Environmental Capacity

BACKGROUND

Various terms are used to describe the extent to which the environment is able to accommodate stress without unacceptable effects. One such term is "environmental capacity." As commonly used, and certainly as used throughout this report, environmental capacity is defined as the ability of the environment to accommodate a particular activity or rate of activity (in the case of this report, that activity is development) without unacceptable impact.

This report results from a series of meetings and discussions with the Environmental Technical Advisory Committee, or ETAC, which was a group of environmental and natural resource experts formed to provide input into the master planning process for Brice Prairie. ETAC consists of representatives from the US Geological Survey (USGS), the US Fish and Wildlife Service (USFWS), the Wisconsin Department of Natural Resources (DNR), La Crosse County Department of Land Conservation, Vierbicher Associates, the Mississippi Valley Conservancy and the Town of Onalaska.

The Upper Mississippi River National Wildlife and Fish Refuge (Refuge) virtually surrounds Brice Prairie. The Refuge harbors an abundance of resident and migratory wildlife species, including species that are threatened either locally or federally. Continued urbanization of the Prairie could cause further stress to these species by eliminating upland habitat. It is also important to note that the native sand prairie of this region has been substantially depleted by development and agricultural practices. In order to provide wildlife habitat, the sand prairie should be restored where possible on Brice Prairie. ETAC determined the location of the important environmental features on the Prairie and identified areas to be protected from development.

EXECUTIVE SUMMARY

Overall, from an environmental perspective, the Committee agreed that limited capacity appears to be available for additional development on the Prairie, as long as it is done in an environmentally responsible manner. However, ETAC noted that while it is relatively easy to quantify capacity for transportation and emergency services, environmental capacity is harder to quantify. It is important for the Town to follow the goals, objectives and policies in the Town's Comprehensive Plan and the recommendations in this report to guide development. The Committee determined that, ultimately, groundwater is probably the limiting factor for development. Because of the importance of this resource, the contamination that has already occurred and the permeable Prairie soils that are susceptible to contamination, groundwater is a primary concern.

DISCUSSION & ANALYSIS

Brice Prairie is uniquely situated along the shores of Lake Onalaska and the Black River and is surrounded by the Upper Mississippi River National Wildlife and Fish Refuge (Refuge). The Prairie has long been used for agricultural practices and is the primary access gateway to the Refuge. It therefore deserves its own analysis for land use planning because of the unique environmentally sensitive resources both on and adjacent to the Prairie.

This section of the report discusses existing plans and studies, the attributes of the Environmental Features Map, and the relevant environmental issues on the Prairie. In addition, recommendations related to each resource are provided within each section and are marked '**Recommendation**'.

Existing Plans and Studies

As part of this report, other plans, documents and reports for Brice Prairie were reviewed to gain background knowledge. The Town has many useful documents that help identify environmental problems related to loss of habitat and open space, and resulting negative environmental impacts such as water quality contamination. These reports include:

- Hydraulic and Sedimentation Study, Town of Onalaska WI, Vierbicher Associates, Inc. 1995
- Brice Prairie Watershed Stormwater Management Plan, Vierbicher Associates, Inc. 2000
- The Groundwater Flow System Beneath Brice Prairie, Town of Onalaska, WI, Dawn Chapel, 2003
- Geology of La Crosse County, Wisconsin. Thomas J. Evans, 2003, WI Geological and Natural History Survey Bulletin 101
- Numerical Simulation of Ground-Water Flow in La Crosse County, Wisconsin, and into Nearby Pools of the Mississippi River. U.S. Geological Survey. Water Resources Investigation Report 03-4154
- Soil Survey of La Crosse County, NRCS, 1960
- Upper Mississippi River National Wildlife and Fish Refuge Draft Environmental Impact Statement and Comprehensive Conservation Plan
- Town of Onalaska Comprehensive Plan 2005-2025

Recommendation - As developments are proposed on the Prairie, it is important for the Town to understand existing and future plans and reports referencing Brice Prairie and implement the recommendations.

Environmental Features Map

While many reports and environmental studies address Brice Prairie, the environmental capacity of the Prairie is a difficult to define. In an attempt to answer this question, ETAC worked with the Town's consultant, Schreiber/Anderson Associates, and the City of Onalaska to create the Environmental Features Map. The map identifies environmental, archeological, recreational and cultural areas that should be protected. The following features are included on the Environmental Features Map, which is included at the end of this report.

Boat Ramp

There are three (3) boat ramps on Brice Prairie.

Recommendation – The boat ramps are important locations for recreational activities and should be well connected to the Prairie's park and recreation system.

Foot Access

There are three (3) foot access points that connect Brice Prairie to the Refuge.

Recommendation - It is extremely important to connect the pedestrian access points to the Prairie and Refuge to a network of bicycle and pedestrian facilities on the Prairie.

Observation Area

There are three (3) existing observation areas located on Brice Prairie, and one (1) proposed. Two (2) of the existing areas are within the Refuge between CTH ZN and the Great River State Trail; the third is at a high point between the Great River State Trail and STH 35, just south of CTH OT. The proposed observation area is at Browns Marsh, near the intersection of CTH Z and CTH ZB. These observation areas provide opportunities to view wildlife, important prairie habitat and scenic vistas on the Prairie, which are important parts of the area's attraction.

Recommendation – The viewsheds of the observation and interpretive areas of Brice Prairie should be protected.

Park

Parks are located throughout the Prairie and are typically found in all subdivisions.

Recommendation - As development occurs and new parks are developed, it will be important to link the parks through the neighborhoods and to one another via pedestrian, bicycle and greenway networks.

Railroad

The railroad corridor provides a distinct barrier from northwest to southeast across Brice Prairie.

Recommendation - It is important to provide bicycle and pedestrian connections across the rail line and between the Great River State Trail and local pedestrian and bicycle networks on Brice Prairie.

DNR Bike Trail & Lands

This map layer depicts land that is owned by the DNR and includes the Great River State Trail as well as adjacent property. Much of the land adjacent to the trail is either owned by the railroad or the USFWS, or is proposed to be purchased from willing sellers by the USFWS. This is an important link in the tourism network of this area. Tourism is one of the state's largest industries and provides a significant amount of revenue to state and local governments.

Recommendation – Prohibit new development between the railroad tracks and CTH XX as stated in the Town of Onalaska's Comprehensive Plan.

Recommendation- Maintain and enhance the scenic Great River State Trail to provide a rustic, rural trail experience and connect trail networks from this corridor onto Brice Prairie.

Creek Conservation Buffer

The map depicts a 100-foot buffer on either side of Halfway Creek and Sand Lake Creek to protect wildlife habitat and water quality. This width is the minimum stream buffer width that is typically recommended (Stormwater Manager's Resource Center 2003). As buffer width increases along a creek, wildlife and water quality benefits increase. Larger buffers offer a greater chance of undisturbed nesting, habitat variability, better foraging opportunities and the chance to establish adequate territories for animals that live in the shoreland area. Wider riparian buffers can be

expected to provide an adequate variety of microhabitats and thus offer a greater chance of avoiding predators, finding suitable habitat and establishing adequate territories. A buffer strip 100-200 feet wide along streams and rivers can provide for overall benefits to shoreline dependent wildlife, riparian wildlife and many generalist species. Buffers of this size can be protective of stream habitat and water quality as well (Shoreland Management Program Assessment, DNR, Bernthal, 1997).

