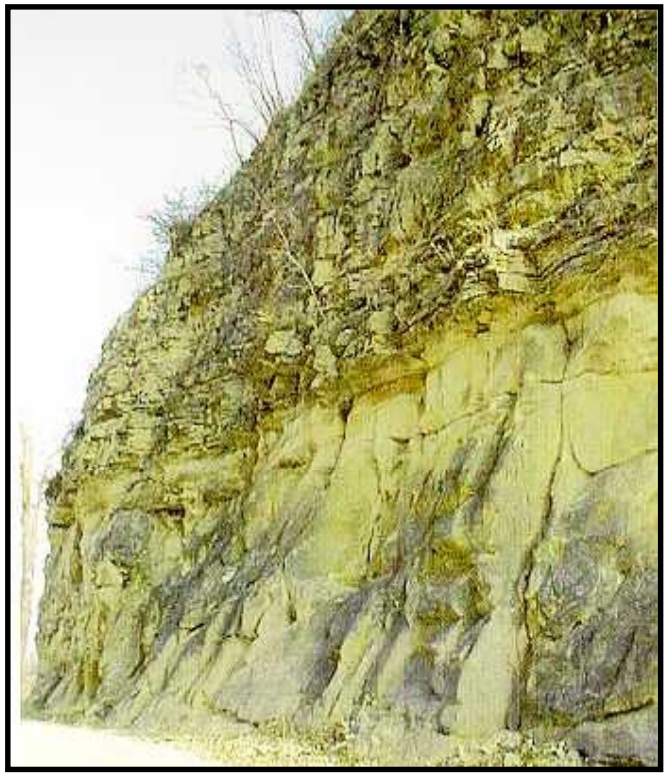
An aquifer is a rock or soil formation that can store and transmit water efficiently. Several aquifers are available in this region. Some water is available in the Prairie du Chien Formation, a dolomite/limestone layer that caps the higher ridges. Older wells on the ridgetops often terminate in this formation, which can contain sink holes, caves, and channels, also referred to as karst features. These features are created from water dissolving the limestone bedrock which can lead to surface runoff moving quickly through underground fissures and caves rather than slowly

migrating through the ground. Consequently, water from this source is vulnerable to contamination from surface activities.

Historically, communities and industries have injected waste water into this formation and, until more recently, impacts have not been understood or assessed. Because of the karst features present in this formation, groundwater flow directions are not always easy to predict, making it difficult to accurately determine either the source of a contaminant or which wells may be potentially affected. Since 1975, State Administrative Code (NR112) has prohibited the use of any well for disposal of solid wastes, sewage, surface water or waste water drainage. Over the years Administrative Code (NR812) was revised to also prohibit use of any excavation or opening deeper than it is wide regardless of depth for disposal of pollutants. WDNR is currently in the process of updating Administrative Code to prohibit groundwater injection wells as defined by EPA.

While many old ridgetop wells were 150-200 feet deep, it is not uncommon for new wells to be constructed to depths between 300 and 600 feet. The purpose of this extra depth is to tap into one of the sandstone aquifers underlying the dolomite. However, it is in these deeper aquifers that iron and excessive hardness may present a problem for the potable water supply.

Figure 17. Fractured dolomite over sandstone.



Sandstone is near the surface in some parts of the basin, particularly in the wider valleys and on hillsides, where overlying dolomite and shale have been eroded away. While these sandstones are generally high producing aquifers, they are much more vulnerable to contamination from surface activities when they are near the surface.

Springs are common throughout the basin and serve as potable water for some of the older homes and farmsteads. In general terms, springs occur when moisture, in the form of rain or snow melt, percolates downward through the layers of rock until it encounters a layer that is difficult to penetrate, for example the contact between sandstone and shale. Since it is more difficult for the moisture to enter the next rock formation, it instead flows horizontally, to exit on the sides or bottom of the hill. Oftentimes, property owners will simply insert a pipe into the "eye" of the spring (where the water comes out of the rock), and let the pipe carry water from the spring to a cistern or other reservoir. The state Administrative Code has requirements for constructing spring houses; however, many older unprotected springs still exist.

During drought, the flow in some streams is derived solely from groundwater discharge as base-flow into the stream. This is an important contribution, not only in terms of quantity, but also

because the surface water temperatures are maintained by groundwater. Cold water fisheries are preserved, as are other water-fed habitat areas.

Sand and gravel deposits provide good quality potable water in river valleys, flood plains, and lower areas of the basin. Both drilled wells and sandpoint wells are used in this unconsolidated material. Groundwater is shallow and easily impacted by surface activities. Artesian wells are present where the confining rock layers are penetrated, along rivers and in limited areas around Sparta. A few artesian wells exist in Fort McCoy.

Figure 18. Artesian or flowing well.

