6.0 Management Measures Action Plan

Earlier sections of this plan summarized Wind Point watershed's characteristics and identified causes and sources of watershed impairment. This section includes an "Action Plan" developed to provide stakeholders with recommended "Management Measures" (Best Management Practices) to specifically address plan goals at general and site specific scales. The Action Plan is divided into two subsections:

- *Programmatic Measures :* general remedial, preventive, and policy watershed-wide Management Measures that can be applied across the watershed by various stakeholders.
- *Site Specific Measures:* actual locations where Management Measure projects can be implemented to improve surface and groundwater quality, green infrastructure, and flooding.

The recommended programmatic and site specific Management Measures provide a solid foundation for protecting and improving watershed conditions but should be updated as projects are completed or other opportunities arise. Key implementation stakeholders are encouraged to organize partnerships and develop various funding arrangements to help delegate and implement the recommended actions. The key stakeholders in the watershed are listed in Table 35.

Table 35. Key Wind Point watershed stakeholders/partners.

Key Watershed Stakeholder/Partner	Acronym/Abbreviation
Root-Pike Watershed Initiative Network	Root-Pike WIN
City of Racine	Racine
City of Racine Health Department	Racine Health Dept.
City of Oak Creek	Oak Creek
City of South Milwaukee	South Milwaukee
Village of Caledonia	Caledonia
Village of North Bay	North Bay
Village of Wind Point	Wind Point
United States Environmental Protection Agency (Region 5)	USEPA
Wisconsin Department of Natural Resources	WDNR
University of Wisconsin Extension	UWEX
Fund for Lake Michigan	FLM
SC Johnson & Son	SCJ
The Prairie School	Prairie School
Racine County Land Conservation Committee	LCC
Thompson & Associates	TA
Caledonia Conservancy	CC
Southeastern Wisconsin Regional Planning Commission	SEWRPC
We Energies	We
Racine County	Racine County
Milwaukee County	Milwaukee County
USDA Natural Resource Conservation Service	USDA
Developers	Developer
Farming Community	Farm

6.1 Programmatic Management Measures Action Plan

Numerous types of programmatic Management Measures are recommended to address watershed objectives for each plan goal. The following pages include recommended measures that are applicable throughout the watershed and information needed to facilitate implementation of specific actions. A brief summary of the general programmatic measure types is included below:

Policy: Local, state, and federal government can help prevent watershed impairments in various ways through policy but specifically by adopting the Wind Point watershed plan, implementing green infrastructure policy, requiring conservation developments, protecting groundwater, reducing road salt usage, requiring natural detention basins, and allowing use of native vegetation/landscaping.

Non-Structural: This includes a broad group of practices that prevent impairment through maintenance and management of Management Measures or programs that are ongoing in nature and designed to control pollutants at their source. Such BMPs include agricultural programs available to farmers and street sweeping.

Structural: This includes a broad group of practices that prevent impairment via installation of in-the-ground measures. This plan focuses on implementation of naturalized stormwater measures/retrofits, permeable paving, vegetated filter strips/buffers, natural area restoration, wetland restoration, and use of rainwater harvesting devices.

Educational: Outreach is important to educate the public related to environmental impacts of daily activities and to build support for watershed planning and projects. Topics typically addressed include land management, pet waste management, good housekeeping, etc.

Local Watershed Resource Educational Material

- *"The Water's Edge – Helping fish and wildlife on your waterfront"*: Produced by WDNR & UWEX
- *"Shoreline Plants and Landscaping":* Produced by WDNR & UWEX
- *"Managing the Water's Edge – Making Natural Connections"*: Produced by SWRPC
- *"Protecting Your Waterfront Investment"*: Produced by WDNR, UW Extension Center for Land Use Education, & UWEX
- *"Impervious Surfaces – How they Impact Fish, Wildlife, and Waterfront Property Values"*: Produced by WDNR, UW Extension Center for Land Use Education, & UWEX
- *"Managing Leaves and Yard Trimmings"*: Produced by WDNR, UWEX, and SWRPC
- *"Storm Sewers – The Rivers Beneath our Feet"*: Produced by WDNR & UWEX
- *"Rain Gardens – A how-to manual for homeowners"*: Produced by WDNR & UWEX

6.1.1 Policy Recommendations

Various recommendations are made throughout this report related to how local governments can improve the condition of Wind Point watershed through policy. Policy recommendations focus on improving watershed conditions by preserving green infrastructure, protecting groundwater, minimizing road salts, sustainable management of stormwater, and allowances for native landscaping. To be successful, the Wind Point Watershed-Based Plan would need to be adopted and local plans and ordinances would need to be updated with recommendations. The process of creating and implementing policy changes can be complex and time consuming. And, although there are numerous possible policy recommendations for the watershed, the following policy recommendations are considered the most important and highest priority for implementation.

Plan Adoption & Implementation Policy Recommendations

- Watershed Partners adopt the Wind Point Watershed-Based Plan and incorporate plan goals, objectives, and recommended actions into comprehensive plans and ordinances.

Green Infrastructure Network Policy Recommendations

- Each municipality consider incorporating the identified Green Infrastructure Network into comprehensive plans and development review maps.
- Utilize tools such as protection overlays, setbacks, open space zoning, conservation easements, conservation and/or low impact development, etc. in municipal comprehensive plans and zoning ordinances to protect environmentally sensitive areas on identified Green Infrastructure Network parcels.
- Utilize tools such as Development Impact Fees, Stormwater Utility Taxes, Special Service Area (SSA) Taxes, etc. to help fund future management of green infrastructure components where new and redevelopment occurs.
- Encourage developers to protect sensitive natural areas, restore degraded natural areas and streams, then donate all natural areas and naturalized stormwater management systems to a public agency or conservation organization for long term management with dedicated funding such as Development Impact Fees, Stormwater Utility Taxes, Special Service Area (SSA) Taxes, etc. In general, it is not recommended that these features be turned over to HOA's to manage.
- Establish incentives for developers who propose sustainable or innovative approaches to preserving green infrastructure and using naturalized stormwater treatment trains.
- Consider limiting mitigation for wetlands lost to development to occur within the watershed.

Groundwater Policy Recommendations

- Encourage stormwater management practices that infiltrate water in any development or redevelopment.
- Limit impervious cover within new and redevelopments occurring within Subwatershed Management Units 2, 4, 6, 7, 12, 13, and 17 which are ranked as highly vulnerable to future impervious cover.
- Limit impervious cover and incorporate infiltration practices within new and redevelopments in areas having "High" to "Very High" groundwater recharge potential.

Road Salt Policy Recommendations

- Each municipality consider supplementing existing programs with deicing best management practices such as utilizing alternative deicing chemicals, anti-icing or pretreatment, controlling the amount and rate of spreading, controlling the timing of application, utilizing proper application equipment, and educating/training deicing employees.

Stormwater Management Facility Policy Recommendations

- Encourage new development and redevelopment to use stormwater management facilities that serve multiple functions including storage, water quality benefits, infiltration, and wildlife habitat.
- Consider reduced runoff volume from new and retrofitted detention basins.

Native Landscaping/Natural Area Restoration

- Allow native landscaping within local ordinances.
- Ensure local "weed control" ordinances do not discourage or prohibit native landscaping.
- Include requirements for short and long term management with performance standards for restored natural areas and stormwater features within new and redevelopment.

6.1.2 Dry & Wet Bottom Detention Basin Design/ Retrofits, Establishment, & Maintenance

Detention basins are best described as human made depressions for the temporary storage of stormwater runoff with controlled release following a rain event. There are 39 detention basins in Wind Point watershed and most are associated with residential and commercial development and do not necessarily benefit water quality and wildlife. Many existing wet bottom and dry bottom basins are planted with turf grass along the slopes and bottoms. These attributes do not promote good infiltration, water quality improvement, or wildlife habitat capabilities.

Studies conducted by several credible entities over the past two decades reveal the benefits of detention basins that serve multiple functions. According to USEPA, properly designed dry bottom infiltration basins can reduce total suspended solids (sediment) by 75%, total phosphorus by 65%, and total nitrogen by 60%. Wet bottom basins designed to have wetland characteristics can reduce total suspended solids (sediment) by 77.5%, total phosphorus by 44% and total nitrogen by 20%.

Detention Basin Recommendations

Future detention basin design within the watershed should consist of naturalized basins that serve multiple functions, including appropriate water storage, water quality improvement, natural aesthetics, and wildlife habitat. There are also a large number of opportunities to retrofit existing dry or wet bottom detention basins by incorporating minor engineering changes and naturalizing with native vegetation. Site specific retrofit opportunities are identified in the Site Specific Action Plan. Location, design, establishment, and long term maintenance recommendations for naturalized detention basins are included below.

Detention Location Recommendations

- Naturalized detention basins should be restricted to natural depressions or drained hydric soil areas and adjacent to other existing green infrastructure where feasible in an attempt to aesthetically fit and blend into the landscape. Use of existing wetlands for detention should be evaluated on a case by case basis.
- Basins should not be constructed in any average to high quality ecological community.
- Outlets from detentions should not enter sensitive ecological areas.

Detention Design Recommendations

- One appropriately sized, large detention basin should be constructed across multiple development sites where feasible rather than constructing several smaller basins.
- Side slopes should be no steeper than 4H: 1V, planted to native prairie vegetation, and stabilized with erosion control blanket. Native oak trees (*Quercus sp.*) and other fire-tolerant species should be the only tree species planted on the side slopes for management purposes.
- Dry bottom basins should be planted to mesic, wet-mesic, or wet prairie.
- A minimum 5-foot wide shelf planted to native wet prairie and stabilized with erosion control blanket should be constructed above normal water level in wet and wetland bottom basins. This area should be designed to inundate after every 0.5 inch rain event or greater.
- A minimum 10-foot wide shelf planted with native emergent plugs should extend from normal water level to 2 feet below normal water level in wet and wetland bottom basins.
- Permanent pools in wet and wetland bottom basins should be at least 4 feet deep.
- Irregular islands and peninsulas can be constructed in wet and wetland bottom basins to slow the movement of water through the basin to improve water quality. These features should be planted to native prairie.
- A 4-6 foot deep forebay can be constructed at the inlet(s) of wet and wetland bottom basins to capture sediment; a 4-6 foot deep micropool can also be constructed at the outlet to prevent clogging.

Short Term (3 Years) Native Vegetation Establishment Recommendations

Developers should generally be responsible for implementing short term management (three years) of detention basins and other natural areas to meet a set of performance standards. Measures needed include mowing during the first two growing seasons to reduce annual and biennial weeds. Spot herbiciding is required to eliminate problematic non-native/ invasive species. In addition, the inlet and outlet structures should be checked periodically for erosion and clogging. Table 36 includes a three year schedule appropriate to establish native plantings around naturalized detention basins.

Long Term (4 Years +) Native Vegetation Maintenance Recommendations

HOA's and businesses often lack the knowledge and funding to implement long term management resulting in the decline of these areas over time. Developers should be encouraged to donate naturalized detention basins and other natural areas to a local municipality or conservation organization for long term management who receive funding via a Special Service Area (SSA) tax or other means. Table 37 includes a cyclical long term schedule appropriate to maintain native vegetation around detention basins.

Figure 57. Naturalized dry bottom infiltration basin design.

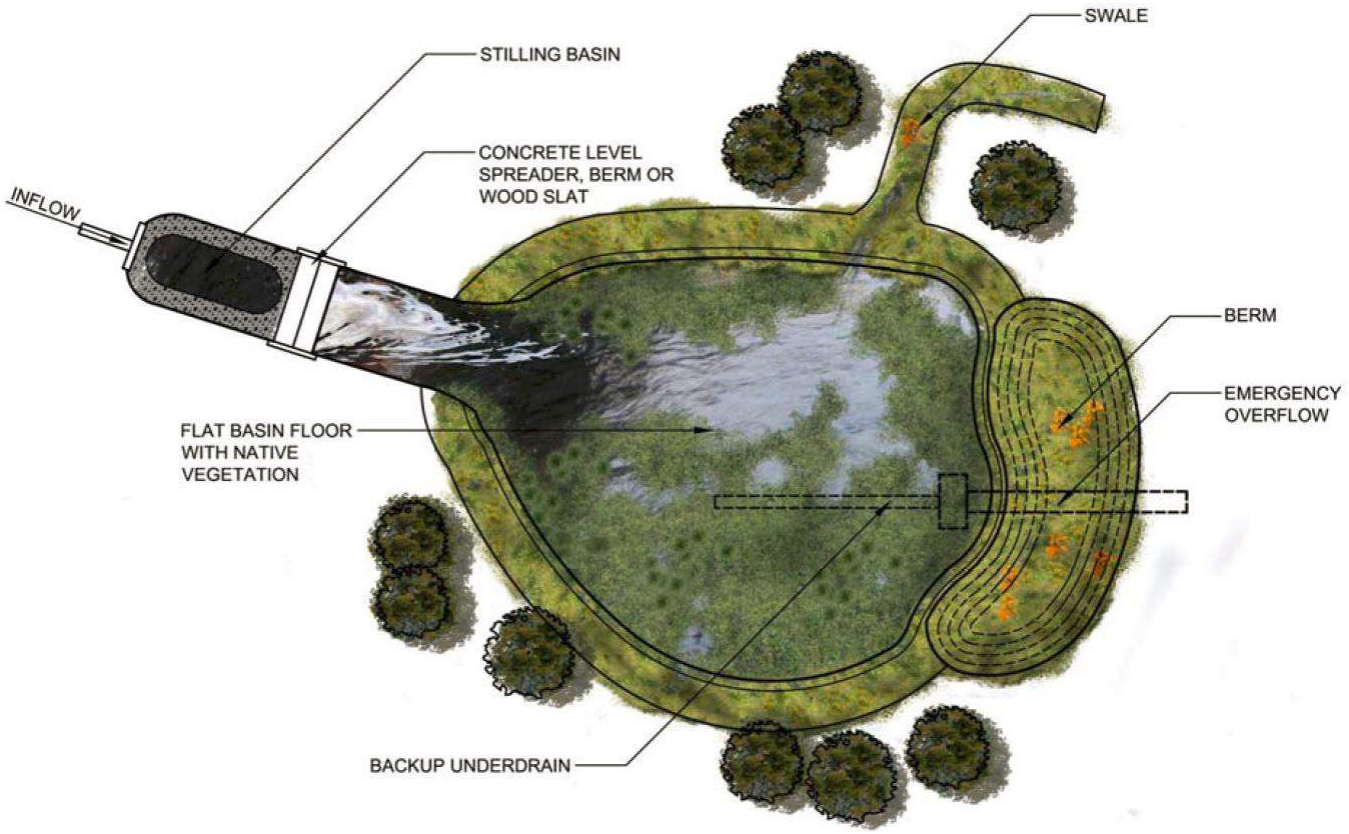


Figure 58. Naturalized wet bottom detention basin design.