Recommendation - Protect the water quality and wildlife habitat of Halfway Creek and Sand Lake Creek and their associated creek beds and riparian areas by encouraging best management practices. A minimum 100-foot buffer with native vegetation should be required on both sides of the creeks. This buffer recommendation does not preclude existing uses from continuing; however, any redevelopment of parcels adjacent to the creeks should adhere to these standards.

Low-Lying Recharge Areas

Low-lying groundwater recharge areas were originally mapped in the Brice Prairie Watershed Stormwater Management Plan Appendix A – Map #1. The map indicates locations of natural storage areas, including depressions, woods, prairie grasses and wetlands.

Recommendation – Protect low-lying groundwater recharge areas from development by requiring that they be used as locations for detention ponds or other recharge areas. The Brice Prairie Watershed Stormwater Management Plan provides additional recommendations for the design of these areas.

Drainage Buffer Areas

These areas, also identified in Appendix A – Map #1 of the Brice Prairie Watershed Stormwater Management Plan, show grass/prairie grass buffer areas designated to provide water quality and water quantity benefits.

Recommendation - Buffer areas surrounding low-lying groundwater recharge areas should be designated as greenway corridors that may allow trail access and wildlife habitat connection points.

USFWS – Owned Lands

The Environmental Features Map shows the lands that are currently owned by the USFWS as part of the Refuge. It is assumed that these lands are protected from development; however, land use on adjacent properties can affect the Refuge.

Recommendation - In order to maintain important fish and wildlife habitat, landowners adjacent to the Refuge should implement best management practices to prevent negative effects to the Refuge.

Recommendation – Encourage a 300-foot buffer between the Refuge and development on the Prairie. A 300-foot buffer is a generally accepted buffer width to protect wildlife habitat (Ecological Riverfront Design, APA, 2004).

USFWS – Future Land Acquisitions (from willing sellers)

The USFWS would like to purchase land from willing sellers to incorporate into the Refuge, as outlined in the 1987 Refuge Master Plan and the Upper Mississippi River National Wildlife and Fish

Refuge Draft Environmental Impact Statement and Comprehensive Conservation Plan. Many of these areas are higher value wetlands and therefore provide crucial habitat for a variety of fish and wildlife, protect surface water quality flowing into Lake Onalaska, help protect the Prairie's vulnerable groundwater and provide flood control for Midway and the Prairie. The Town's 1997 Comprehensive Plan addresses the value of these wetlands and recognizes that construction of a roadway across this area or widening of existing roads and the resulting land uses that would occur could create traffic problems that could put these highly valued wetlands at risk.

While these lands are supportive of important habitat for a variety of species, they also support game fish and wildlife, which is an important economic activity in Wisconsin, generating over $4 billion in economic output, $142 million in sales tax revenue, and supports more than 45,000 jobs.

Recommendation – Support the USFWS in acquiring land from willing sellers.

Recommendation – Limit or prohibit road access across lands identified by the USFWS for purchase from willing sellers.

Conservancy Overlay

This layer was initially identified in the Town's 2005 Comprehensive Plan and consists of a variety of resources that should be protected from development, including known archeological districts, wetlands, floodplains, wet soils, shorelands, steep slopes and wildlife habitat. This layer has been expanded from the Comprehensive Plan to include the wildlife habitat and the Onalaska Municipal Landfill Superfund site at the northwest end of the Prairie.

Archeological Districts

The only known archeological district on Brice Prairie is the Midway Archaeological District, northwest of the intersection of CTH Z and CTH ZB. The site is listed on the National Register of Historic Places and is currently used as agricultural land.

Recommendation - The Midway Archaeological District should be protected through zoning, Purchase of Development Rights (PDR), or other similar techniques.

(Editor's Note: After the completion of the ETAC's work, the US Fish and Wildlife announced plans to purchase approximately 183 acres on Brice Prairie. The targeted parcels include the Midway Archeological District.)

Wetlands, Floodplains and Wet Soils

Because the Prairie is adjacent to Lake Onalaska and the Mississippi River, there are an abundance of wetlands, floodplains and wet soils. Many of these areas are already protected within the Refuge; however many other sensitive parcels are outside the Refuge between the railroad tracks and CTH XX and are currently vacant or being farmed. The USFWS has targeted much of this land for acquisition from willing sellers. It is important to note that many of these areas are undevelopable because of environmental constraints.

Recommendation - The Town and County should strictly enforce existing state and federal regulations that prohibit development in floodplains and wetlands to help protect these areas.

Recommendation - Best management practices that protect the Prairie's wetlands, floodplains and wet soils should be encouraged.

Steep Slopes

Steep slopes are also important to protect from development because of the increase in erosion and sedimentation that can occur when these areas are developed. Most of Brice Prairie is relatively flat, except the land along Lake Onalaska, which is almost entirely developed.

Recommendation - Provide educational materials to landowners along Lake Onalaska through the Town newsletter, website or other means to inform them of best management practices to limit the amount of erosion and resulting sedimentation that occurs on their property.

Superfund Site

A portion of the Conservancy Layer covers the Onalaska Municipal Landfill site at the northwest corner of the Prairie. The 7-acre landfill is situated on an 11-acre parcel of property adjacent to the Black River. The landfill area was formerly a sand and gravel quarry. From 1969 to 1980, the Town of Onalaska operated the landfill, where municipal refuse was commingled with industrial solvents such as naphtha, toluene and trichloroethene. The solvents from the landfill have entered the groundwater beneath the site, causing the contamination of an adjacent homeowner's drinking water well that the Town of Onalaska replaced in the early 1980s. A floating layer of hydrocarbons, which acts as a source of groundwater contamination, is presently emanating from the landfill.

U.S. EPA and the state began cleanup efforts in 1993 with construction of a remedy -- a landfill cover, a groundwater extraction and treatment system and a bioremediation system. Bioremediation (which supplied air to the subsurface soil) ended as scheduled in 1998. Groundwater treatment ended in 2001, when DNR began studies of natural attenuation at the site. Five-year reviews, completed in 1998 and 2003, determined that the remedy was still protective of human health and the environment. Current data indicates that metals are the only contaminants above the cleanup standards. The state took over the operation and maintenance of the site in June 2002. (Source: NPL Fact Sheet for Onalaska Municipal Landfill, US Environmental Protection Agency, June 2005.)

Recommendation – Do not allow commercial or residential development on or around the former Onalaska Municipal Landfill, a Superfund ste. A 10-20 acre park and/or natural area conservancy or open space recreational area compatible with the nearby and adjacent Refuge land and potentially contiguous with Town-owned lands could be created.

Shorelands and Wildlife Habitat

The Conservancy Overlay included on the Environmental Features map includes shoreland areas and the wildlife habitat of Brice Prairie. The importance of shorelands and wildlife habitat and recommendations for their protection are explored in detail later in this report.