Public Water Supplies

Groundwater supplies 56 public water utilities in the basin, in addition to 22 other-than -municipal (mobile home parks and subdivisions); 29 non-transient non-community public water users (schools, daycare facilities, factories serving 25 or more of the same people for at least 6 months of the year); and 159 transient facilities (taverns, churches, campgrounds serving 25 people for at least 60 days of the year), all with their own water wells (Table 3). All facilities which have water available to the public in any of the above categories are subject to safe drinking water requirements. These requirements include water sampling for a variety of contaminants, such as volatile organic compounds, synthetic organic compounds, inorganic compounds, bacteria, and radioactive contaminants. These tests include a wide variety of commonly used chemicals found in solvents, de-greasers, metals, polishes, print and paint shop chemicals, electronics and chemical plants, household cleaning products, pesticides, and some naturally occurring toxins.

Table 3: Public Waters Supply Systems in the Bad Axe LaCrosse River Basin in 2001

Municipal	56
Other-than-municipal (mobile home parks, subdivisions)	22
Non-Transient Non-Community (schools, daycare facilities, factories, etc. serving at least 25 or more of the same people for at least 6 months/year)	29
Transient Non-Community (taverns, churches, campgrounds, etc. serving at least 25 people for at least 60 days/year)	159

Municipal and other-than-municipal systems must report their water sampling results to water users via a Consumer Confidence Report. This report lists all sampling parameters, any detected chemicals, safe drinking water standards for the chemical, and health affects associated with consuming water containing the detected chemical.

Private Water Supplies

Private well owners are encouraged to sample their wells annually for bacteria and, in farming areas, for nitrates. More frequently, wells are being sampled and inspected for code compliance as part of real estate transactions. La Crosse County citizens can contact the La Crosse County Health Department for water testing. For all Wisconsin citizens, the Wisconsin State Laboratory

of Hygiene (*www.slh.wisc.edu* or 1-800-442-4618) in Madison provides sample bottles and water testing. Some private laboratories also conduct water analysis from private wells.

The movement of many people from urban areas to more rural settings results in the drilling of more private water supply wells. A state licensed well driller and pump installer should be contracted for such work. Licensed well drillers and pump installers are required to adhere to the state code covering such activities (Chapter NR 812). This code includes prescribed setback distances from the well to potential pollutant sources, proper materials and installation of well casings, proper grouting and sealing of wells, installation of vermin proof well caps, prescribed height of finished well, among other things. If this type of work is not done correctly, an aquifer may become contaminated or a private well owner may experience problems with their well, pump, or water supply.

Common Groundwater Contaminants

Bacteria

Probably the most common groundwater contaminant is bacteria. Bacteria contamination can result from poorly constructed wells, flooding, or surface activities that impact the well, such as contaminated run-off. It is often difficult to find and eradicate the source, although, typically, well owners are advised to chlorinate their well as a first step in removing bacteria. Coliform bacteria, the most common contaminant, is a non-pathogenic group of organisms. While not harmful itself, its occurrence may indicate the presence of other more harmful organisms.

It is recommended that private well water be analyzed for the presence of coliform bacteria annually, but more frequently after flood episodes or heavy rains. If the well construction is questionable or if the well was contacted by flood waters, it may need to be chlorinated before the water is used for consumption.

Nitrates

Nitrates are another common groundwater contaminant. The state drinking water standard is 10 parts per million (ppm) and, although this is a conservative number, well owners are encouraged to monitor their water supply closely if nitrates are detected near the standard. In particular, nitrate consumption poses a problem for infants under 6 months of age and some studies suggest that fetuses may also be adversely affected if a pregnant mother consumes water high in nitrates.

Elevated nitrate concentrations can be the result of over application of manure and other fertilizers, sludge and wastewater spreading, failing on-site waste disposal systems, a high density of waste disposal systems; manure storage, animal feedlots, or the improper location or construction of wells. While the state administrative code requires that every new well be tested for bacteria, nitrate tests are recommended, but not required.

Pesticides

Occasionally, pesticides are detected in either public or private groundwater supplies. For example, the Department of Agriculture, Trade and Consumer Protection has established an atrazine prohibition area between Viroqua and Westby encompassing four sections because atrazine, a common corn herbicide, was detected in area wells. The restriction will be lifted when the herbicide is no longer detected in groundwater samples from these wells.

Potential Sources of Groundwater Contamination

Landfills

Approximately 35 old, abandoned landfills are located in this basin. Groundwater impacts have occurred at several of these. Private wells west of the Sand Creek landfill, a landfill jointly operated by the City of Sparta and Monroe County, have been impacted by a contaminant plume emanating from the landfill. Local wells continue to be monitored, but a community well has been constructed to serve those homes where volatile organic compounds were detected above safe drinking water standards in the water.