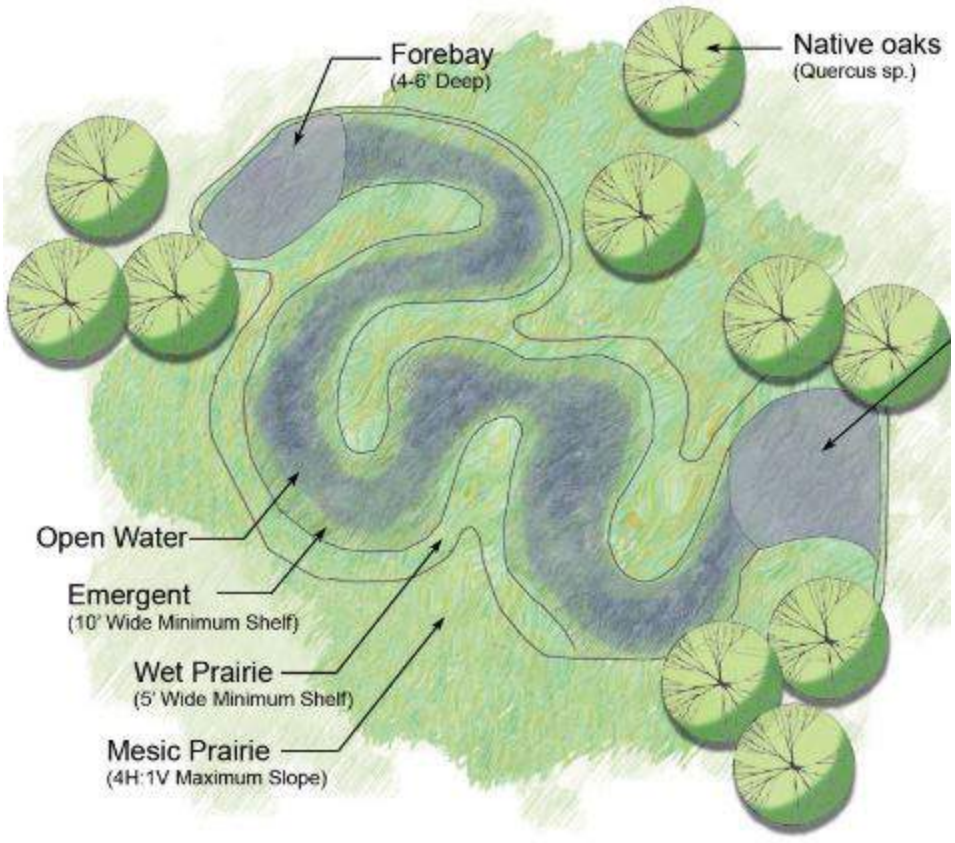


Table 36. Three-year vegetation establishment schedule for naturalized detention basins.

Year 1 Establishment Recommendations
Mow prairie areas to a height of 6-12 inches in May, July, and September.
Spot herbicide non-native/invasive species throughout site in late May and again in August/September. Target thistle, reed canary grass, common reed, purple loosestrife, and all emerging woody saplings.
Check for clogging and erosion control at inlet and outlet structures during every site visit.
Year 2 Establishment Recommendations
Mow prairie areas to a height of 12 inches in June and August.
Spot herbicide non-native/invasive species throughout site in May and again in August/September. Target thistle, reed canary grass, common reed, purple loosestrife, and all emerging woody saplings.
Plant additional emergent plugs if needed and reseed any failed areas in fall.
Check for clogging and erosion control at inlet and outlet structures during every site visit.
Year 3 Establishment Recommendations
Spot herbicide non-native/invasive species throughout site in May and again in August/September. Target thistle, reed canary grass, common reed, purple loosestrife, and all emerging woody saplings.
Check for clogging and erosion control at inlet and outlet structures during every site visit.

Table 37. Three year cyclical long term maintenance schedule for naturalized detention basins.

Year 1 of 3 Year Maintenance Cycle
Conduct controlled burn in early spring. Mow to height of 12 inches in November if burning is restricted.
Spot herbicide problematic non-native/invasive species throughout site in mid-August. Specifically target thistle, reed canary grass, common reed, and emerging woody saplings such as willow, cottonwood, buckthorn, and box elder.
Check for clogging and erosion control at inlet and outlet structures during every site visit.
Year 2 of 3 Year Maintenance Cycle
Spot herbicide problematic non-native/invasive species throughout site in August. Specifically target thistle, reed canary grass, common reed, and emerging woody saplings such as willow, cottonwood, buckthorn, and box elder.
Mow prairie areas to a height of 6-12 inches in November.
Check for clogging and erosion control at inlet and outlet structures during every site visit.
Year 3 of 3 Year Maintenance Cycle
Spot herbicide problematic non-native/invasive species in August. Specifically target thistle, reed canary grass, common reed, and emerging woody saplings. Cutting & herbiciding stumps of some woody saplings may also be needed.
Check for clogging and erosion control at inlet and outlet structures during every site visit.

Rain garden adjacent to single family home

6.1.3 Rain Gardens

Rain gardens have become a popular new way of creating a perennial garden that cleans and infiltrates stormwater runoff from rooftops and sump pump discharges. A rain garden is a small shallow depression that is typically planted with deep rooted native wetland vegetation. These small gardens can be installed in a variety of locations but work best when located in existing depressional areas or near gutters and sump pump outlets. Not only do rain gardens clean and infiltrate water, they also provide food and shelter for many birds, butterflies, and insects.

Rain Garden Recommendations

Education programs in the watershed should focus on teaching residents and businesses the beneficial uses of rain gardens. Local governments in the watershed should also install demonstration rain gardens as a way for the general public to better understand their application. The Root-Pike Watershed Initiative Network website contains valuable information for anyone wanted to construct a rain garden. The website contains information related to calculating costs, finding professional landscapers, and recommends appropriate native plants and plant retailers. In addition, rain gardens can be registered as part of Root-Pike WIN's Rain Garden Initiative - see rootpikewin.org/ for more information. A second valuable rain garden resource was produced by WDNR and UW-Extension entitled "*Rain Gardens- a how-to manual for homeowners*" (WDNR, 2003). This document provides details on how a homeowner can design and install a rain garden and can be found at clean-water.uwex.edu/pubs/rain garden.

6.1.4 Vegetated Swales (Bioswales)

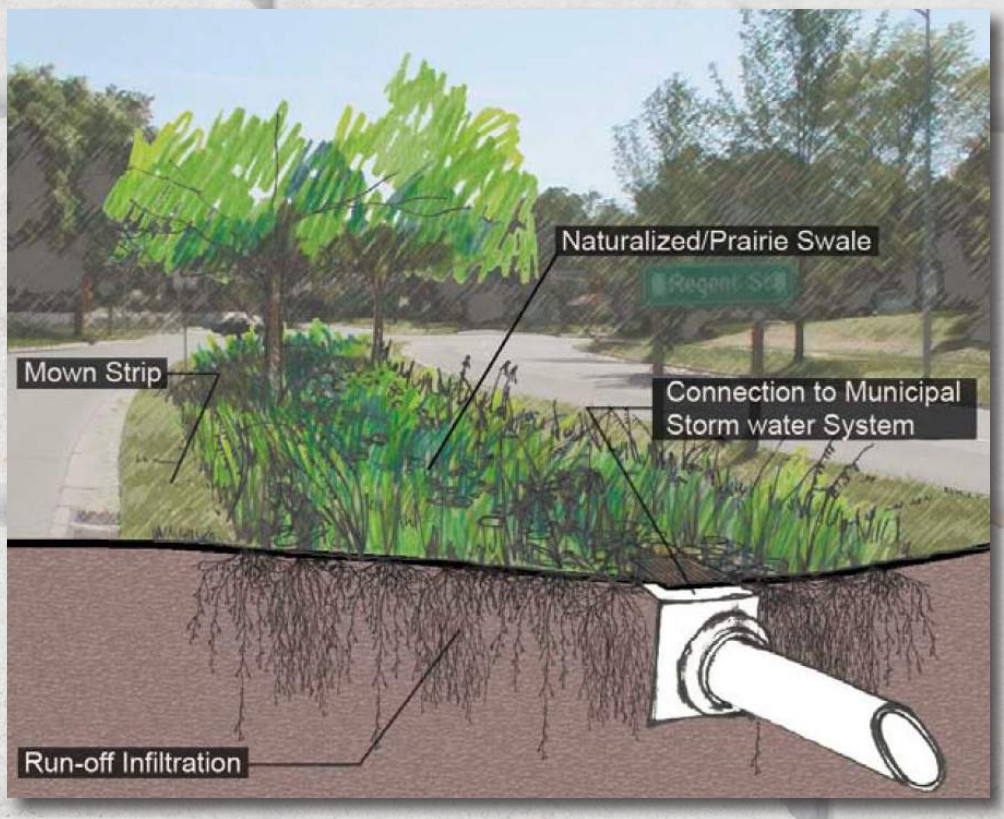
Vegetated swales, also known as bioswales, are designed to convey water and can be modified slightly

to capture and treat stormwater for the watershed. Vegetated swales are designed to remove suspended solids and other pollutants from stormwater running through the length of the swale. The type of vegetation can dramatically affect the functionality of the swale. Turf grass is not recommended because it removes less suspended solids than native plants. In addition, vegetated swales can add aesthetic features along a roadway or trail. They can be planted with wetland plants (preferably native) or a mixture of rocks and plant materials can be used to provide interest.

Swales can be designed as either wet or dry swales. Dry swales include an underdrain system that allows filtered water to move quickly through the stormwater treatment train. Wet swales retain water in small wetland like basins along the swale. Wet swales act as shallow, narrow wetland treatment systems and are often used in areas with poor soil infiltration or high water tables.

Water quality is improved by filtration through engineered soils in dry swales and through sediment accumulation and biological systems in wet swales. According to USEPA, vegetated swales reduce total suspended solids (sediment) by 65%, total phosphorus by 25%, and total nitrogen by 10%.

Vegetated Swale Recommendations
Vegetated swales should be used to replace pipes or curbs in new and redevelopment where feasible. Swales can easily be integrated into various urban fabrics with curb cuts for water to access them from roadways, or they can be added between existing lots or in the grassy parkways between roads and sidewalks. Typically swales are used in lower density settings where infiltration might be maximized. Dry swales should be used for smaller development areas with small drainages. Wet swales should be used along larger roadways, small parking areas, and commercial developments.



Above: Dry vegetated swale rendering. Overlay: One type of pervious pavement.

6.1.5 Pervious Pavement & Porous Asphalt

Pervious pavement and porous asphalt are used in place of traditional impervious paving materials to decrease the total amount of runoff leaving a site by promoting infiltration of stomrwater runoff into the ground. Other benefits include filtering of contaminants from runoff, reducing peak velocity and volume of runoff thereby alleviating flooding downstream, groundwater recharge, and less need for stormsewers.

Traditionally, the quantity and quality of water running off paved surfaces, together with buildings, are the primary reason for stormwater treatment. Pervious surfaces reduce runoff rates and volumes and can be used in almost every capacity in which traditional asphalt, concrete, or pavers are used. Pervious surfaces captures first flush rainfall events and allows water to percolate into the ground. It also allows for stormwater to be treated through soil biology and chemistry as the water slowly infiltrates. Groundwater and aquifers are recharged and water that might otherwise go directly to stormsewers will slowly infiltrate, reducing flooding and peak flow rates entering streams. Studies documented by USEPA show that properly designed and maintained pervious surfaces can reduce total suspended solids (sediment) by as much as 90%, total phosphorus by 65%, and total nitrogen by up to 85%.

Pervious Pavement and Porous Asphalt Recommendations
Future development and redevelopment should consider the use of pervious pavement & porous asphalt. Certain policy requirements should also be considered for using these products in important groundwater recharge areas. Pervious surfaces can be used in a variety of settings including parking lots, parking aprons, private roads, fire lanes, residential driveways, sidewalks, and bike paths.

6.1.6 Riparian Buffers

Riparian buffers are defined as land adjoining any water body including ponds, lakes, streams, and wetlands. In 2010 the Southeastern Wisconsin Regional Planning Commission (SWRPC) produced a document entitled "Managing the Water's Edge: Making Natural Connections" (SWRPC 2010). The research presented in this document was conducted to determine if an optimal riparian buffer design or width could be determined that effectively reduces pollutants, provides water quality protection, helps prevent channel erosion, provides adequate fish and wildlife habitat, enhances environmental corridors, augments baseflow, and moderates water temperature.