Groundwater Quality (drinking water)

Groundwater is the current source of drinking water for residents of Brice Prairie, and for that matter, all of La Crosse County. Not only is it critical for human consumption, but groundwater also plays an important role in maintaining the quality and quantity of the Prairie's surface water resources, including the wetlands, creeks, Black River and Lake Onalaska.

Two aquifers underlie Brice Prairie as shown in Figure 1. A shallow sand-and-gravel aquifer is found 10-20 feet below the surface and is up to 200 feet thick. This overlies a sandstone aquifer up to 300 feet thick. The sand-and-gravel aquifer is much more permeable than the underlying sandstone aquifer.

Groundwater in the sand-and-gravel aquifer beneath Brice Prairie flows mainly to the southwest at a rate of about 3 feet/day and eventually discharges into Lake Onalaska. In comparison, groundwater in the underlying sandstone flows also towards the southwest but at a rate of about 0.1 feet/day. Groundwater flowing beneath Brice Prairie originates from two sources: as precipitation that falls on Brice Prairie and infiltrates through the land surface and as groundwater flowing through the aquifers to the Brice Prairie area from up gradient recharge areas. The local infiltrating precipitation (9 to 12 inches per year) accounts for approximately 10 percent of the influx to the groundwater beneath Brice Prairie. The remaining 90 percent comes mainly through recharge areas from the northeast.

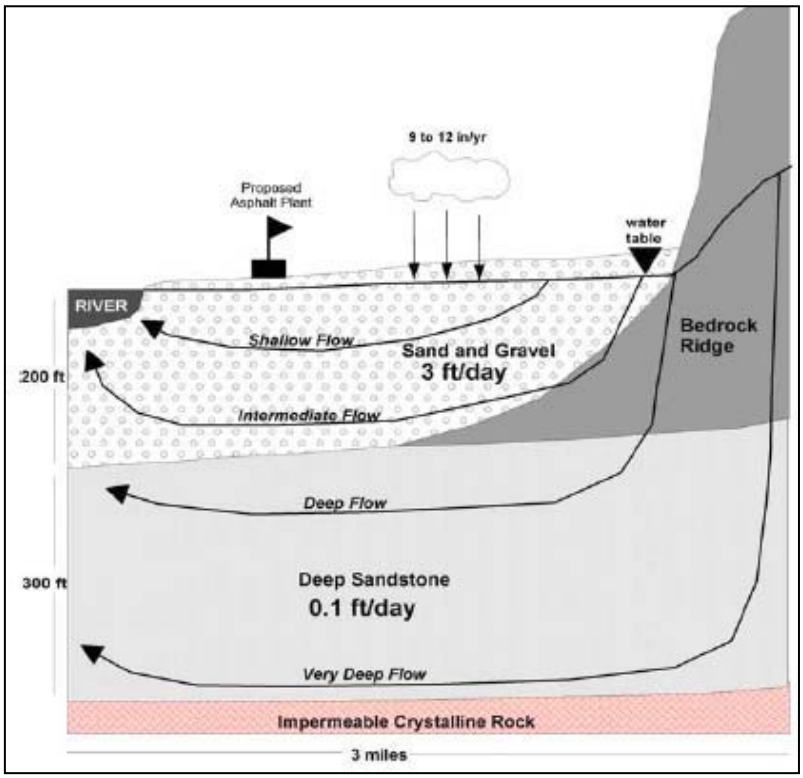


Figure 1 (Source: The Groundwater Flow System Beneath Brice Prairie, Town of Onalaska, Wisconsin, Dawn Chapel, Wisconsin Geological and Natural History Survey, 2003.)

Because of the permeable soils and shallow aquifer, the groundwater under Brice Prairie is extremely vulnerable to contamination. Rapid infiltration rates on the Prairie can mobilize contaminants and move them into the aquifer, where they can then travel rapidly through the permeable substrate materials and contaminate private wells. Municipal sewer and water service is not currently available on the Prairie, and if provided, will require costly sewer lift stations.

In addition to the Onalaska Municipal Landfill Superfund site at the northern tip of Brice Prairie (see Superfund Site section), several documented contamination sources on the Prairie have the potential to impact groundwater and surface water quality. DNR records indicate no remedial action is underway at these sites and they are listed as closed. The sites are:

- Kanes Prairie Market (N5914 CTH ZZ): Leaking underground storage tank
- Metallics, Inc. Ponds (W7274 CTH Z): Voss and Metals in a pond
- Blount, Inc. Outers Operation (N5549 CTH Z): Volatile organic compound (VOC) or Solvent contamination

In addition to the contamination sources mentioned above, nitrate groundwater contamination is occurring on the Prairie and on surrounding lands. According to the La Crosse County Health Department, wells have exceeded safe drinking water standards for nitrates at the Heritage Hills development, just east of the Prairie. Residents who live in the subdivision's 42 homes had obtained their water supply from a single 130-foot deep well drilled into the shallow, unconfined Mississippi River Valley Alluvial Aquifer. However, this well is in the process of being abandoned and individual wells are being drilled for each residence. According to Davy Engineering, nitrate concentration is the only reported parameter of concern but there may be other contaminants present. It is estimated that it will cost at least $18,000 per household for a property owner with a half-acre lot and 150 feet of road frontage to hook up to City water and sewer (source: City of Onalaska, 2005). While Heritage Hills is not directly located on the Prairie, it is an example of how concentrated development on the area's highly permeable soils can negatively affect groundwater quality. In addition, it was recently discovered that groundwater in the Midway area of Brice Prairie is contaminated with high salt concentrations, and residents of several homes in this area must drink bottled water.

To illustrate groundwater flow beneath Brice Prairie, the Wisconsin Geological and Natural History Survey completed groundwater modeling. Particles were placed in the model and tracked for 4 years. Figures 2-7 show the starting location of the imaginary particles and their movement after 6 months, 1 year, 2 years, 3 years and 4 years of flow through the aquifer. The figures represent a series of "snapshots" in time of groundwater movement, and show that all groundwater beneath Brice Prairie eventually discharges into Lake Onalaska.

Figures 2-7 illustrate the high rates of groundwater flow in the permeable sand-and gravel aquifer beneath Brice Prairie. "Land-use practices such as the spreading of agricultural and lawn fertilizers, dairy feed lots, private septic systems, or spills from fuel storage tanks may contribute to the degradation of groundwater quality" (Chapel, 2003).

The fact that all groundwater on the Prairie flows to the southwest and is eventually discharged into Lake Onalaska has implications for how developments are sited. When development occurs upgradient, or northeast, of existing development, any groundwater contamination that occurs in the new development may affect existing wells southwest of the contamination. The Town can manage any potential contamination by implementing the following recommendations.

Recommendation – Implement the Groundwater Management Program that is described beginning on page 27 of the Brice Prairie Watershed Stormwater Management Plan.

Recommendation – Implement the best management practices on pages 118-135 of the Brice Prairie Watershed Stormwater Management Plan including creating a stormwater management ordinance, a wellhead protection ordinance, and a groundwater protection overlay district.

Recommendation – All wells should be checked at least annually for nitrate and other contaminants, such as bacteria (per La Crosse County Health Department). As of 2005, a well test kit is available from the County Health Department for $42. The kit can be used to measure both nitrate and coliform bacteria. Other potential contaminants that should be measured periodically include arsenic,

lead, radon gas, atrazine and other pesticides, radium and volatile organic compounds (VOCs).