Groundwater contamination has also occurred at a second City of Sparta landfill, but no private wells have been impacted at this time. An investigation to determine the dimensions of the contaminant plume will be initiated in the future.

Leachate from an old landfill adjacent to the active La Crosse County landfill has been detected in monitoring wells near the landfill. On-going maintenance and management should limit impacts to potable water supplies in the area. The active landfill currently receives general household waste. Demolition material is deposited in a separate on-site landfill. A site dedicated solely for ash generated from the Xcel Energy (formerly NSP) plant is also located on the same property.

Contaminant detects have also occurred at the abandoned City of La Crosse Isle le Plume landfill. This landfill was basically a marsh between the Mississippi River and a backwater slough that has been filled with waste. The landfill is currently used for leaf and brush storage, compost, salt storage, a municipal shop, and storage of other materials transported up river by barge. Because the landfill is basically in the river, little can be done to remediate the leachate discharges to groundwater.

Industrial

Industrial activities throughout the basin have resulted in groundwater contamination of specific areas. The source of these contaminated areas varies from dry cleaners to gas stations to manufacturing facilities, or simply spills of hazardous chemicals. The leaking underground storage tank (LUST) program lists 197 sites in this basin where petroleum contamination has occurred, some of which have impacted groundwater.

Reportable spills occurred at 214 locations in the basin. These represent a variety of spilled substances, resulting in soil and, in some cases, groundwater contamination. Some spills required remedial actions such as removing contaminated soil.

Additional contaminated sites are addressed through the DNR remediation and redevelopment (R&R) program. Included in this group would be discharges from above ground tanks, dry cleaners, salvage yards, etc. As of September 2001, the R&R program is involved with 83 of these types of sites. These sites are in various stages of clean-up, depending on the severity of the problem, ranging from simple soil removal to aggressive groundwater treatment and monitoring.

Cleaning contaminated groundwater is an expensive and long-term project. In many cases, a plume of contamination cannot be contained or removed and groundwater wells or surface water may be adversely impacted for the forseeable future.

Because of the expense associated with various kinds of clean-up, more and more contaminated locations are being left to bio-degrade naturally, requiring long-term monitoring to ensure that degradation is actually taking place. Soil microbes act on some chemicals and, given enough time, can effectively eliminate the chemicals. However, other chemicals left to degrade on their own will break down into products that may be more toxic than the original chemical.

Linear Seepage Cells

Linear seepage cell is a term coined to describe permitted discharges of treated wastewater effluent to dry waterways. Except during storm runoff or snowmelt, the effluent seeps into the ground before reaching a continuously flowing stream. A strategy to effectively protect both surface and groundwater was developed by the Wisconsin DNR for wastewater discharges that are not categorized exclusively as surface or groundwater. This strategy allows adequate monitoring of discharges that were permitted as surface water discharges in the past, but which may have both surface and groundwater impacts.

The Bad Axe - La Crosse River Basin contains five linear seepage cells: Westby Wastewater Treatment Plant, Westby Co-op Creamery, St. Joseph Sanitary District, Cashton Wastewater Treatment Plant, and Ridgeview Inn.

A compliance schedule has been or will be inserted in the discharge permits for these existing linear seepage cells that requires the permittee to:

1. Identify all private wells within a certain distance of the effluent ditch, from the point of discharge to the point where the effluent soaks into the ground.

2. Sample their wastewater effluent for a series of nitrogen containing compounds, chlorides, bacteria, and total dissolved solids.

3. Sample any private wells identified in item (1) for the parameters listed in (2). If any well shows these contaminants at levels above the appropriate enforcement standard, the permittee would be required to clean up the affected water supply due in whole or part to the permitted discharge, and act to prevent future violations.

4. Inspect the effluent ditch for sinkholes annually in areas of karst topography. If sinkholes are identified, the permittee must plug the sinkhole, reroute effluent around the sinkhole, reroute the waterway, or otherwise prevent effluent from directly entering groundwater via the sinkhole. Permittees with the effluent ditch inspection requirement must submit a report summarizing the ditch inspection and any actions taken to maintain the waterway.

New dischargers to linear seepage cells and existing dischargers that upgrade their plants are strongly encouraged to pipe the effluent to a surface water and meet discharge limits for that surface water or construct an appropriately engineered groundwater discharge system. If neither of these options is chosen, the discharger would then be required to meet the 10 mg/l total nitrogen standard, and other groundwater discharge standards as well as surface water standards for the stream classification at the discharge point.

Groundwater Protection Activities

Well Abandonment

Improperly constructed wells, old windmill wells, pit wells, or any unused well are a significant threat to groundwater quality and must be properly abandoned. If these wells are not properly sealed, they can directly channel contaminated surface water into the groundwater, via the open well casing. This water bypasses the purifying action that normally takes place in the upper layers of the soil. These wells also pose a hazard to small children and animals and are sometimes used for disposing of unwanted chemicals or other materials.