Interestingly, no consensus of optimal buffer width could be determined but what is apparent is that many riparian corridors no longer fulfill their potential due to encroachment by agricultural and urban development. SEWRP's document summarizes how to maximize both water quality protection and conservation of aquatic and terrestrial wildlife populations using buffers as shown in Figures 59 and 60.

Riparian Buffer Recommendations

As described in SERWPC's document, the use of "Environmental Corridors" or what is also known as green infrastructure to connect open space and other natural area features should be embraced and the minimum Goals of 75 should be achieved where feasible whereby 75% minimum of the total stream length should be naturally vegetated to protect the functional integrity of the water resource and 75 foot wide minimum riparian buffers are recommended from the top edge of each stream bank that are naturally vegetated to protect water quality. SEWRPC also recommends that new development should incorporate water quality and wildlife enhancement or improvement objectives by creating green infrastructure and buffer linkages. This can be achieved by maintaining a minimum 150 foot protection area around isolated riparian features. This protection area consists of optimal core habitat that is protected with minimized edge effects (Figure 60).

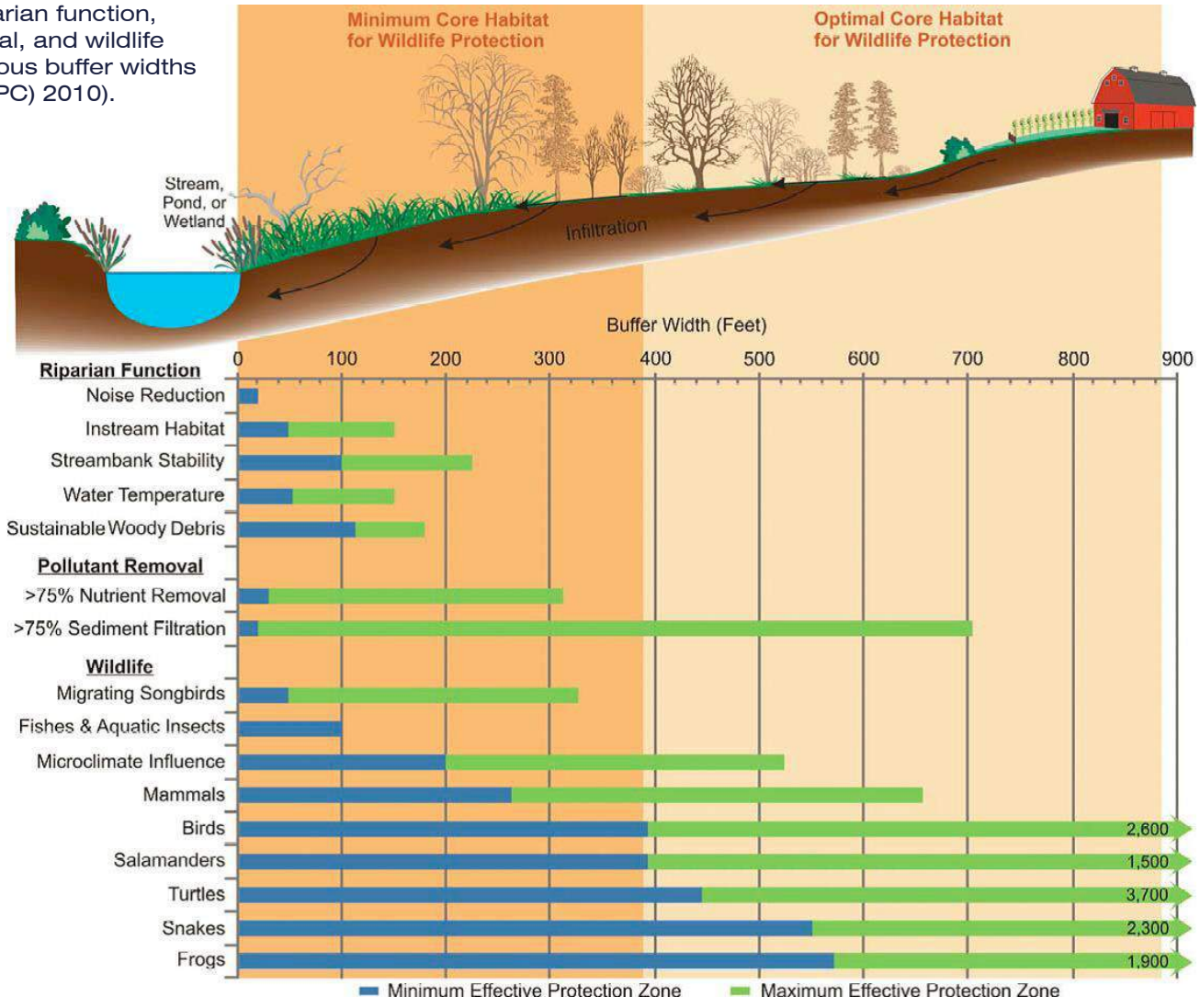
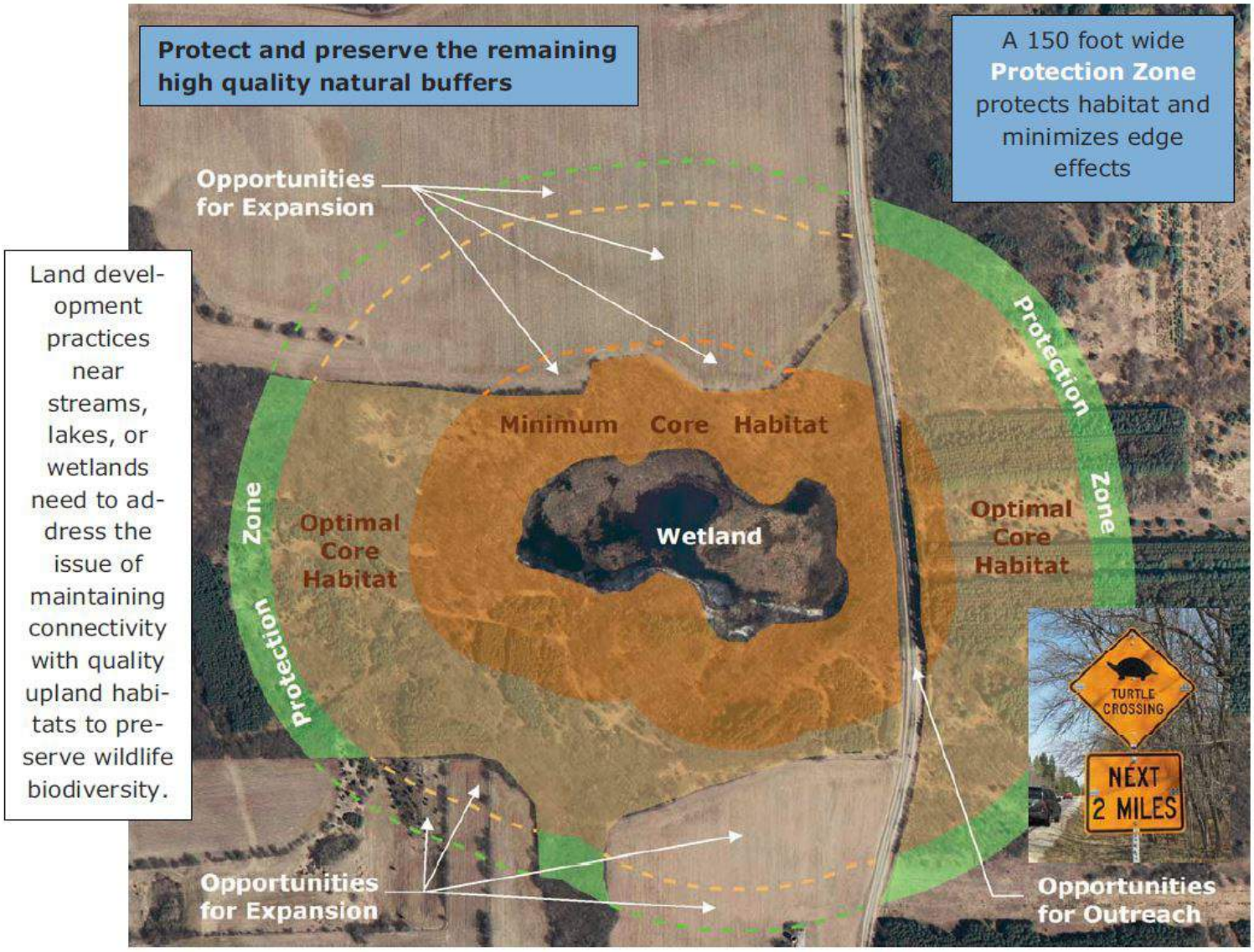


Figure 59. Riparian function, pollutant removal, and wildlife benefits for various buffer widths (Source: SEWRPC) 2010).

Figure 60. Riparian area core habitat and protection zones (Source SEWRPC 2010).



6.1.7 Natural Area Restoration & Native Landscaping

Natural area restoration and native landscaping are essentially one in the same but at different scales. Natural area restoration involves transforming a degraded natural area into one that exhibits better ecological health and is typically done on larger sites such as publically owned open space. Native landscaping is done at smaller scales around homes or businesses and is often formal in appearance. Both require the use of native plants to create environments that mimic historic landscapes of the Midwest such as prairie, woodland, and wetland. Native plants are defied as indigenous, terrestrial or aquatic plant species that evolved naturally in an ecosystem. The use of native plants in natural areas or native landscaping is well documented. They adapt well to environmental conditions, reduce erosion, improve water quality, promote water infiltration, do not require fertilizer, provide wildlife food and habitat, and have minimal maintenance costs.

Natural Area Restoration/Native Landscaping Recommendations
Large residential lots with existing natural components and rough areas within golf courses provide many of the best opportunities for natural area restoration and native landscaping at a larger scale. Homeowners interested in restoring natural areas or implementing native landscaping can find guidance through Root-Pike Watershed Initiative Network (WIN) or by contacting an Ecological Consulting company. Backyard habitats can be certified through the National Wildlife Federation's Certified Wildlife Habitat program.

Shoop Park Golf Course is the only golf course in the watershed and is situated along Lake Michigan in the

Village of Wind Point. The course could be improved ecologically and serve as more functional green infrastructure by implementing natural area restoration into existing designs. The Audubon Cooperative Sanctuary Program (ACSP) is an education and certification program that helps golf courses protect the environment by providing guidance for outreach and education, resource management, water quality and conservation, and wildlife habitat management. A golf course becomes certified under the program when implementing and documenting recommended environmental management practices. Annual program membership fees are $200.

Clockwise from above: Native landscaping near residential home (source: Mike Halverson); Wetland restoration within Conservation Development; Dune restoration at North Beach Park.

6.1.8 Wetland Restoration

Over 2,300 acres or 80% of the historic wetlands in Wind Point watershed have been lost to farming and other development practices since European settlement in the 1830s. Wetlands are one of the most important habitat types for harboring plant and animal diversity, as well as for protecting surface water quality, and reducing flooding. These potential benefits make wetland restoration highly beneficial and rewarding.

Approximately 267 acres of drained wetland was discovered in areas of the watershed where wetland restoration might be possible but many of these areas are located on land that is currently in agricultural production, golf course land, or land likely to be mined in the future. The wetland restoration process involves returning hydrology (water) and vegetation to soils that once supported wetlands. The USEPA estimates that wetland restoration projects can reduce suspended solids (sediment) by 77.5%, total phosphorus by 44%, and total nitrogen by 20%.

Wetland Restoration Recommendations
Municipalities should strongly consider requiring "Conservation Design" that incorporates wetland restoration on parcels slated for future development. Another potential option is to restore wetlands as part of a wetland mitigation bank where wetlands are restored on private or public land and become "fully certified." Then, developers are able to buy wetland mitigation credits from the wetland bank for wetland impacts occurring elsewhere in the watershed. It may also be possible for owners of wetland mitigation banks to sell "water quality trading credits" to wastewater treatment plants that produce phosphorus in effluent that exceeds state standards. The Site Specific Action Plan section of this report identified sites where wetland restoration might be feasible.

6.1.9 Dune Swales Restoration

The idea of restoring dune swales along Lake Michigan as a mitigation measure is a relatively new idea that was spearheaded by the City of Racine Parks & Health Departments in 2004 between Kid's Cove Playground and North Beach Oasis. Dunes were strategically placed and planted adjacent in this area to address several issues impacting beach management practices and water quality. The result of the project is a dune system that utilizes vegetation as a means of controlling wind-blown sand, provides a natural landscape, deters roosting gulls, and aids in the infiltration of non-point source runoff from nearby impervious surfaces thereby preventing polluted stormwater from entering the near shore waters.

Dune Swale Restoration Recommendations
There are likely many opportunities for dune swale restoration along the coast of Lake Michigan within Wind Point Watershed. Local municipalities and other entities should use the example at North Beach and implement similar restorations as a way to enhance green infrastructure along the lake.

Top: Routine street sweeping is an effective Management Measure. Source: USGS. Bottom: Stream restoration project example.

6.1.10 Street Sweeping

Street sweeping is often overlooked as a Management Measure option to reduce pollutant loading in watersheds. With approximately 1,400 acres of roads accounting for about 10% of the watershed, municipal street sweeping programs could significantly reduce non-point source pollutants from urban areas in Wind Point watershed. Street sweeping works because pollutants such as sediment, trash, road salt, oils, nutrients, and metals that would otherwise wash into stormsewers and streams following rain events are gathered and disposed of properly. The USEPA and Center for Watershed Protection (CWP) report similar pollutant removal efficiencies for street sweeping; weekly street sweeping can remove between 9% and 16% of sediment and between 3% and 6% of nitrogen and phosphorus. This is equivalent to removing about 200 tons/year sediment and 122 lbs/yr phosphorus and nitrogen from 1,400 acres of roads in the watershed.