Figure 2: Starting particle locations.

Figure 3: Particle traces after 6 months.

Figure 4: Particle traces after 1 year.

Figure 5: Particle traces after 2 years.

Figure 6: Particle traces after 3 years.

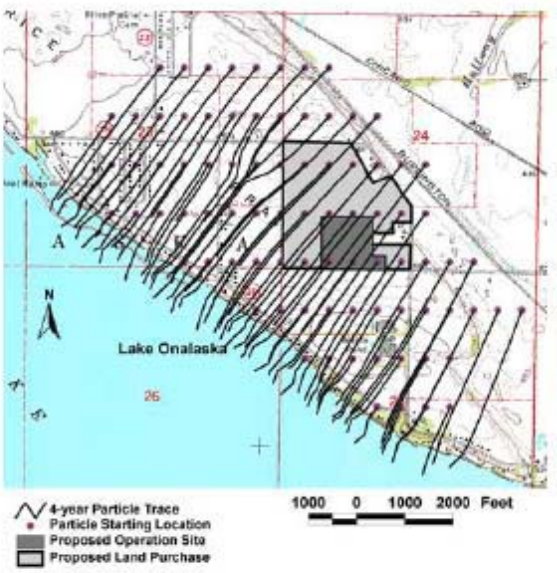


Figure 7: Particle traces after 4 years.

**Disclaimer: Figures 2-7 were created for a project ("Proposed Operation Site") that was not implemented. However, the images clearly illustrate the groundwater flow patterns on the Prairie and are therefore included in this report. Source: The Groundwater Flow System Beneath Brice Prairie, Town of Onalaska, Wisconsin, Dawn Chapel, Wisconsin Geological and Natural History Survey, 2003.*

Recommendation – Implement a groundwater/well monitoring program. Wells are currently monitored by individuals, DNR and La Crosse County but no consistent, organized records are kept. The existing test wells at the Superfund site and in Midway could be monitored as part of this program. Criteria to address include:

- Identify who will conduct the monitoring
- Identify who will maintain the groundwater database
- Identify how often the monitoring will be conducted
- Identify what contaminants needs to be monitored

It is important to compile the results in one location that is easily accessible. This way the Town and others can monitor when and where groundwater contamination is occurring, which will help avoid the need for costly solutions to mitigate groundwater contamination. The Town should consider working with La Crosse County and possibly the University of Wisconsin – La Crosse to assist with this project.

Recommendation – The Town should consider working with the USGS, USFWS and others to determine where groundwater contamination, such as fecal coliform and phosphorus, is entering Lake Onalaska, and ultimately where it originates so it can be managed. This can be accomplished using thermal infrared imagery to identify groundwater seeping into the lake.

Recommendation – Encourage community-based septic systems in new developments.

Recommendation – Use covenants to require community wells in new developments. Test these wells as part of the recommended well monitoring program and potentially use homeowner fees to pay for the testing.

Recommendation – Map groundwater recharge zones for community wells and any new high capacity wells and protect these areas as well as a buffer around the recharge area. Development and any practices that could cause groundwater contamination, such as application of manure or pesticides, should be controlled in these areas.

Recommendation – The Town of Onalaska should inform and educate their residents about proper maintenance of septic systems and other measures to reduce groundwater contamination.

Recommendation – The Town should encourage homeowners to apply lawn fertilizers and other chemicals minimally and responsibly throughout the Prairie.

Recommendation – The Town should use public education to reduce discharges of motor oil, household wastes, litter, anti-freeze, deicing chemicals, yard fertilizers, agricultural herbicides, pesticides and fertilizers. The Town should provide educational materials about the County's hazardous waste recycling facility.

Impervious Surfaces

Development increases impervious surfaces, which can negatively impact surface water quality. As more development occurs on the Prairie and in the surrounding watershed, the percentage of impervious surfaces will increase with new roads, driveways, roofs and other non-porous materials.

Also, as development occurs, the number of stream channels is reduced because stormwater conveyances are typically used to channel water away from developments. Stream "baseflow," or normal dry-weather flow, is lower because rainfall and snowmelt are not infiltrated and are not available to recharge streams or aquifers. In areas where residents depend on wells for their drinking water supply, such as on Brice Prairie, underground aquifers can be depleted due to increasing demand from new development and an associated decrease in infiltration as impervious surfaces replace natural land cover.

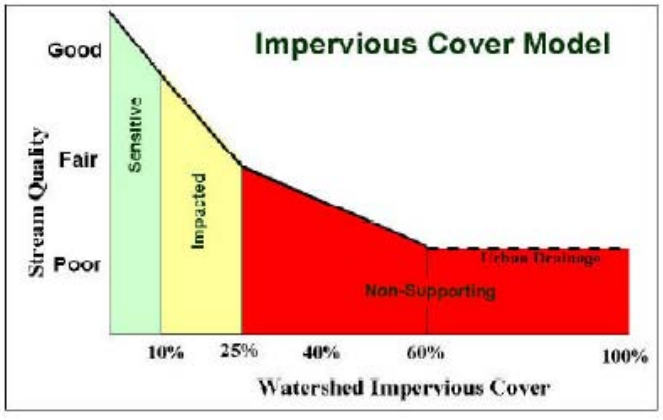
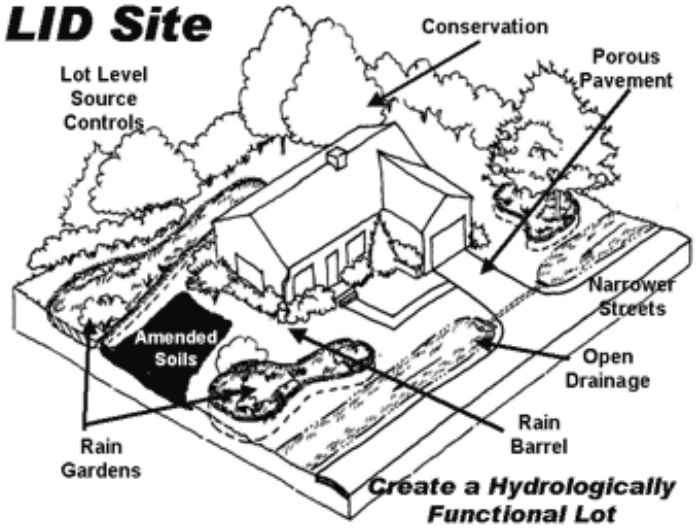


Figure 8 (Source: Schueler, 1994)

Widely accepted research indicates that stream channels begin to degrade when effective impervious cover approaches 10 percent of a watershed. Effective impervious surface is defined as connected impervious surfaces, such as roofs, driveways and streets, which provide stormwater flows fairly directly and quickly to streams or other receiving bodies of water. When effective imperviousness exceeds 25 percent, channel erosion and habitat degradation become significant, as well as the potential for

contamination of drinking water sources. Effective impervious surface can be used as an indicator of aquatic health and biodiversity (U.S. EPA, www.epa.gov/watertrain/smartgrowth/13rt.htm). It is estimated that Brice Prairie currently has an effective impervious surface of 6.3 percent. This number is approaching the point at which stream channels begin to erode.