Although current law allows anyone to conduct well abandonment, it is recommended that a licensed well driller be contacted for this work. It is required that all of the internal piping be removed from the well prior to abandonment and that an attempt be made to clean the well of any debris. Generally, well owners do not have the equipment to perform these tasks.

Communities that provide public water to their residents are required to implement a well abandonment ordinance which requires all unused wells in the community to be abandoned. Wells may be retained only if 1) the well is code-complying; 2) the well produces two safe bacteria samples; 3) the well has a legitimate use; 4) no cross-connections exist between the well and the community water supply system; and 5) a permit is obtained from the community utility. The purpose of this ordinance is to protect the public water supply and preserve the aquifer.

La Crosse County Groundwater Study

The purpose of this study is to characterize La Crosse County's groundwater resources and to subsequently identify areas which contribute groundwater to municipal wells in the County. This work is being conducted by the U.S. Geological Survey and the Wisconsin Geological and Natural History Survey in Madison, WI with contributions from La Crosse County and the Wisconsin DNR. This project began in 1999 and is slated for completion in 2002.

The purpose of the La Crosse County groundwater study is to understand and characterize the regional groundwater flow system, as well as the local groundwater resources around population centers, so that they may be properly managed and preserved. Questions this study hopes to answer include:

✔ Where can new municipal wells be placed so that interference with other wells is minimized and water yield optimized?

✔ Where does the water pumped from a well originate?

✔ What areas need to be protected so that water from an individual well is not contaminated?

✔ How much of the La Crosse County's groundwater comes from the Mississippi River by induced filtration?

✔ What is the direction and rate of movement of contaminants that have entered or may enter the aquifer in the near future?

The La Crosse County Groundwater Study will yield three maps presenting groundwater elevations, geologic composition, and aquifers of the County. A Hydrogeology of La Crosse County report and a Zone of Contribution for Municipal Wells in La Crosse County report will also be produced.

Wellhead Protection Areas

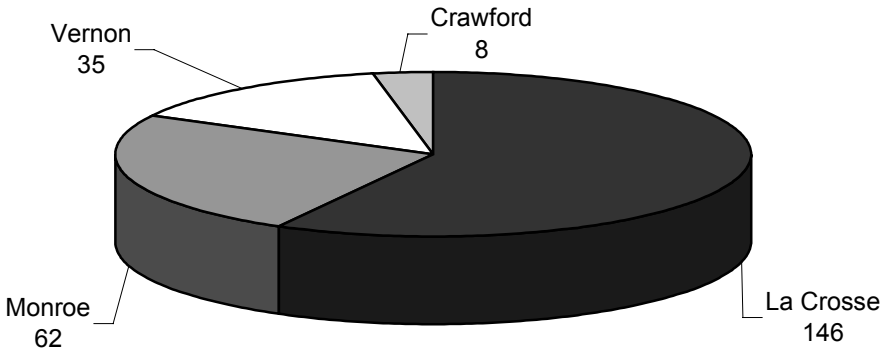
A Wellhead Protection Plan (WHPP) is designed to protect a limited geographical area around a public water supply well or wellfield. The WHPP identifies the recharge area of the aquifer providing water to the well, sources of contamination within the recharge area, and management approaches to protect the water supply. Since May 1992, the DNR has required all municipalities planning to construct new wells to have prior approval of a WHPP for the proposed well. For wells constructed prior to May 1992, a WHPP is strongly encouraged. In the Bad Axe - La Crosse River Basin, Coon Valley, West Salem and Fort McCoy have approved Wellhead Protection Plans. The City of La Crosse and the City of Onalaska are producing Wellhead Protection Plans even though they are not required.

High Capacity Wells

Publicly and privately owned wells designed to pump 70 gallons per minute or more are designated as "high capacity wells". Such wells are generally constructed to serve public water supplies, farm irrigation, quarry washing operations, cranberry operations and industrial use. Prior to construction of these wells, state code dictates that DNR approval must be acquired. Currently state regulations only prohibit high capacity wells from impacting nearby municipal water wells. However, the public and the DNR are becoming more concerned about the potential impacts from high capacity wells to groundwater levels near sensitive streams which rely heavily on groundwater flow. As a result, it is likely that legislation will be introduced at the state level to expand authority to regulate this type of groundwater withdrawal.

The Bad Axe - La Crosse River Basin contains 251 high capacity wells, many of which serve municipalities. La Crosse County contains the most with 146, followed by Monroe County with 62, Vernon County with 35 and Crawford County with 8. These totals only include the portion of each county within the Bad Axe - La Crosse River Basin (Figure 19).

Figure 19 High Capacity Wells in the Bad Axe-La Crosse River Basin in 2001



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