Street Sweeping Recommendations
It is likely that several if not all of the municipalities in the watershed already implement street sweeping to some degree. The frequency of street sweeping is a matter of time and budget and should be determined by each municipality. Weekly street sweeping would provide the best results but bi-weekly sweeping is cited as being sufficient in most cases.

6.1.11 Stream, Ravine, & Riparian Area Restoration & Maintenance

The leading causes of degraded stream conditions in Wind Point watershed are channel modification and degraded riparian areas. Streambank erosion is generally problematic only where various streams become ravines along Lake Michigan. Stream surveys reveal that about 35% (34,950 linear feet) of stream length in the watershed is highly channelized. Another 31% (29,639 linear feet) is moderately channelized. 45% of riparian areas are in poor condition. Severe erosion is occurring along 7% (5,448 linear feet) of stream length within ravines. Pollutant modeling indicates that approximately 5,600 tons/yr of sediment or 59% of sediment loading comes from eroded streambanks and ravines within the watershed.

Stream and ravine restoration requires more data, more paperwork, and more negotiating than most other kinds of restoration projects. Permits are required for even the simplest component such as bank stabilization. After getting through regulatory hurdles, stream/ravine restoration is one of the best Management Measures that can be implemented to improve degraded stream and riparian area conditions. This work involves improvements to a stream channel using artificial pool-riffle complexes, streambank stabilization using a combination of bioengineering with native vegetation and hard armoring with rock if needed, and adjacent riparian area improvements via removal of non-native vegetation and replacement with native species. These practices are typically done together as a way to improve water quality by reducing sediment transport, increasing oxygen, and improving habitat. The USEPA reports that as much as 90% of sediment, phosphorus, and nitrogen can be reduced following stream restoration. The downside to stream restoration is that it is technical and expensive. Stream restoration projects include detailed construction plans, often complicated permitting, and construction that must be done by a qualified contractor.

With so many individual landowners with parcels intersecting the tributary streams in the watershed, routine maintenance of stream systems is challenging. In many cases, landowners simply do not have the knowledge or are not physically capable of maintaining streams on their property. Stream maintenance includes an ongoing program to remove blockages caused by accumulated sediment, fallen trees, etc. and is a cost effective way to prevent flooding and streambank erosion.

Stream , Ravine, & Riparian Area Recommendations

There are many opportunities to implement stream, ravine, and riparian area restoration in the watershed. These opportunities are identified in the Site Specific Action Plan. As far as stream maintenance goes, agencies such as the Wisconsin Department of Natural Resources (WDNR), University of Wisconsin-Extension, and Root-Pike Watershed Initiative Network (WIN) can help guide land management for riparian owners. In addition, the American Fisheries Society has created a short document called "Stream Obstruction Removal Guidelines" which is meant to clarify the appropriate ways to maintain obstructions in streams to preserve fish habitat.

6.1.12 Septic System Maintenance

The number of households and businesses on septic systems in Wind Point watershed is not well known. However, many older residential developments in rural areas are likely on septic. When septic systems are not maintained and fail they can contribute high levels of nutrients and bacteria to the surrounding environment. Literature sources from USEPA indicate a general septic system failure rate of between 2% and 5%.

Septic System Recommendations

Septic owners should become compliant with sewage treatment and disposal ordinances and have routine inspections and sampling completed at least every six months. The USEPA provides an excellent guide for septic system owners called "A Homeowner's Guide to Septic Systems (USEPA, 2005)." The guide explains how septic systems work, why and how they should be maintained, and what makes a system fail.

6.1.13 Agricultural Management Practices

Much of Wind Point watershed has been developed to residential, commercial, and industrial uses but 1,311 acres of agricultural land remain in 2012. This accounts for 11% of the watershed area. Pollutant loading estimates using USEPA's STEPL model point to agricultural land as a significant contributor of nutrients and sediment in runoff. In fact, agricultural areas are estimated to contribute about 11,197 lbs/yr (37.5%) of nitrogen, 2,689 lbs/yr (15.7%) of phosphorus, and 1,432.4 tons/yr (15%) sediment. Fortunately, there are numerous agricultural measures and funding sources that can be used by farmers to protect water quality. Many recommended programs are offered through the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS). The following is a summary of USDA 2014 Farm Bill and Wisconsin NRCS agricultural programs that have environmental benefits: (www.usda.gov/wps/portal/usda/usdahome).

2014 Farm Bill Financial Assistance Programs

NRCS offers financial and technical assistance to help agricultural producers make and maintain conservation improvements on their land:

Environmental Quality Incentive Program (EQIP)

The NRCS's Environmental Quality Incentive Program (EQIP) is a voluntary conservation program that provides financial assistance to individuals/entities to address soil, water, air, plant, animal and other related natural resource concerns on their land. EQIP offers financial and technical help to assist participants to install or implement structural and management practices on eligible agricultural land.

Conservation Stewardship Program (CSP)

The Conservation Stewardship Program helps agricultural producers maintain and improve their existing conservation systems and adopt additional conservation activities to address priority resources concerns. Participants earn CSP payments for conservation performance - the higher the performance, the higher the payment. The benefit is improved resource condition including soil quality, water quality and quantity air quality, and habitat quality. CSP provides two types of payments through five-year contracts: annual payments for installing new conservation activities and maintaining existing practices; and supplemental payments for adopting a resource-conserving crop rotation.

2014 Farm Bill Easement Programs

NRCS offers easement programs to eligible landowners to conserve working agricultural lands, wetlands, grasslands and forestlands:

Agricultural Conservation Easement Program (ACEP)

The Agricultural Conservation Easement Program (ACEP) provides financial and technical assistance to help conserve agricultural lands and wetlands and their related benefits.

Agricultural Land Easements NRCS provides financial assistance to eligible partners for purchasing Agricultural Land Easements that protect the agricultural use and conservation values of eligible land. The program protects grazing uses and related conservation values by conserving grassland, including rangeland, pastureland and shrubland. Under the Agricultural Land component, NRCS may contribute up to 50 percent of the fair market value of the agricultural land easement. Where NRCS determines that grasslands of special environmental significance will be protected, NRCS may contribute up to 75 percent of the fair market value of the agricultural land easement.

Wetland Reserve Easements provide habitat for fish and wildlife, including threatened and endangered species, improve water quality by filtering sediments and chemicals, reduce flooding, recharge groundwater, protect biological diversity and provide opportunities for educational, scientific and limited recreational activities.

NRCS provides technical and financial assistance directly to private landowners and Indian tribes to restore, protect, and enhance wetlands through the purchase of a wetland reserve easement. Through the wetland reserve enrollment options, NRCS may enroll eligible land through:

- **Permanent Easements** – conservation easements in perpetuity. NRCS pays 100 percent of the easement value for the purchase of the easement. Additionally, NRCS pays between 75 to 100 percent of the restoration costs.
- **30-year Easements** – 30-year easements expire after 30 years. NRCS pays 50 to 75 percent of the easement value for the purchase of the easement. Additionally, NRCS pays between 50 to 75 percent of the restoration costs.
- **Term Easements** - easements that are for the maximum duration allowed under applicable State laws. NRCS pays 50 to 75 percent of the easement value for the purchase of the term easement. Additionally, NRCS pays between 50 to 75 percent of the restoration costs.

Healthy Forests Reserve Program (HFRP)

The Healthy Forests Reserve Program (HFRP) helps landowners restore, enhance and protect forestland resources on private lands through easements and financial assistance. Through HRFP, landowners promote the recovery of endangered or threatened

species, improve plant and animal biodiversity and enhance carbon sequestration.

HFRP provides landowners with 10-year restoration agreements and 30-year or permanent easements for specific conservation actions. For acreage owned by an Indian tribe, there is an additional enrollment option of a 30-year contract. Some landowners may avoid regulatory restrictions under the Endangered Species Act by restoring or improving habitat on their land for a specified period of time.

2014 Farm Bill Partnership Programs

NRCS works with partners to leverage additional conservation assistance for agricultural producers and landowners in priority conservation areas:

Regional Conservation Partnership Program (RCPP)

The Regional Conservation Partnership Program (RCPP) promotes coordination between NRCS and its partners to deliver conservation assistance to producers and landowners. NRCS provides assistance to producers through partnership agreements and through program contracts or easement agreements. RCPP encourages partners to join in efforts with producers to increase the restoration and sustainable use of soil, water, wildlife and related natural resources on regional or watershed scales.

Other 2014 Farm Bill Programs

Agricultural Conservation Experienced Services (ACES)

Through the Agriculture Conservation Experienced Services (ACES) Program, experienced workers, age 55 and over, help NRCS employees provide technical services in support of conservation. NRCS enters into agreements with nonprofit organizations that provide ACES workers on a part-time or full-time basis. NRCS provides funds, office space, position descriptions, work assignments and oversight for the ACES positions, while the nonprofit organization handles advertising, recruiting, hiring and payroll for each position.

Conservation Innovation Grants (CIG)

Conservation Innovation Grants (CIG) are competitive grants that stimulate the development and adoption of innovative approaches and technologies for conservation on agricultural lands. CIG accelerates technology development and transfer, and the adoption of promising technologies and approaches to address some of the nation's most pressing natural resource concerns. NRCS identifies successful projects for potential integration of technologies and approaches into NRCS' toolkit of conservation practices.

Emergency Watershed Protection Program (EWP)

The purpose of the Emergency Watershed Protection Program (EWP) was established by Congress to respond to emergencies created by natural disasters. The EWP Program is designed to help people and conserve natural resources by relieving imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences.

Wisconsin NRCS Programs

Cooperative Conservation Partnership Initiative (CCPI)

The CCPI provides funding for eligible partner organizations through grant agreements focusing on the priorities of the Environmental Quality Incentives Program or the Wildlife Habitat Incentives Program.

Conservation Stewardship Program (CSP)

The CSP will help owners and operators of agricultural lands maintain conservation stewardship and implement and maintain additional needed conservation practices. The conservation benefits gained will keep farms and ranches more sustainable and profitable and increase the benefits through improved natural resources.

Conservation Technical Assistance (CTA)

Through Conservation Technical Assistance, NRCS assists landowners and land users, communities, units of state and local government, Tribes, and other Federal agencies in planning and implementing conservation systems.

Conservation Reserve Program (CRP)

CRP can reduce erosion, increase wildlife habitat, improve water quality, and increase forestland. Landowners set aside cropland with annual rental payments based on amount bid. Tree planting, wildlife ponds, grass cover, and other environmental practices are eligible practices. Land is accepted into the program if bid qualifies. Continuous signup is open for buffers, waterways and environmental practices. Periodic signups are announced throughout the year for other practices. The contract period is 10 years, 15 years if planting hardwood trees. It is transferable with change in ownership and public access is not required.

Environmental Quality Incentives Program (EQIP)

EQIP provides technical and financial help to landowners for conservation practices that protect soil and water quality. Grassed waterways, stream fencing, critical area planting, terraces, manure management systems including storage structures and barnyard runoff protection, and many other conservation practices are eligible for EQIP. Projects are selected based on environmental value. Contracts run for 1-10 years and may be eligible for financial assistance, up to $300,000 for the life of the Farm Bill. Public Access is not required.

Conservation Tillage (no till) farming. Source: farmprogress.com.

Forestry Programs
Forestry programs provide cost-sharing for forestry practices with 10 or more acres. Practices eligible include tree planting, site preparation for natural regeneration, timber stand improvement, etc. Landowners must agree to maintain practices for the estimated life span. A management plan is required but public access is not required.

Grassland Reserve Program
The Grassland Reserve Program (GRP) is a voluntary program for landowners and operators to protect grazing uses and other related conservation values by restoring and conserving eligible grassland and certain other lands through rental contracts and easements. When properly managed, grasslands can result in cleaner, healthier streams, and reduced sediment loads in water bodies. These lands are vital for the production of livestock forage and provide forage and habitat for maintaining healthy wildlife populations. They also add to the beauty of the landscape, provide scenic vistas and open space, provide for recreational activities and protect the soil from water and wind erosion.

Grazing Lands Conservation Initiative
The Grazing Lands Conservation Initiative is intended to provide technical, educational and other help to conserve and improve privately owned grazing and pasture lands. Intended practices include prescribed grazing, animal trails and walkways, and fencing.

Great Lakes Restoration Initiative
To improve the health of the Great Lakes, NRCS is providing financial and technical resources to 8 states to improve water quality in the region. Through this Initiative, NRCS focuses on helping farmers implement conservation practices that reduce erosion, improve water quality, and maintain agricultural productivity in selected watersheds.

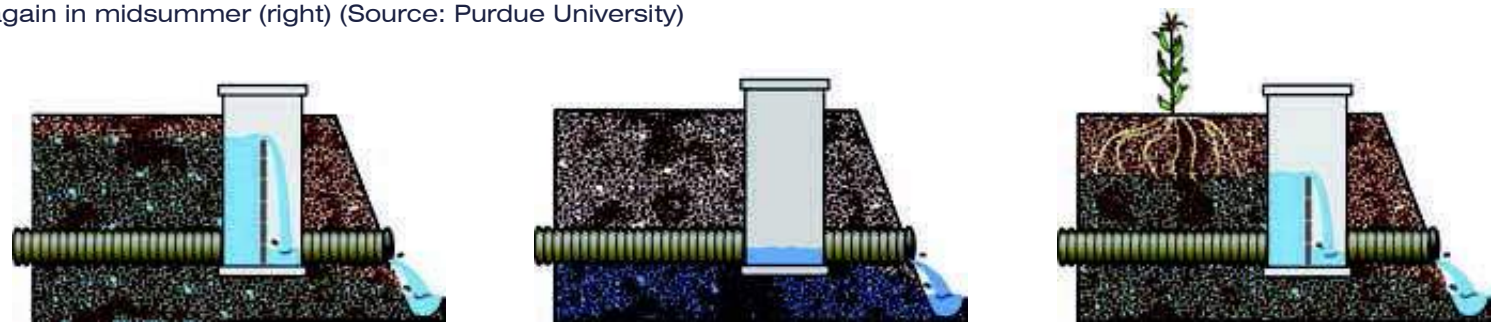
Wetlands Reserve Program (WRP)
The WRP provides an opportunity to restore wetlands previously altered for agricultural use. Eligible land is land which has been owned for one year and can be restored to wetland conditions. Landowners may restore wetlands with permanent or 30-year easements or 10-year contracts. Permanent easements pay 100% of the agricultural value of the land and 100% cost-sharing; 30-year easements pay 75% of the agricultural value and 75% cost-sharing; 10-year contract pays 75% cost-share only.