Residents in the Town of Onalaska and neighboring communities are concerned about increased runoff volume from driveways, roofs and roads and have vocalized this in public meetings. The USFWS has found that sedimentation, which is aggravated by increased runoff from these impervious surfaces, is a significant issue for the Refuge. In 1993, heavy flooding occurred in Midway on Brice Prairie. The flooding was associated with heavy rains and considerable runoff that resulted from the high percentage of impervious surfaces found within the Halfway Creek Watershed. In addition, increased sediment loads seriously hindered the ability of Halfway Creek and Sand Lake Creek to carry additional water, and overbank flows are likely to have occurred.

Recommendation – The Town should promote Low Impact Development including raingardens throughout Brice Prairie to direct runoff into the ground and to minimize the effects of increased runoff.

Recommendation – The Town could encourage the use of raingardens through covenants and subdivision ordinances.

Recommendation – The Town should implement a raingarden when a new Town Hall is built to educate residents. The Town should work with the La Crosse County Department of Land Conservation to get their assistance to design and build the demonstration raingarden.

Recommendation – Continue to monitor effective impervious surface and attempt to keep it below 10 percent.

Recommendation – Cooperate with the USFWS to promote land use planning efforts that ensure that water quality impacts to the Refuge are considered. The USFWS's Draft Environmental Impact Statement and Comprehensive Conservation Plan recommends working with others through an aggressive Refuge program to seek a continuous improvement in the quality of water flowing through and into the Refuge, including measuring dissolved oxygen, major plant nutrients, suspended material, turbidity, sedimentation and contaminants.

Shorelands

Brice Prairie boasts a substantial amount of shoreline along both Lake Onalaska and the Black River. Unfortunately, degradation and destruction of wildlife habitat has occurred due to development

along these shorelines. This is significant because as much as 90 percent of all living things found in Wisconsin's lakes and streams are found along the shallow margins and shorelines. Protecting shoreland resources is essential.

One of the best techniques to protect shorelands is through buffers zones, which are areas that may extend from 25 to 100 or more feet from the water's edge onto the land and 25 to 50 feet into the lake, depending on the site circumstances. Buffer zones along shorelands are beneficial for landowners, water quality and wildlife. The Lakescaping for Wildlife and Water Quality handbook from the Minnesota DNR serves as an excellent educational guide for proper management of shoreland areas and notes the following benefits of buffers:

- Emergent vegetation, like bulrushes and cattails, reduce shoreline erosion caused by wind and boat traffic.
- The natural terrestrial vegetation buffer zone serves as a buffer strip that helps prevent lawn fertilizer and pesticide runoff from reaching the lake.
- Aquatic vegetation helps purify lake water by removing contaminants and by calming water, which allows suspended soil particles to settle to the lake bottom.
- Buffer zones reduce the amount of fertilizer and herbicide needed on a lakeshore property because the resulting lawn is smaller, and native plants in the buffer zone do not need fertilizer or herbicides.
- Buffer zones reduce the acreage of lawn and the amount of time needed for mowing and lawn maintenance.
  Source: Lakescaping for Wildlife and Water Quality, Minnesota DNR

In addition, the Wisconsin Conservation Briefing Book 2005-2006 recommends revising Shoreland Zoning Rules (NR115) to contain the following:

- Require maintenance or restoration of natural vegetation in a "primary" buffer measuring 50 feet deep from the ordinary high water mark inland.
- Maintain a 75-foot minimum shoreland setback for new structures.
- Limit the square footage cap for maintenance and repair of structures located closer than 75 feet from the water.
- Require stormwater management practices to control runoff pollution from each shoreland parcel.

Recommendation – Work with the U.S. Army Corps of Engineers, the Lake Onalaska Protection and Rehabilitation District, and property owners to encourage better land management practices along the Lake Onalaska and Black River shoreline.

Recommendation – Provide educational materials to shoreland property owners through the Town newsletter, website or other means to inform them of best management practices for living along the waterfront.

<u>Wildlife Habitat</u>

Brice Prairie is uniquely positioned within the Mississippi River valley, the heart of a major migration pathway for several hundred species of migratory birds. The area is one of several Mississippi floodplain terraces, supporting a layer of loamy sand that overlays a thick deposit of sand and gravel. As a result, most of Brice Prairie is well drained and once sustained a mesic-dry prairie community that likely was maintained by climate, fire and the grazing of elk and bison. Land survey records from 1846 describe prairie and oak openings dominating the upland vegetation of the area. When Ho-

Chunk Nation members camped on Brice Prairie in the early 1900s, the area was characterized by "high prairie grasses and large oak trees" that offered habitat to an array of wildlife species.

In the current landscape, the Refuge surrounds Brice Prairie. The Refuge is arguably the most important corridor of wildlife habitat in the central United States and is characterized by high diversity and abundance of resident and migratory species. Brice Prairie, Halfway Creek Marsh, the Black River Bottoms and Lake Onalaska provide habitat for a wide variety of wildlife. The entire area lies within the Mississippi flyway for migratory birds, and Lake Onalaska is particularly important as a nesting site for ducks and shorebirds and as a stopover for migrating waterfowl. Lake Onalaska's 7,700 acres also provide critical habitat for bald eagles, tundra swans and canvasback ducks. The entire Refuge, including the area adjacent to Brice Prairie, is designated a globally important bird area by the American Bird Conservancy. In addition, bald eagles, herons, pelicans, cranes as well as a wide variety of diving and puddle ducks take advantage of the available habitat. The Mississippi River and surrounding lands are also recognized as the primary passageway for hundreds of bird species migrating between the neotropics of Central and South America to the northern United States, Canada and the arctic. Many other types of wildlife (including amphibians, reptiles, birds and mammals) inhabit the area and use Brice Prairie for nesting, shelter and food. The Refuge is the most visited refuge in the nation with 3.7 million annual visitors (source: Supplement to the Upper Mississippi River National Wildlife and Fish Refuge Draft Environmental Impact Statement and Comprehensive Conservation Plan).

While few remnants of the prairie and savanna communities once supported on Brice Prairie are evident today, much of the open landscape persists and the area still has the potential to sustain area-sensitive grassland bird species. Agricultural fields and woodlots still support neotropical and resident songbirds, nesting and feeding waterfowl, sandhill cranes, an assortment of amphibian, reptile and mammal species and raptors. Brice Prairie likely provides habitat for several rare or declining USFWS Regional Conservation Priority species such as the northern harrier, red-headed woodpecker, northern flicker, loggerhead shrike and field sparrow. Preservation of large, contiguous tracts of land maintains the opportunity for the effective management of additional Regional Conservation Priority species that are known to breed on the Refuge. Potentially benefiting are several area-sensitive species including upland sandpipers (minimum open grassland are >75-185 acres), bobolinks (>25-75 acres), eastern meadowlarks (>12 acres), dickcissels (>25 acres) and grasshopper sparrows (>25-75 acres). Industrial and/or residential development on Brice Prairie decreases the area's capacity to support area-sensitive wildlife.

Restoring sand prairie to the area would significantly help both migratory and resident wildlife populations. The Mississippi Valley Conservancy is currently restoring and reseeding the Holland Sand Prairie, which is a dry prairie. The potential plant list for the Holland Sand Prairie, which will likely be similar to that used in a Brice Prairie restoration effort, includes over 130 species, primarily native species with some species threatened or special concern. Of the 50 forbs, 3 shrubs and vines and 13 grasses to be planted on the Holland Sand Prairie, the most common are listed in Figure 9.

Figure 9: Holland Sand Prairie Common Plant List

Common Name	*Scientific Name*
Big Bluestem	Adropogon geradii
Black-eyed Susan	Rudbeckia hirta
Butterfly Milkweed	Asclepias tuberosa
Button Blazing Star	Liatris aspera
Canada Wild Rye PLS	Elmyus canadensis
Indian Grass PLS	Soghastrum nutans
June Grass PLS	Koeleria cristat

Large-flowered Beardtongue	Penstemon grandiflorus
Little Bluestem	Adropogon scoparius
Northern Dropseed PLS	Sporobolus heterolepis
Ohio Spriderwort	Tradescantia ohiensis
Pale Purple Coneflower	Echineacea pallida
Patridge Pea	Cassia fasciculata
Purple Prairie Clover	Petalostemum purpureum
Round-headed Bush Clover	Lespedeza capitata
Side-Oats Grama PLS	Bouteloua curtipendula
Silky Prairie Clover	Petalostemum villosum
Switch Grass	Panicum virgatum
White Prairie Clover	Petalostemum candidum

Source: George Howe, Mississippi Valley Conservancy, January 2006.

Recommendation - Protect and buffer wildlife habitat areas from development. The following recommendations are adapted from Managing Development for People and Wildlife: A Handbook for Habitat Protection by Local Governments, The Great Outdoor Colorado Trust Fund (1997)

- Maintain large, intact areas of native vegetation needed to support wildlife by preventing fragmentation through development.
- Set priorities for species and habitats to support and improve the numbers and diverse locations of those species.
- Protect critical landscapes and regulate the use of vegetation in new developments to minimize the invasion of exotic plants.
- Identify and protect wildlife corridors to connect habitats and provide uninterrupted movement.
- Protect rare species habitats and ecological processes in those habitats.
- Balance the opportunity for recreation by the public with the habitat needs of wildlife.

Recommendation – The lands at the far western end of Brice Prairie should be protected, and should be considered a priority area for the Purchase of Development Rights program. A 10-20 acre park and/or natural area conservancy or open space recreational area compatible with the nearby and adjacent Refuge land and potentially contiguous with Town owned lands (old landfill) could also be created.

Recommendation – Work with the USFWS and others to implement their goal of maintaining and enhancing grassland habitat on the Refuge. The Town should encourage 300-foot buffers between development and the Refuge to help achieve this goal. In general, it is accepted that 300 feet is the minimum accepted width needed to provide adequate habitat and movement corridors for most wildlife species (Functions of Riparian Areas for Wildlife Habitat, Cohen, 1997).

Recommendation – Work with the DNR and the Audubon Society to promote Brice Prairie as part of the Great Wisconsin Birding and Nature Trail.

Recommendation – Recognize that any land on Brice Prairie that can be restored back to sand prairie will harbor wildlife and will help provide wildlife corridors and connections to the Refuge.

Agriculture

Agriculture has been a part of the culture, economy and land use on Brice Prairie for many years. While there are questions as to the role of agriculture in contamination of groundwater on the Prairie, it is anticipated that agriculture will continue to play a role in the community. Residents associate the rural agricultural character of the Prairie with their identity and way of life. While it is understood that some agricultural land will likely be converted to residential and other uses over time, it will also be important to protect productive farmland and agricultural operations. Part of that preservation strategy involves protecting agricultural land from encroaching, incompatible land uses. Historically, that meant providing reciprocal setbacks, which require separation of new residential construction from nearby livestock operations. Applying reciprocal standards maintains a two-way buffer necessary to reduce land use conflicts.

These traditional standards are changing with the proposed Agriculture, Trade and Consumer Protection (ATCP) 51 rule, which is a pending administrative rule relating to the siting of new livestock facilities. The rule applies only to counties that currently regulate the siting of livestock facilities or any county that intends to regulate the siting of facilities. La Crosse County must use the standards required by this new rule if it intends to regulate siting of facilities over 200 animal units. The rule establishes maximum standards from which a regulating county cannot deviate. La Crosse County regulates new facilities through Conditional Use Zoning at 200+ animal unit facilities. Among other requirements, the new rule establishes uniform statewide setbacks. There are also no setbacks for odor, but odor must meet a "predicted odor" level. There are no setbacks for spreading of manure near property lines. Local setbacks for new facilities may not require setbacks further than 100 to 200 feet from property lines depending on circumstances. New waste storage structures may be located 350 feet from roads or property lines. A county currently regulating must adopt these changes within 6 months of rule adoption. Because the Town is under County zoning, the County does have the authority to zone the Prairie to exclude livestock facilities with over 200 animal units.

In most cases, the Town must use the standards required by this new rule. The Town could adopt stricter standards by ordinance if justifiable based on pubic health and safety. The Town has authority to prohibit a proposed livestock facility that violates:

- Shoreland and floodplain zoning ordinances
- Construction site erosion control or stormwater management ordinances
- Generally applicable building, electrical, or plumbing codes

The Town cannot deny a siting application because of traffic, noise, dust, light, workforce, scenic or lifestyle issues.

There is an existing dairy operation on the Prairie that plans to operate for the foreseeable future, but may not have enough land to maintain its current operating level. If this operation becomes increasingly confined by encroaching development, a situation may arise where the dairy may need to cease operations or risk groundwater contamination, both on-site and from runoff, that will contaminate wells and affect surrounding natural resources. Increased residential development in this area may also cause conflicts with neighboring residents.

Recommendation – Promote rotational grazing on Brice Prairie.

Recommendation – Require a 300-foot buffer around the existing dairy operation and fields to ensure that sufficient land is available for this farm to continue its operations. Explore the use of PDR to acquire this buffer.

Recommendation – Explore and encourage the use of PDR to help preserve family farming on Brice Prairie.

Recommendation – Utilize PDR to ensure that higher standards for agricultural practices are required on land that is enrolled in a PDR program. This could include best management practices for agriculture, prohibition of the use of certain chemicals, etc.

Recommendation – Work with the La Crosse County Department of Land Conservation to ensure farmers are meeting agricultural best management practices.

Recommendation – Work with the County to ensure the Prairie is zoned to exclude facilities over 200 animal units.

Greenways and Trails

Greenways and trails are an excellent way to provide access throughout the Prairie and create linkages to regional trails and other communities. In addition, numerous studies have demonstrated that greenways and trails increase property values. These linear open spaces may occur through woods, fields, and along roads, rail or utility corridors, and waterways and can help protect groundwater by serving as a recharge area. Trails allow for public access; greenways may or may not. The Great River State Trail runs along the northern part of the Prairie from northwest to southeast and is an outstanding local and regional amenity.

Recommendation – The Great River State Trail is an excellent resource that should be linked to the Prairie through a local trail system.