Wildlife Habitat Incentive Program (WHIP)
WHIP can develop or improve wildlife habitat on privately owned land through installation of in-stream structures, restoring prairies and oak savannas, providing brush management and control of invasive species. Almost any type of land is eligible, including agricultural and non-agricultural lands. WHIP provides funding to assist with restoration costs and public access is not required.

Other Agricultural Recommendations
Subsurface (Tile) Drainage Best Management Practices
Subsurface drain tiles are a commonly used practice by farmers to help lower the water table of poorly drained fields and/or wet areas within fields. Unfortunately, nitrogen and phosphorus often find their way into tiles through cracks and macropores in the soil. The tiles then carry these nutrients to local streams. Management of the water table through control structures at drain tile outlets is a promising approach to reduce the amount of nutrients that exit the tile lines (Figure 61). This is accomplished by adjusting the control structure so that the water table rises after harvest to limit drainage during the off-season. The water table can then be lowered a few weeks prior to planting in spring. The water table can also be raised in midsummer to store water for crops.

Waste (Manure) Management
Livestock production within the agricultural industry is a producer of waste materials that need management. These wastes include primarily manure from livestock. The NRCS has produced the "Agricultural Waste Management Field Handbook (AWMFH)" to provide specific guidance for planning, designing, and managing systems where agricultural wastes are involved. It can help assist agricultural producers in organizing a comprehensive plan that results in the integration of waste management into overall farm operations. Material in this handbook covers a wide range of activities from incorporating available manure nutrients into crop nutrient budgets to proper disposal of waste materials that do not lend themselves to resource recycling.

Figure 61. Use of tile control to raise water table after harvest (left), drawdown prior to seeding (middle), and raised again in midsummer (right) (Source: Purdue University)



6.1.14 Rainwater Harvesting & Re-use

Water harvesting and re-use via rain barrels and cisterns are important options to decrease the amount of stormwater runoff in a watershed. It is a simple, economical solution that can be done by any homeowner or business. On most homes and buildings, the water from roofs flows into downspouts and then onto streets, parking areas, or into stormsewers. Disconnecting the downspouts and using either rain barrels or cisterns for re-use later can reduce the flood levels in local streams.

Water re-use differs based on the type of storage and water treatment. A rain barrel is typically attached to a downspout and collects water for irrigation purposes. In many areas, residential irrigation can account for almost 50 percent of residential water consumption. Re-using water is a great way of minimizing water use and lowering water bills.

A cistern also stores water from rooftop runoff to be used later. However a cistern is often larger, sealed, and the water can be filtered for a wider variety of uses. With appropriate sanitation treatments, water from cisterns can even be reused for toilets, housecleaning, showers, hand washing, and dish washing. Cistern water, without any sanitation, can be used for lawn and garden watering, irrigation, car washing, and window cleaning.

The primary purpose of rain barrels and cisterns is water storage. Rain barrels typically store 55 gallons each. Cisterns can store greater amounts. Rain barrels and cisterns also reduce water demand in the summer months by reducing the potable water used for irrigation or other household uses.

Rain barrel adjacent to residential home (source: Rainbarrelsource.com)

Rainwater Harvesting & Reuse Recommendations

Education programs in the watershed should focus on teaching residents and businesses the beneficial uses of rain barrels and cisterns. Local governments in the watershed should aim to install demonstration rain barrels as a way for the public to better engage in their use around residential homes. Local governments and organizations such as Root-Pike Watershed Initiative Network (WIN) should begin to or continue sponsoring programs where residents and businesses can purchase rain barrels.

6.1.15 Conservation & Low Impact Development

The negative effects of "Traditional Development" are well documented. As additional residential and other development occurs within Wind Point watershed, it will be extremely important to consider development alternatives such as Conservation or Low Impact development. Caledonia, for example, is a proactive community in the watershed that has already introduced a Conservation Subdivision ordinance.

Conservation Development Design
Conservation Development design facilitates development density needs while preserving the most valuable natural features and ecological functions of a site. It does this by reducing lot size, especially lot width thereby reducing the amount of roads and infrastructure (Figures 62 & 63). The open space is typically preserved or restored natural areas that are integrated with newer natural Stormwater Treatment Train features and recreational trails. The open space allows the residents to feel like they have larger lots because most of the lots adjoin the open space system.

Such flexibility is intended to retain or increase the development rights of the property owner and the number of occupancy units permitted by the underlying zoning designation, while encouraging environmentally responsible development. Conservation design is most appropriate in areas having natural and open space resources to be protected and preserved such as floodplains, groundwater recharge areas, wetlands, woodlands, streams, wildlife habitat, etc. It can also be used to preserve and integrate agricultural uses into the land pattern. The approach first takes into account the natural landscape and ecology of a development site rather than determining design features on the basis of pre-established density criteria. The general steps included below are generally followed when designing the layout of a development site:

Step 1: Identify all natural resources, conservation areas, open space areas, physical features, and scenic areas and preserve and protect these areas from any negative impacts generated as a result of the development.

Step 2: Locate building sites to take advantage of open space and scenic views by requiring smaller lot sizes or cluster housing as well as to protect the development rights of the property owner and the number of occupancy units permitted by the underlying zoning of the property.

Step 3: Design the transportation system to provide access to building sites and to allow movement throughout the site and onto adjoining lands; roads should not traverse sensitive natural areas.

Step 4: Prepare engineering plans which indicate how each building site can be served by essential public utilities

Figure 62. Stormwater Treatment Train within Conservation Development.

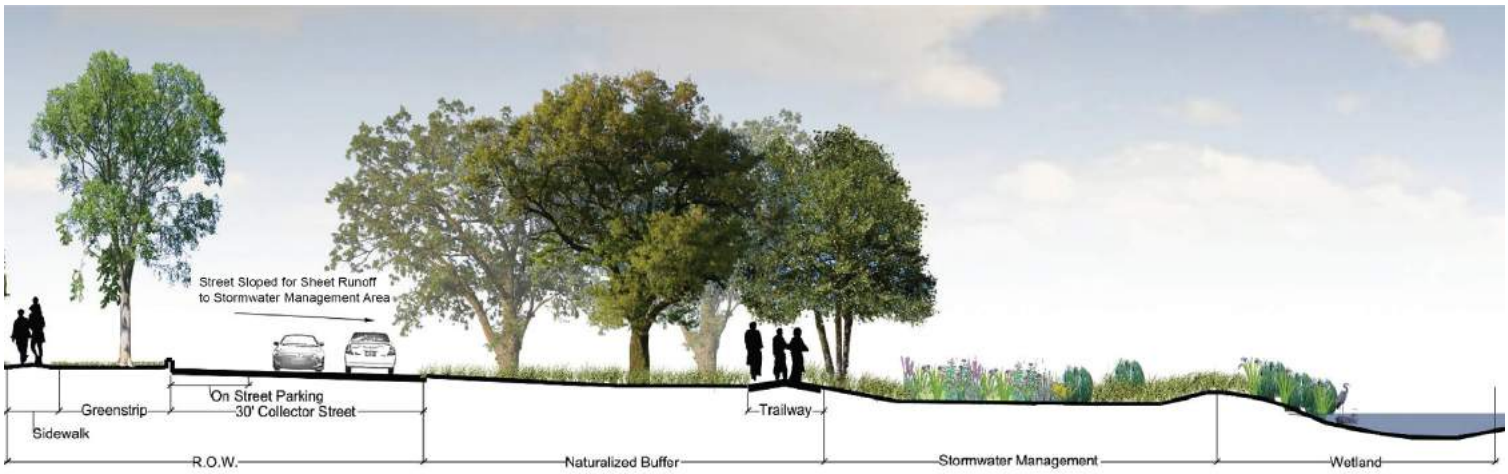


Figure 63. Traditional vs. Conservation Development Design (Elkhorn, WI)

Figure 64. Conservation/Low Impact development design

Low Impact Development (LID)
Low impact development (LID) focuses on the hydrologic impact of development and tries to maintain pre-development hydrologic systems, treating water as close to the source as possible. LID principals can be incorporated into development or stormwater ordinances and used in new development or retrofitting existing developments. Green infrastructure systems are created to mimic natural processes that promote water infiltration, native plant evapotransiration, and stormwater reuse.

Low impact development seeks to keep stormwater out of pipes and instead keep the entire infrastructure more natural and above ground. Solutions start at the lot scale such as rain gardens and overflows to swales adjacent to roads. Larger impervious areas, such as a commercial development may utilize constructed wetlands for stormwater storage while adding value to the area by enhancing aesthetics, site interest and the ecology. Milwaukee Metropolitan Sewerage District (MMSD) has been influential in determining pollutant reductions for various LID methodologies. The Noteworthy section below is a list of possible Management Measure practices, as described by MMSD in, "Evaluation of Stormwater Reduction Practices (MMSD, 2003)."

Figure 65. Greener Streetscape using LID practices. "*Greening the Code*" Washington County, OR

MMSD Recommended Management Measure Practices

Downspout Disconnection: Disconnection of roof downspouts from sewers or from direct runoff to other impervious land surfaces.

Rain Barrels: Collection of roof runoff in barrels, later used as irrigation.

Cisterns: Roof runoff collection systems that store water in a tank: water may be reused for toilet, laundry, and lawn watering purposes.

Rain Gardens: Small vegetated depressions used to capture water and promote infiltration and evapotranspiration.

Green Roofs: Soil and vegetation installed on top of a conventional flat or slightly sloped roof. A complete green roof system may include a watertight membrane, protective layer, insulation, irrigation system, drainage system, filter layer, soil, and plants.

Rooftop Storage: Temporary storage of rain on a flat roof and the gradual release of this volume using restricted roof drain inlets.

Green Parking Lots: Various measures used to reduce the impervious area of a parking lot and promote infiltration and/or evapotranspiration.

Stormwater Trees: Increasing tree canopies to provide stormwater interception and evapotranspiration.

Porous Pavement: The use of porous asphalt or concrete, modular block systems, grass pavers, or gravel pavers to allow stormwater infiltrate and not runoff.

Inlet Restrictors/Pavement storage: Grading and flow restrictors that allow the temporary storage of stormwater on streets and parking lots.

Bioretention: Landscaped depressions planted with grass, shrubs, and/or trees. Typically built with a sand/gravel underdrain, mulch, and soil amendments to maximize storage, infiltration and water cleansing.

Onsite Filtering Practices: Practices such as sand filters, bioretention cells, swales, and filter strips that use a filter media (sand, soil, gravel, peat, or compost) to reduce runoff and promote water cleansing.

Pocket Wetlands: Small constructed wetlands that can reduce peak flows and runoff volumes, and remove pollutants via settling and bio-uptake.

French Drains and Dry Wells: Gravel-filled trenches used to capture roof runoff and allow it to percolate into the soil.

Infiltration Sumps: Below ground, perforated, cylindrical, concrete structures used to collect stormwater and allow it to percolate into the soil.

Compost Amendments: Incorporating decomposed organic material into the soil to improve infiltration and vegetation performance.

Stormwater Policies: Land development and stormwater management criteria and requirements

Economics of Conservation Developments and Low Impact Development

Both conservation developments and low impact development (LID) are not only environmentally sound choices, but economical ones for both developers and municipalities. Conservation design can produce some of its biggest cost savings in infrastructure costs such as site preparation, stormwater management, site paving, and sidewalks (Conservation Research Institute, 2005). According to a study conducted by Applied Ecological Services, Inc., the average savings created by choosing conservation development over more traditional footprints is 24% (Table 38) (AES, 2007). Not only do lots in conservation developments typically cost less to install, but they also "carry a price premium ... and sell more quickly than lots in conventional subdivisions (Mohamed, 2006)." Another study conducted in Concord, Massachusetts found that over an eight year period, a cluster development with protected open space had a 2.6% higher annual appreciation rate over "residential properties with significantly larger private yards, but without the associated open-space (Lacy, 1990)."

While low impact development covers a range of stormwater practices, it has some of the same cost benefits as conservation design. Typically LID practices "can cost less to install, have lower operations and maintenance costs, and provide more cost-effective stormwater management and water-quality services than conventional stormwater controls (ECONorthwest, 2007)." Similarly to conservation design, cost savings from utilizing LID practices can be found as a reduction in the amount of drainage infrastructure and land disturbance required; additionally, property values can be increased by 12 - 16% (UNH Stormwater Center, 2011).

There is also evidence that combining both conservation and low impact development practices through holistic site design can create deeper cost savings for developers as well as increased ecosystem benefits – particularly by combining clustered site designing and naturalized stormwater management systems (Conservation Research Institute, 2005). Not only do conservation and low impact development practices provide a more economical possibility for developers and municipalities, but they can improve water quality, habitat, and property values in the watershed.

Table 38. Savings of Conservation Development over Traditional Subdivision Design for ten Midwestern conservation development projects.

Savings of Conservation Development over Traditional Subdivision Design (P=Project)

Positive numbers are savings of Conservation Development over Traditional.
Negative numbers are costs of Conservation Development over Traditional.