Recommendation – Work with surrounding municipalities and landowners to implement the Halfway Creek Trail and connection to the Great River Trail.

Recommendation – Create a new multi-use trail, parallel to the Great River State Trail, from the intersection of CTH Z/ZN to the Black River, with connections to the Great River State Trail and CTH Z (from the Town of Onalaska Comprehensive Plan).

Recommendation – Develop a second bike trail through Brice Prairie that runs along major subdivisions and connects to the Great River State Trail (from the Town of Onalaska Comprehensive Plan).

Recommendation – The Drainage Buffer Areas on the Environmental Features Map provide an excellent opportunity to provide greenways and trails, which should be dedicated through any developer agreements.

Recommendation – La Crosse County updates their Comprehensive Outdoor Recreation Plan every 5 years. The Town should work with La Crosse County to target and protect sensitive environmental areas and parkland on the Prairie.

Cultural Resources

In addition to the environmental resources and capacity of the Prairie, ETAC also discussed opportunities to create recreational and cultural corridors and nodes. This relates to the Town's vision as a recreational center for the region.

The Town envisions a cultural center west of the junction of CTH Z and CTH ZN. The Midway Archaeological District is located in this area. The USFWS is considering locating their La Crosse District Office and a visitor/interpretive center in this area; they would also like between 40 and 80 acres for native sand prairie restoration with interpretive trails. Additionally, the Town of Onalaska plans to relocate their Town Hall in the future and would like to create a park and ball fields at a new Town Hall facility. This would be an excellent location for such a facility.

Recommendation – Encourage the USFWS to locate their La Crosse District Refuge Offices and Visitor's Center on the Prairie. The location should encourage appropriate development and assist residents in their efforts to preserve open space and help establish Brice Prairie as a gateway to Lake Onalaska and the Upper Mississippi River National Wildlife and Fish Refuge.

Recommendation – Create a cultural resource node west of the junction of CTH Z and CTH ZN with the archaeological district, a proposed USFWS facility and a proposed Town Hall facility.

Recommendation – Promote area tourism by enhancing Brice Prairie's status as a gateway to Lake Onalaska and the Refuge.

Recommendation – Protect the significant archaeological resources on Brice Prairie. Many of these resources are deemed eligible for inclusion on the National Register of Historic Places.

Recommendation – Work to increase and enhance public access to Lake Onalaska and the Black River.

Recommendation - A trail network should connect from a possible Town Hall/USFWS site to other neighborhoods, community destinations, the Great River State Trail and other trails on the Prairie.

(Editor's Note: After the completion of the ETAC's work, USFWS announced plans to purchase approximately 183 acres on Brice Prairie at the intersection of CTH Z and CTH ZN. Approximately 13 acres will have as office, small visitor's center, classroom/meeting room and maintenance facility. The remaining area will feature a prairie and conservation reserve.)

ADDITIONAL STUDIES AND IMPLEMENTATION TOOLS

Additional Studies

While it is obvious where buffers and environmental protection areas should be located on much of the Prairie, ETAC members recognized information gaps, and acknowledged that the following additional studies may be needed:

- Development and public utilities – The Town needs to understand how public water and sewer would impact development on the Prairie.

- Groundwater contamination – Groundwater studies should be conducted to determine location/type/cause of contamination including the role of agriculture versus septic systems and the nitrate problem.

- Wildlife habitat studies - The impact development has on the Refuge is an important factor to consider in determining environmental capacity on Brice Prairie. It is important to recognize both direct and cumulative impacts, which include effects on groundwater and sedimentation. It is also important to consider how new roads could impact habitat.

- Economic impact of water quality on lakefront property values - ETAC noted that Lake Onalaska's water quality is declining. Nutrient loading from adjacent properties may contribute to water quality issues, but the contribution has not been quantified. In addition to being an environmental impact, it is also an economic impact. ETAC discussed the possibility of looking at the relationship between property values and water quality. If both ground and surface water quality continue to degrade on Brice Prairie, this could negatively impact property values along Lake Onalaska. This further study could start from the published report "Lakeshore Property Values and Water Quality: Evidence from Property Sales in the Mississippi Headwaters Region" Krysel, Boyer, Parson, and Welle, Mississippi Headwaters Board, 2003. In addition, studies in Minnesota and Wisconsin, available through DNR and UW-Extension, have assessed the relationships between property values and lake water quality.

Implementation Tools

Implementation tools are necessary to create the type of development that will respect and protect the Prairie's environmental resources. To implement the recommendations in this Report, it is critical to gain public support and buy-in to the vision for the Town. If there is buy-in to this vision, the Town government will have a much easier time implementing development standards that meet the vision. It is also important to remember that the long-term integrity of the vision and its implementation must be sustained through political changes over time. When good developers and builders see that policies and implementation are consistent, that the rules apply to everyone and that if they stick to the vision, approvals will be timely, then they will deliver the projects to implement the vision.

The Town of Onalaska asked ETAC to make recommendations on how to accomplish and implement the type of development discussed in this Report. Options are discussed below.

Educational Efforts

- Public education – If the Town wishes to implement the recommendations in this Report, it is important that they educate the public as to why these recommendations are important, and show residents how they can be a part of the solution to make Brice Prairie more environmentally sustainable. This campaign is already beginning and information is being disseminated at the Town Hall. Additional methods to educate the public have been included throughout this Report.

Recommendation – The Town should work with the Lake Onalaska Protection and Rehabilitation District, the U.S. Army Corps of Engineers, and the USFWS to create a demonstration area at the Upper Brice Prairie Landing or similar site for no-

mow programs, best management practices for pesticide and fertilizer application, raingardens and other similar initiatives.

Recommendation – The Town should promote native vegetation landscaping to restore the sand prairie and educate residents about this initiative.

Recommendation – Because the Prairie is adjacent to the Refuge, the Town should coordinate with the USFWS to provide public information including media, brochures, signage, and programs to increase awareness of the invasive species threat and what residents can do to minimize the introduction or spread of invasive species.

Recommendation - As it considers constructing a new Town Hall, the Town should consider implementing construction and/or landscaping practices that showcase these best management practices. Education topics include:

- Well and septic maintenance
- Use of fertilizers/pesticides
- Lakescaping/shoreland development
- Best farming practices
- Low impact development
- Stormwater management

Zoning and Land Development Regulations

- Zoning and land division ordinance – There are many ways to implement good development through zoning, including:

    - Require open space to be used for prairie/trails/greenways as parcels are divided.
    - Create a conservation subdivision ordinance to allow developers to build conservation or cluster subdivisions by right.
    - Conventional single-use, low-density development projects should be subjected to variances, increased regulatory review, and increased fees.
    - Zoning should be changed to allow higher densities and mixed uses.
    - Subdivision regulations, engineering codes, building codes, road ordinances, and environmental rules must be examined to determine how they influence the Town's vision.
    - Alternative stormwater management techniques should be allowed and encouraged.
    - Street designs and upgrade standards must accommodate pedestrians and bicyclists.
    - A well-head protection or groundwater overlay zone should be created for the Prairie that reflects the unique soils and groundwater issues in the area.
    - Zoning overlay districts can be used to protect sensitive environmental or cultural features or wildlife habitat. For example, Summit County, CO has a habitat protection overlay zone that "seeks to fully protect wildlife habitats within the wildlife overlay zone from significant adverse affects of development" (Summit County, Colorado, 1994). The overlay zone can be multipurpose and protect sensitive areas, such as floodplains, wetlands, and steep slopes, along with wildlife habitats. The zone should identify the permitted development density and minimum setbacks for development from wildlife habitat. Also, the Town could require most, if not all, development in an overlay zone as a conditional use.