Project:	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Average
ITEM											
Grading	-$214,740	$257,832	$1,813,726	$2,215,025	$1,856,206	$1,862,988	$796,705	$291,957	$302,497	$2,852,312	51.00%
Roadway	$84,702	$18,754	-$16,477	-$130,230	$1,464,599	$1,187,386	$205,168	$9,231	-$9,963	$801,484	18.00%
Storm Sewer	$181,611	$31,220	$6,648	$89,676	$974,689	$547,184	$210,289	$65,501	$110,021	$678,302	40.00%
Sanitary Sewer	$41,614	-$4,365	$0	-$203,064	$850,962	$224,776	$72,436	-$15,502	$5,960	$423,458	6.00%
Water	$44,483	-$4,671	-$63,680	-$215,881	$905,157	$240,064	$76,815	-$16,257	$5,973	$451,084	5.00%
Ecological	-$56,500	-$74,857	-$277,472	-$400,321	-$407,131	-$625,084	-$160,341	-$93,954	-$264,513	-$380,992	-154.00%
Amenities	$17,572	-$16,202	-$94,399	-$226,216	$552,667	$221,666	$7,825	-$15,749	-$39,274	$266,982	6.00%
Contingencies	$132,055	$51,928	$342,087	$282,247	$1,549,287	$914,745	$302,225	$56,307	$27,675	$1,273,157	24.00%
Total Savings	$660,277	$259,639	$1,710,433	$1,411,235	$7,746,436	$4,573,725	$1,511,124	$281,534	$138,377	$6,365,787	
Total Percent Savings	19.00%	20.00%	33.00%	15.00%	43.00%	32.00%	25.00%	15.00%	4.00%	37.00%	24.30%*
Cost Savings Per Lot	$8,725.00	$6,978.00	$147,012.00	$29,012.00	$7,904.00	$20,077.00	$7,346.00	$4,078.00	$4,959.00	$67,676.00	$30,376.70

* Total Savings Percentage is *not* the percentage savings of all individual Items added together, because dollar-values of Items are different.
Visit www.appliedeco.com for more detailed info.

6.1.16 Green Infrastructure Planning

A green infrastructure network provides communities with a tool to identify and prioritize land use or conservation opportunities and plan development that benefits both people and nature by providing a framework for future growth. It identifies areas not suitable for development, areas suitable for development but that should incorporate conservation or low impact design standards, and potential development areas that do not affect green infrastructure. Watershed stakeholders can use green infrastructure plans for trail routing, open space linkages, and natural area restoration decisions. Residents can use green infrastructure recommendations to reduce runoff from their properties and to see how their properties fit into the larger network. A Green Infrastructure Network for the watershed was developed in Section 3.11.

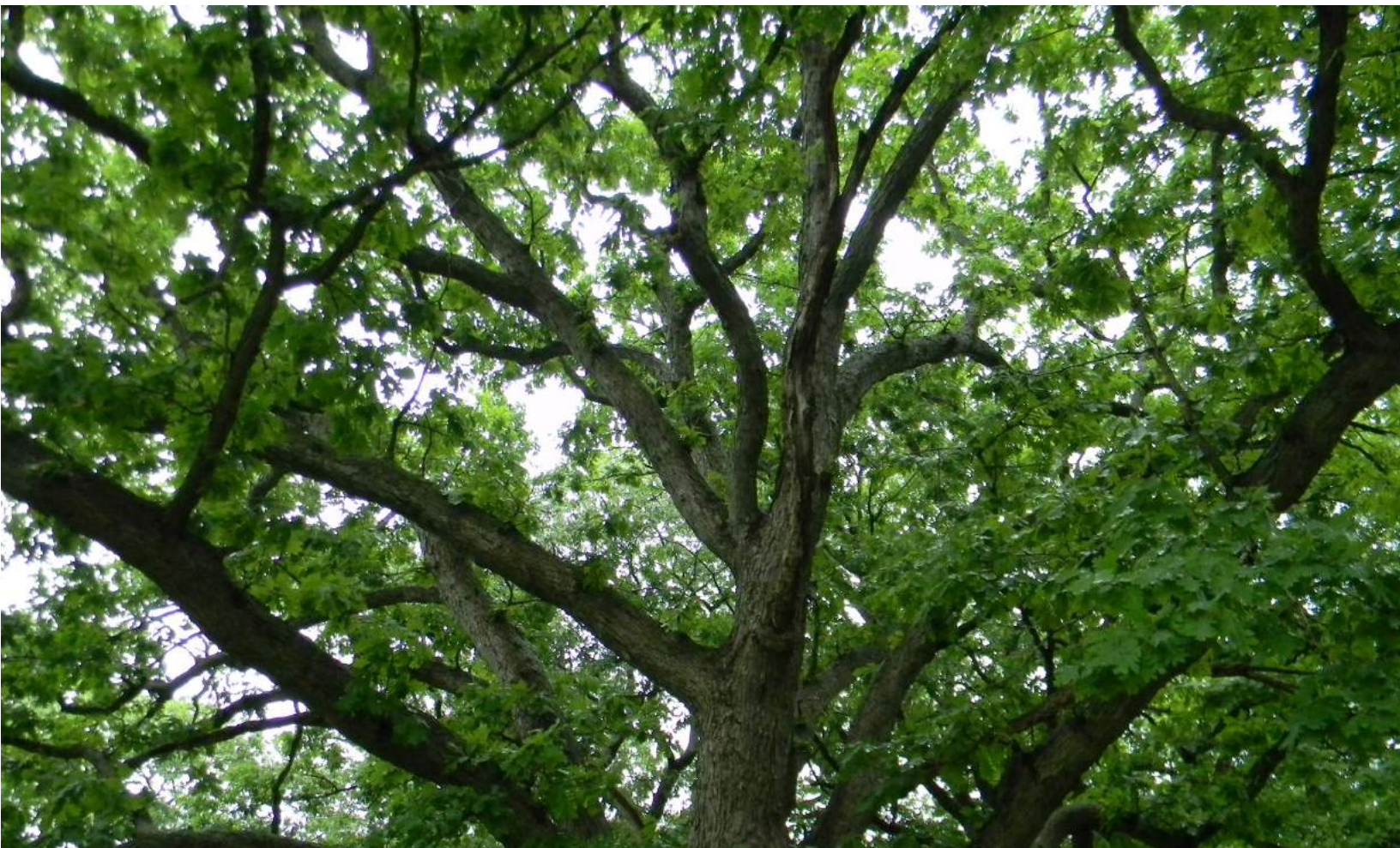
Green Infrastructure Network *implementation* has several actions:

- Protect specific unprotected green infrastructure parcels through acquisition, regulation, and/or incentives.
- Incorporate conservation or low impact design standards on green infrastructure parcels where development is planned.
- Limit future subdivision of green infrastructure parcels.
- Implement long term management of green infrastructure.

Green Infrastructure Recommendations

A Green Infrastructure Network can only be realized by coordinated planning efforts of local municipalities, park districts, developers, and private land owners. Stakeholders should follow the recommended process below to initiate and implement the Green Infrastructure Network for Wind Point watershed.

1. Include all green infrastructure parcels in updated community comprehensive plans and development review maps.
2. Create zoning overlay and update development ordinances to require conservation development/low impact design on all green infrastructure parcels.
3. Require Development Impact Fees and/or Special Service Area taxes for all new development to help fund future management of green infrastructure.
4. Identify important unprotected green infrastructure parcels not suited for development then protect and implement long term management.
5. Work with private land owners along stream/tributary corridors to manage their land for green infrastructure benefits.
6. Use the Green Infrastructure Network to identify new trails and trail connections.



6.1.17 Water Quality Trading & Adaptive Management

The following information is cited directly from a Wisconsin Department of Natural Resource's (WDNR) document entitled "A Water Quality Trading How To Manual" (WDNR 2013). Water Quality Trading (WQT or "trading") presents a way for municipal and industrial Wisconsin Pollutant Discharge Elimination System (WPDES) permit holders to demonstrate compliance with water quality-based effluent limitations (WQBELs). Generally, trading involves a point source facing relatively high pollutant reduction costs compensating another party to achieve less costly pollutant reduction with the same or greater water quality benefit. In other words, trading provides point sources with the flexibility to acquire pollutant reductions from other sources in the watershed to offset their point source load so that they will comply with their own permit requirements. Trading is not a mandatory program or regulatory requirement, but rather a market-based option that may enable some industrial and municipal facilities within Wind Point watershed to meet regulatory requirements more cost-effectively. Now that more restrictive water quality standards are effective in Wisconsin, such as those for phosphorus, trading may be economically preferable to other compliance options.

There are many benefits to trading:

1. Permit compliance through trading may be economically preferable to other compliance options.

2. New and expanding point source discharges can utilize trading to develop new economic opportunities in a region, while still meeting water quality goals.

3. Permittees, and the point and nonpoint sources that work cooperatively with them, can demonstrate their commitment to the community and to the environment by working together to protect and restore local water resources.

Adaptive management is often confused with trading, as both options allow permittees to work with nonpoint or other point sources of phosphorus in a watershed to reduce the overall phosphorus load to a given waterbody. Adaptive management is solely focused on phosphorus compliance and improving water quality so that the applicable phosphorus criterion is met. Trading is not limited to phosphorus and may be used to meet limits for various compounds. Trading focuses on compliance with a discharge *limit* while adaptive management focuses on compliance with phosphorus *criteria*.

Water quality trading has seven components: pollutant, trading participants, pollution reduction credit, credit threshold, trade ratio, location, and timing (Figure 66). Each of these components must be adequately addressed in a trading strategy. The "pollutant" is simply the contaminant being traded. The "trading participants" are entities involved in the trade. "Credit" is the amount of a given pollutant that is available for trading. "Credit Threshold" is the amount of pollutant reduction that needs to be achieved before credits are generated. "Trade ratios" are put in place due to uncertainty margins. "Location" refers to the fact that the credit user and generator must discharge to the same waterbody. "Timing" is important because credits must be generated before they can be used to offsite the pollution.

Figure 66. Water quality trading components (source: WDNR).

6.1.18 Brownfield Redevelopment

Brownfields are parcels of land that once harbored industrial or commercial uses but have since been vacated. These sites often contain remnants of infrastructure and may have contaminated soils depending on what was located there previously and can be difficult to appropriately reuse. Nevertheless, the conversion of former brownfield sites into natural areas, parks, or open space can be a great way to reintroduce green spaces into highly urbanized areas.
The Lakefront Redevelopment Area is one such site in Wind Point watershed. The site is 250 acres of brownfield on the Lake Michigan shoreline within the City of Oak Creek. The City hired a consultant to engage citizens and stakeholders to help develop a vision for the site with the overall purpose to create an overall development framework for the site that provides public access to the lakefront. The results of the planning effort are included in a document entitled *Lakefront Redevelopment Action Plan* (City of Oak Creek 2011) that was adopted in February, 2012 (Figure 67). This plan follows in the footsteps of the 2009 effort by UW-Milwaukee that produced a document entitled *Lakeview Redevelopment Plan: City of Oak Creek, Wisconsin* (UW-Milwaukee 2009). Groups interested in brownfield redevelopment should follow a similar planning approach to that which was used for the Lakefront Redevelopment Area.

Funding for the redevelopment efforts should be leveraged through Tax Increment Financing (TIF) financing and brownfield and environmental remediation grants. Final redevelopment plans should also be refined through an intensive public planning workshop complemented by an in-depth market analysis. This will result in a final plan which has the support of the public and is rooted in economic realities.

Figure 67. Lakefront Redevelopment Plan (Source: Oak Creek 2011)

The Wisconsin Department of Natural Resources (WDNR) has a Remediation and Redevelopment program that oversees the investigation and cleanup of environmental contamination and the redevelopment of contaminated brownfields. This program provides a range of financial and liability tools available to assist local governments and other groups to clean up and redevelop brownfields in Wisconsin. In addition, The Brownfields Study Group was created in 1998 at the direction of the governor and State Legislature, to evaluate Wisconsin's current brownfields initiatives and recommend changes, as well as propose additional incentives for the cleanup and reuse of brownfields. The Study Group continues to drive important brownfields policy changes in Wisconsin.

Grant monies from the state and federal government are often used in brownfield redevelopments, especially for projects with large amounts of brownfield and infill land. Available grants through the State of Wisconsin include those administered by the Department of Natural Resources and the Department of Commerce. Federal grants and loans from the US Environmental Protection Agency are available as well.

Additionally, the federal American Recovery and Reinvestment Act of 2009 designated spending in more than 130 different state and federal programs, with the majority of the funds flowing through existing programs. Nation-wide funding has been approved for three federal environmental cleanup programs: $600 million for Superfund sites; $200 million for leaking underground storage tanks (LUSTS); and $100 million for brownfields. The State of Wisconsin has received funding through this federal program to be used for LUSTS and brownfields.

6.2 Site Specific Management Measures Action Plan

Site Specific Management Measure (Best Management Practice [BMP]) recommendations made in this section of the report are backed by findings from the watershed field inventory, overall watershed resource inventory, and input from stakeholders. In general, the recommendations address sites where watershed problems and opportunities can best be addressed to achieve watershed goals and objectives. The Site Specific Management Measures Action Plan is organized by the jurisdiction in which recommendations are located making it easy for users to identify the location of project sites and corresponding project details. It is important to note that project implementation is voluntary and there is no penalty or reduction in future grant opportunities for not following recommendations. Site Specific Management Measures were identified within the following jurisdictional boundaries and are included in the Site Specific Action Plan:

- *Caledonia*
- *North Bay*
- *Oak Creek*
- *Racine*
- South Milwaukee
- Wind Point

Management Measure categories in the Site Specific Action Plan include:

- *Detention Basin Retrofits & Maintenance*
- *Wetland Restoration*
- *Streambank , Ravine, & Channel RestorationGreen Infrastructure Protection Areas*
- *Riparian Area Restoration & Maintenance*
- *Green Infrastructure Protection Areas*
- *Agricultural Management Practices*
- *Other Management Measures*

Descriptions and location maps for each Management Measure category follow. Table 41 includes useful project details such as site ID#, Location, Units (size/length), Owner, Existing Condition, Management Measure Recommendation, Pollutant Load Reduction Efficiency, Priority, Responsible Entity, Sources of Technical Assistance, Cost Estimate, and Implementation Schedule.