- Development review – Use the site plan and subdivision review to require specific stormwater management actions.

Recommendation - The Town should adopt an Official Map for Brice Prairie that identifies all environmental areas to be protected as well as trail systems and other land uses.

Recommendation - The Town should create a set of standards or strategies to promote environmentally sound development on Brice Prairie. The Town should adopted design guidelines to encourage environmentally sensitive development, including:

- **Cluster development with native prairie restoration and trails**
- **Reduced impervious surfaces**
- **Low impact development practices (LID)**
- **Best farming practices**
- **Well and septic maintenance**
- **Stormwater management**

Recommendation - The Town should encourage cluster development on Brice Prairie, with open space protected and enhanced for prairie habitat, and biking and hiking trails connecting throughout.

Development Rights

- Purchase of Development Rights (PDR) – PDR is a voluntary transaction where a landowner receives a cash payment in return for signing a deed of easement that restricts the use of the land to those land uses agreed to by the purchaser of the development rights and the landowner; often these uses involve farming or open space. The Town of Onalaska is currently working on creating such a program.

- Transfer of Development Rights (TDR) – A TDR program designates sending areas, or areas for long-term open space or farmland protection, and receiving areas, or areas where development is desired at increased densities. Credits are issued to landowners in the sending areas, which are in turn purchased by developers wishing to build at increased densities in the receiving areas.

- Voluntary Conservation easements – Easements are typically acquired by land trusts, but can also be purchased by federal, state, or local agencies.

- Outright purchase – Conservation organizations or government agencies can acquire environmentally, culturally, agriculturally, or archeologically sensitive land through outright purchase. Right of first refusal can allow one of these organizations or agencies an opportunity to negotiate with a landowner to purchase a parcel. The Wetland Reserve Program is a federal government program that purchases, leases, and restores wetlands; the 2002 Farm Bill authorized $1.5 billion for this program.

- Land Trusts – Land trusts are non-governmental organizations that seek to conserve lands for ecological, scenic and open space values. They use voluntary tools such as conservation agreements, land purchases, land donations, cooperative acquisitions and landowner registry programs. The Mississippi Valley Conservancy Land Trust is one of many land trusts that are active in the La Crosse County area.

Recommendation – The Town should create and use a PDR Program to buy development rights for properties in environmentally sensitive and archaeologically sensitive areas and agricultural preservation areas on Brice Prairie.

Conservation connected to Development

- Dedication/donation/developer agreements – The Town can require dedication of land through its subdivision ordinance and they should adopt and enforce dedication standards for parks, open space and trails. The low-lying recharge areas and prairie grass vegetation buffer areas are intended to be implemented by private developers as part of the development of these areas.

- Capital Improvements Program – The Town can use its capital improvements program for roads and other infrastructure to direct growth and development away from agricultural and open space areas to areas where development is desired.

- Comprehensive Outdoor Recreation Plan – Through a CORP, a town can require developers to dedicate park and trail lands. An adopted CORP has the benefit of making the Town eligible to receive DNR grants, and facilitating the interconnection of multiple individual trail and greenway segments.

In summary, consistency and discipline in public policy are necessary. Local government and the public must have the patience to wait for the right projects and usher them smartly through the process when they come to facilitate the proposal of similar projects.

Attachments:

- Environmental Features Map: Compiled and created by ETAC during the preparation of this capacity report. GIS support provided by the City of Onalaska.
- Midway Contamination Maps (Chloride, Nitrates, Sodium: Provided by the City of Onalaska.

This map is to be used for reference purposes only.
Every effort has been made to make this map as accurate as possible.

CITY of ONALASKA

Engineering Department

Map Designer: Joe Barstow
Print Date: November 11, 2005
Last Data Update: January, 2005
Scale: 1" = 800'

Brice Prairie Environmental Features Map

Points of Interest
- BOAT RAMP
- FOOT ACCESS
- OBSERVATION AREA
- PARK

Railroad
DNR Bike Trail & Lands
Creek Conservation Buffer
Low Lying Recharge Areas
Drainage Buffer Areas
USFWS - Future Land Acquisitions (from willing sellers)
USFWS - Owned Lands
Conservancy Overlay

Base Layer: 1993 Aerial Photography

Chloride Samples in Midway

NITRATE SAMPLE MAP

Nitrate

- 1.0 - 9.9 mg/l
- 10.0 - 14.9 mg/l
- 15.0 - 23.0 mg/l

monitoringwells

100 50 0 100 Feet

EADOW PL
EVERGREEN WAY
CORD QT
CORD YY
CORD ZN
JOSIE ST
SECOND ST
HAULL ST
FRONT ST
MICHIGAN ST
2ND ST W
AWN ST
LUMBER PL
NORTH CT
WALDEN PLE
SPRING LN
REDWOOD CT
BLACKBERRY ST
RYAN AVE
SCOTT DR
KIMBERY ST
GREGORY ST
ULMAN ST
SPRUCE ST
STHY 35

17.6 22.3 15.9 13.0 15.4 6.60 12.6 2.6 7.3 3.0 2.5 12.4 9.1 12.40 12.3 12.4 11.4 5.50 1.8 16.5 1.5 1.9 4.1 10.4 20.1 14.3 2.2 1.9 7.5 2.4 1.4 5.6 2.0 2.6 1.9 5.1 22.6 1.8 1.0 2.2 7.4 8.7 17.3

SODIUM SAMPLE MAP

SODIUM

- 3.4 - 25.0 mg/l
- 25.1 - 50.0 mg/l
- 50.1 - 720.0 mg/l

monitoringwells

100 50 0 100 200 Feet

24.5
35.10
20.70
135.90
102.5
94.20
37.70
25.90
12.80
88
563.20
15.5
177.10
8.70
112.60
18.90
10.80
76.60
46.90
9.90
5.10
4.80
3.5
12.5
8.30
8.20
17.60
9.20
138.70
148.70
12.20
6.5
141.5
21.10
9.30
8.40
11.20
192.5
10.90
3.60
8.80
57.80
110.70
8.20
46.90
8.60

MEADOW PL
EVERGREEN WAY
CORD XX
CORD OT
WALDEN PL E
NORTH CT
JOSIE ST
WINONA CT
WINONA ST
SECOND ST
HAULL ST
FRONT ST
MICHIGAN ST
2ND ST W
ANN ST
LUMBER PL
CORD ZN
SCOTT DR
KIMBERY ST
RYAN AVE
GREGORY ST
ULMAN ST
SPRING LN
REDWOOD CT
HACKBERRY ST
ALEXANDER AVE
HERITAGE LN
SPRUCE ST
JULIE LN
STH# 35
CORD ZM