Project importance, technical and financial needs, cost, feasibility, and ownership type were taken into consideration when prioritizing and scheduling Management Measures for implementation. High, Medium, or Low Priority was assigned to each recommendation. “Critical Areas” as discussed in Section 5.2 are all High Priority and highlighted in red on project category maps and the Action Plan table. For this watershed plan a “Critical Area” is best described as a location in the watershed where existing or potential future causes and sources of an impairment or existing function are significantly worse than other areas of the watershed. Implementation schedule varies greatly with each project but is generally based on the short term (1-10 years) for High Priority/Critical Area projects and 10-20+ years for medium and low priority projects. Maintenance projects are ongoing

The Site Specific Management Measures Action Plan is designed to be used in one of two ways.

Method 1: The user should find the respective jurisdictional boundary (listed alphabetically in Table 41) then identify the Management Measure category of interest within that boundary. A Site ID# can be found in the first column under each recommendation that corresponds to the Site ID# on a map (Figures 68-74) associated with each category.

Method 2: The user should go to the page(s) summarizing the Management Measure category of interest then locate the corresponding map and Site ID# of the site specific recommendations for that category. Next, the user should go to Table 41 and locate the jurisdiction where the project is located, then go to the project category and Site ID# for details about the project.

Table 39. Percent pollutant removal efficiencies for various Management Measures.

Management Measures	TSS	TN	TP	Bacteria
Vegetated Filter Strips	73%	40%	45%	37%
Wet Pond/Detention	60%	35%	45%	70%
Wetland Detention	77.5%	20%	44%	78%
Dry Detention	57.5%	30%	26%	88%
Infiltration Basin	75%	60%	65%	90%
Streambank/Lake Shoreline Stabilization	90%	90%	90%	N/A
Weekly Street Sweeping	16%	6%	6%	N/A
Porous Pavement	90%	85%	65%	90%

Pollutant Load Reduction Estimates

Where applicable, pollutant load reductions and/or estimates for total suspended solids (TSS), nitrogen (TN), and phosphorus (TP) were evaluated for each recommended Management Measure based on efficiency calculations developed for the USEPA's Region 5 Model. This model uses "Pollutants Controlled Calculation and Documentation for Section 319 Watersheds Training Manual" (MDEQ, 1999) to provide estimates of sediment and nutrient load reductions from the implementation of *agricultural* Measures. Estimate of sediment and nutrient load reduction from implementation of *urban* Measures is based on efficiency calculations used in the Region 5 model. Reduction estimates for bacteria such as *E. coli* are not included in these models.

Estimates of pollutant load reduction using the Region 5 Model are measured in weight/year (tons/yr for total suspended solids and lbs/yr for nitrogen and phosphorus). The model was generally used to calculate weight of pollutant reductions for all recommended High Priority-Critical Areas where calculation of such data is applicable. In summary, pollutant reductions were calculated for 8 detention basin retrofit projects, 8 wetland restoration projects, 4 streambank, ravine, & channel restoration projects, 2 riparian area restoration projects, and 7 agricultural management projects. Spreadsheets used to determine pollutant load reductions can be found in Appendix E.

Estimated *percent* removal of total suspended solids, nitrogen, and phosphorus are included in the Action Plan table for most medium and low priority projects and those projects where calculation of pollutant weight reduction is beyond the scope of this project. The percent removal efficiencies for total suspended solids, nitrogen, and phosphorus were based on various Management Measures included in the Region 5 Model as shown in Table 39. Percent removal efficiencies for total bacteria such as *E. coli* were derived from the National Pollutant Removal Performance Database that was developed by the Center for Watershed Protection (CWP 2007).

Watershed-Wide Summary of Action Recommendations

All Site Specific Management Measures, Education Plan (Section 7.0), and Monitoring Plan (Section 9.1) recommendation information is condensed by Category in Table 40. This information provides a watershed-wide summary of the "Total Units" (size/length), "Total Cost," and "Total Estimate of Pollutant Load Reduction" if all the recommendations in the Site Specific Management Measures Action Plan, Education Plan, and Monitoring Plan are implemented. Key points include:

- 3,238 acres of ecological restoration costing $2,914,795.
- 117,016 linear feet of streambank/ravine restoration costing $6,942,500.
- 118 acres and 86,758 linear feet maintenance costing $150,100 per year.
- 10,910 tons/year of total suspended solids (TSS) would potentially be reduced each year exceeding 7,415 tons/yr Reduction Target identified in Section 5.0.
- 26,227 pounds/year of nitrogen (TN) would potentially be reduced each year.
- 11,886 pounds/year of phosphorus (TP) would potentially be reduced each year, exceeding the 9,605 pounds/year Reduction Target indentified in Section 5.0.
- Education programs will cost $67,750 over five years to implement (see Section 7.0).
- A water quality monitoring plan will cost at least $160,000 to implement (see Section 9.0).

Table 40. Watershed-wide summary of Management Measures recommended for implementation.

Management Measure Category	Total Units (size/length)	Total Cost	Estimated Load Reduction		
			TSS (t/yr)	TN (lbs/yr)	TP (lbs/yr)
Detention Basin Retrofits & Maintenance*					
Retrofits (prairie buffers, emergent plantings, etc.)	114.5 acres	$1,822,000	932.5	3,745	899
Maintenance (burning, mowing, invasives, brushing, etc.)	118 acres	$54,100/yr	na	na	na
Wetland Restoration	445 acres	$3,795,000	86.5	404	162
Streambank/Ravine & Channel Restoration*	16,758 lf	$5,710,000	8,238	16,474	8,238
Riparian Buffer Restoration & Maintenance*					
Riparian Areas	86,758 lf	$882,500	80.5	1,087	165
Maintenance (burning, invasive control, brushing, etc.)	86,758 lf	$96,000/yr	na	na	na
Green Infrastructure Protection Areas**	1,403 acres	na	na	na	na
Agricultural Management Practices*					
Conservation Tillage (no till) and Filter Strips Farming	975 acres	na	1,573	4,517	2,422
Other Management Measures**					
1 Dump Site Cleanup	0.5 acres	$183,000	na	na	na
1 Bluff Erosion Feasibility Study	4,500 lf	$50,000	na	na	na
5 Bioswale Projects	9,000 lf	$300,000	na	na	na
1 Naturalized Detention Basin Construction	0.5 acre	$80,000	na	na	na
Native Prairie Implementation at Shoop Park Golf Course	30 acres	$100,000	na	na	na
5 Rain Garden Projects	1 acre	$51,000	na	na	na
Short Native Prairie Implementation at Batten Airport	150 acres	$400,000	na	na	na
1 Parking Lot Retrofit (Racine Municipal Parking Area)	1 acres	$200,000	na	na	na
Information/Education Plan	Entire Plan	$60,750/5yr	na	na	na
Water Quality Monitoring Plan	Entire Plan	$160,000	na	na	na
TOTALS	**3,238 acres**	**$2,914,795**	**10,910 tons/yr**	**26,227 lbs/yr**	**11,886 lbs/yr**
	118 ac, 86,758 lf maintenance	**$150,100/yr**			
	117,016 lf	**$6,942,500**			
	Education	**$60,750/5yr**			
	Monitoring	**$160,000**			

* Pollutant load reduction calculated for applicable High Priority-Critical Area projects only.
* * Pollutant load reductions were not or could not be calculated using STEPL/Win SLAMM or other modeling.

6.2.1 Detention Basin Retrofits & Maintenance Recommendations

Most detention basins within Wind Point watershed are designed primarily for stormwater storage and provide little in the way of water quality improvement, wildlife habitat, and green infrastructure connections. In the future it is recommended that new standards for detention basins be implemented in local and county development ordinances that reflect recommendations made in Section 6.1.2. Applied Ecological Services, Inc. (AES) conducted an inventory of 39 detention basins in fall of 2012. The results of the detention basin inventory are summarized in Section 3.14.2. Detailed field investigation datasheets and maps can be found in Appendix B.

The condition of detention basins in the watershed varies. Ten (10) dry bottom turf grass, 13 naturalized wet or wetland bottom, and 16 wet or wetland bottom with turf slopes detention basins were inventoried. Of the 39 basins, 10 (26%) provide "Good" ecological and water quality benefits while 18 (46%) basins provide "Average" benefits. The remaining 11 (28%) basins provide "Poor" ecological and water quality benefits because most were designed to meet stormwater storage volume requirements only.

All recommended detention basin retrofits and/or maintenance recommendations are shown on Figure 68 by priority and Site ID# which correspond with the ID# used in the field investigation. General details about each recommendation can be found in the Action Plan Table (Table 41) within the appropriate jurisdictional boundary. All of the High priority recommendations are considered "Critical Areas." Many of these are publicly owned basins and other private basins with significant problems or that present good opportunities; funding and implementation are usually easier on public land or where major problems/opportunities exist. Low or Medium priority is generally assigned to smaller private basins and those with fewer problems or maintenance needs. In addition, there are several detention basins with no retrofit or maintenance recommendations. In some cases, basins are assigned higher priority based on location and/or ability to treat polluted stormwater runoff in a pollutant hotspot subwatershed management unit as determined via the water quality monitoring (see Section 4.0).

It is important to note that detention basin recommendations in Table 41 do not include highly detailed descriptions of proposed work and therefore cost estimates are general in nature and should not typically be used when bidding a project or pursing a grant until a concept plan with more accurate costs is developed.

Critical Area (#31A) detention basin retrofit opportunity in Caledonia.

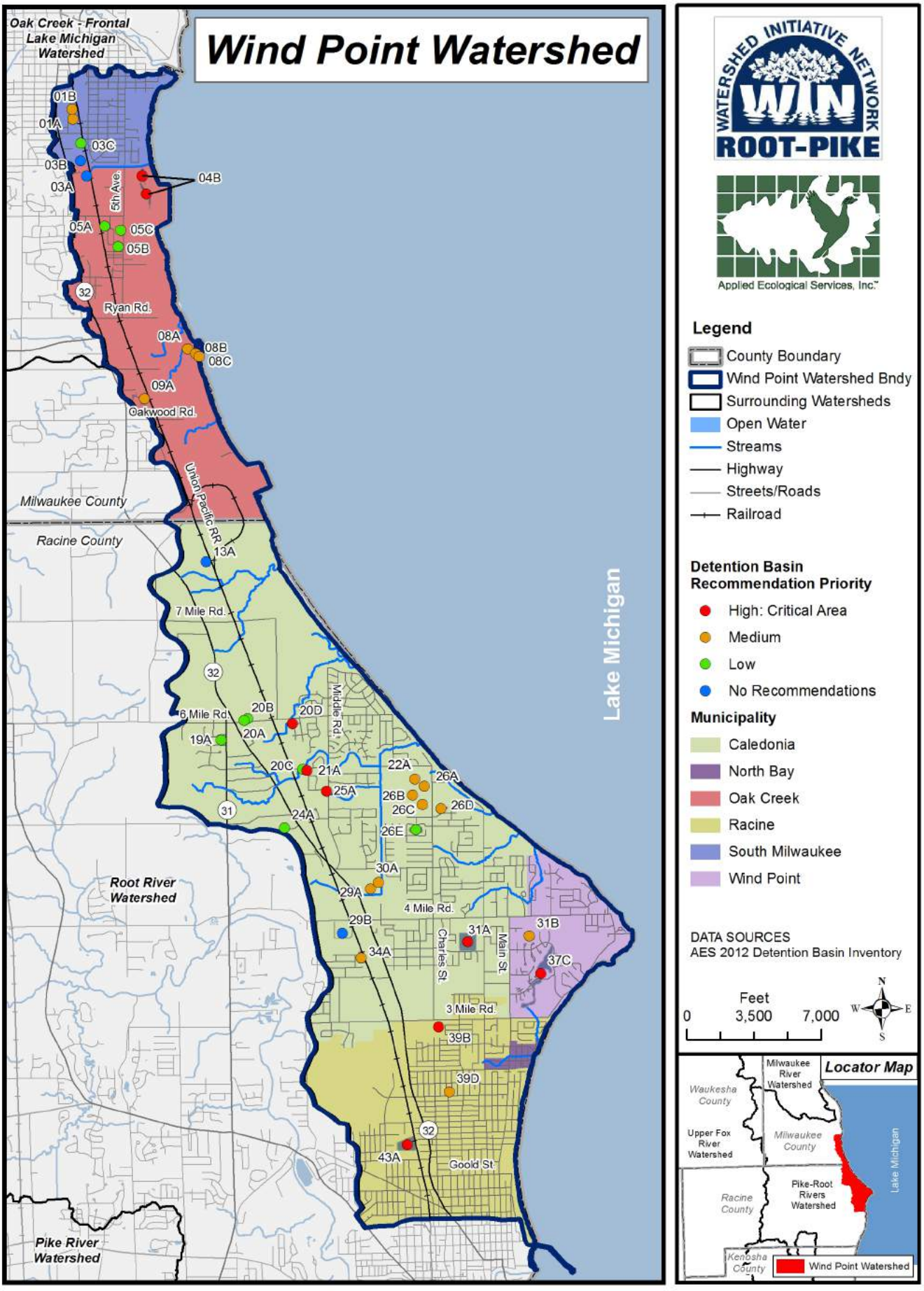


Fig. 68: Detention Basin Retrofit & Maintenance Recommendations

6.2.2 Wetland Restoration Recommendations

Wetland restoration is the process of bringing back historic wetlands in areas where they have been drained. This section does not include enhancement and maintenance for existing wetlands. Restoration can be important for mitigation purposes or done simply to benefit basic environmental functions that historic wetlands once served. Improvement in water quality is the greatest benefit provided by wetland restoration. Other benefits include reducing flood volumes/rates and improved habitat to increase plant and wildlife biodiversity. The wetland restoration process is generally the same for all sites. First a study must be completed to determine if restoration at the site is actually feasible. If it is, a design plan is developed, permits obtained, then the project is implemented by breaking existing drain tiles and/or regrading soils to attain proper hydrology to support wetland vegetation. Planting with native wetland species is the next step followed by short and long term maintenance and monitoring to ensure establishment.

Wetland restoration sites were identified in Section 3.14.3 using a GIS exercise and specific criteria determined to be essential for restoration of a functional and beneficial wetland. The initial analysis resulted in 28 sites meeting these criteria. However, only 14 of these sites were determined to be "potentially feasible" and 11 are considered to have only "limited feasibility" based on careful review of each site using recent aerial photography, open space inventory results, existing land use, and field inspections where appropriate.

Figure 69 includes the location of all recommended wetland restoration sites by site priority and site ID#. The site ID#s match those used in Section 3.14.3. Wetland restoration sites that were determined to have very limited feasibility are not included in the Action Plan. Details about each recommendation can be found in the Action Plan Table (Table 41) within the appropriate jurisdictional boundary.

In general, large sites on agricultural land, sites on public land, and sites within the identified Green Infrastructure Network are higher priority than smaller sites and those on private land. In many cases, potential wetland restoration sites are located on land that is currently farmed but slated for future development. In these cases it is recommended that future development include wetland restoration to the extent possible to act as both detention for the development and possibly as wetland mitigation. The potential 45+ acre wetland restoration site at Cliffside Park could be used as a wetland mitigation bank for wetland impacts in the watershed.

Potential wetland restoration site (#9) at Shoop Park Golf Course

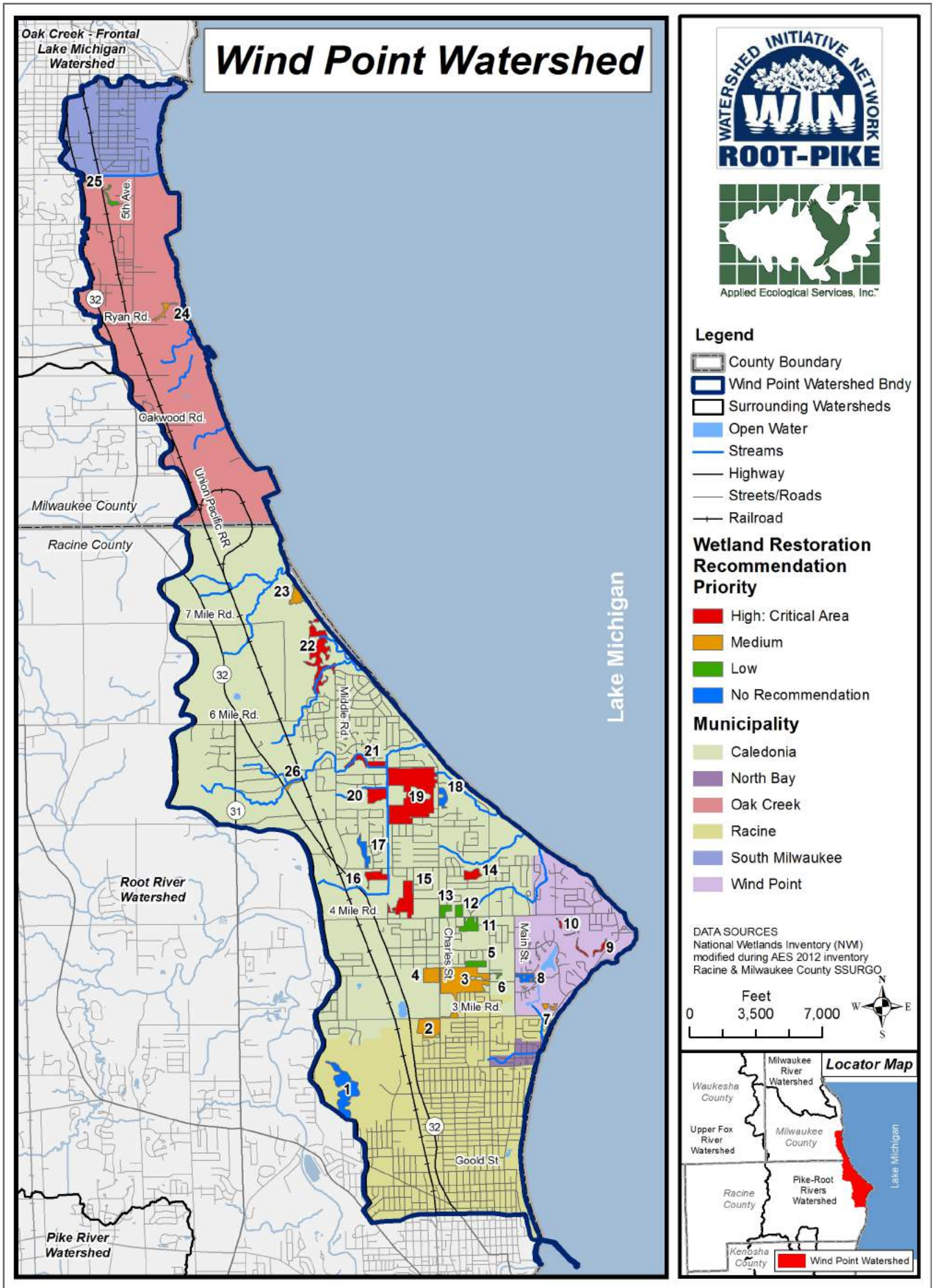


Fig. 69: Wetland Restoration Recommendations

6.2.3 Streambank, Ravine, and Channel Restoration Recommendations

Applied Ecological Services, Inc. (AES) completed a general inventory of 12 primary tributary streams, including ravines in fall of 2012. All streams and tributaries were assessed based on divisions into "Stream Reaches". Twenty eight (28) stream reaches were assessed accounting for 96,911 linear feet or 18.4 linear miles. Detailed notes were recorded for each stream reach related to potential Management Measure recommendations such as improving streambank and channel conditions and maintaining these reaches long term. The results of the stream inventory are summarized in Section 3.14.1; detailed field investigation datasheets can be found in Appendix B.

The condition of tributaries in the watershed varies. According to the inventory, 34% of tributary length is naturally meandering; approximately 31% is moderately channelized; 35% is highly channelized. Approximately 86% of the total tributary length exhibits no or low bank erosion while moderate erosion is occurring along 7% of streambanks. Highly eroded streambanks are all associated with ravine systems near Lake Michigan and accounting for 7% of the total stream length. Many of these eroded ravines are considered "Critical Areas" because they are actively contributing significant sediment loads to Lake Michigan as a result of headcutting.

Most stream and ravine restoration projects include at least one of the following three water quality and habitat improvement components; 1) removal of existing invasive vegetation including trees and shrubs from the banks followed by; 2) stabilized banks using bioengineering, regrading of banks, installation of native vegetation, and hard armoring where necessary; and 3) restored riffles/grade controls in the stream channel to simulate conditions found in naturally meandering streams and to prevent headcutting.

Figure 70 shows the location of all potential streambank/channel and ravine restoration projects by reach ID# and priority while Table 41 lists project details about each recommendation within the appropriate jurisdictional boundary. Potential streambank and channel restoration projects on public land and reaches exhibiting severe problems on private land are generally assigned as higher priority for implementation. Medium and Low priority was generally assigned to stream reaches exhibiting only minor problems. Recommendations are not made for stream reaches where restoration is not needed. It is also important to note that implementation costs listed in Table 41 are estimates only. Actual costs will need to be developed via a conceptual plan prior to applying for grants and installing the project.

Examples of AES streambank stabilization (left) and headcut stabilization (right).

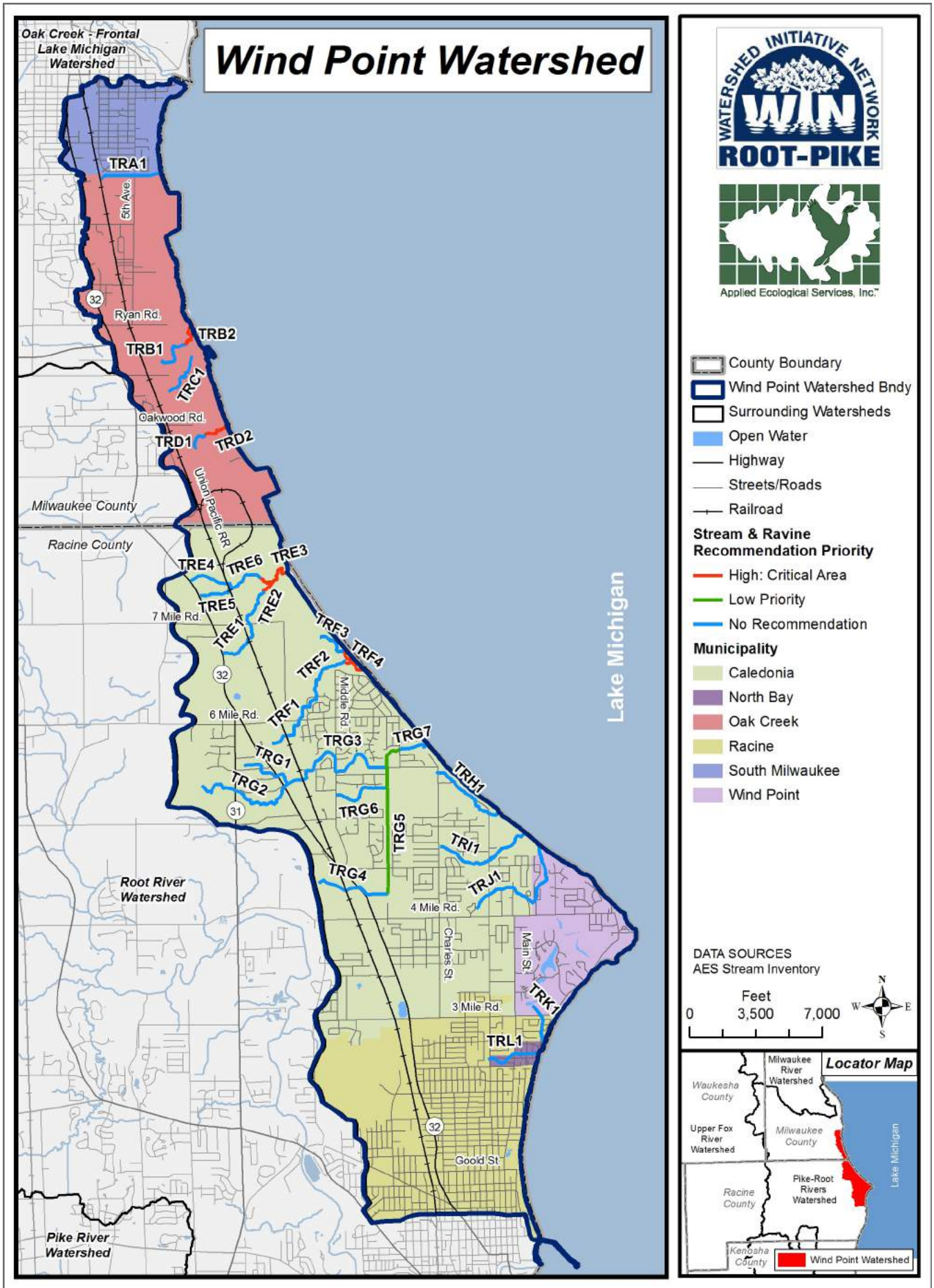


Fig. 70: Streambank, Ravine, & Channel Restoration Recommendations

6.2.4 Riparian Area Restoration & Maintenance Recommendations

Applied Ecological Services, Inc. (AES) completed a general inventory of the riparian areas along all 12 primary tributary reaches in fall of 2012. Riparian areas were assessed by noting the "Condition" as it relates to function and quality of ecological communities present. Field notes also included potential recommendations such as ecological restoration and maintenance. The results of the inventory are summarized in Section 3.14.1; detailed field investigation datasheets can be found in Appendix B.

According to AES's inventory, approximately 22% of the riparian areas are in "Good" ecological condition, 33% are in "Average" ecological condition, and 45% are in "Poor" condition. Riparian areas in poor condition are generally the result of past or present farming and development. Degradation comes in the form of invasive species, narrow buffers, and are comprised of turf grass within residential and commercial areas.

Riparian area restoration and/or maintenance projects generally focus on converting degraded ecological communities into higher quality communities that function to store and filter stormwater while also providing excellent wildlife habitat and green infrastructure corridors. The restoration process usually includes removal of invasive trees, shrubs, and herbaceous vegetation such as turf grass followed by planting with native vegetation. Short and long term maintenance then follows and is critically important in the development process and to maintain restored conditions.

Figure 71 shows the location of all recommended riparian area restoration and maintenance projects by ID# and priority while Table 41 lists project details related to each recommendation within the appropriate jurisdictional boundary. Large scale projects located on public land are generally assigned as higher priority for implementation whereas smaller privately owned areas are Medium and Low priority. It should be noted that implementation costs listed in Table 41 are estimates only. Actual costs will need to be developed via a conceptual plan prior to applying for grants and installing the project.

Potential riparian area restoration site along Tributary G Reach 5

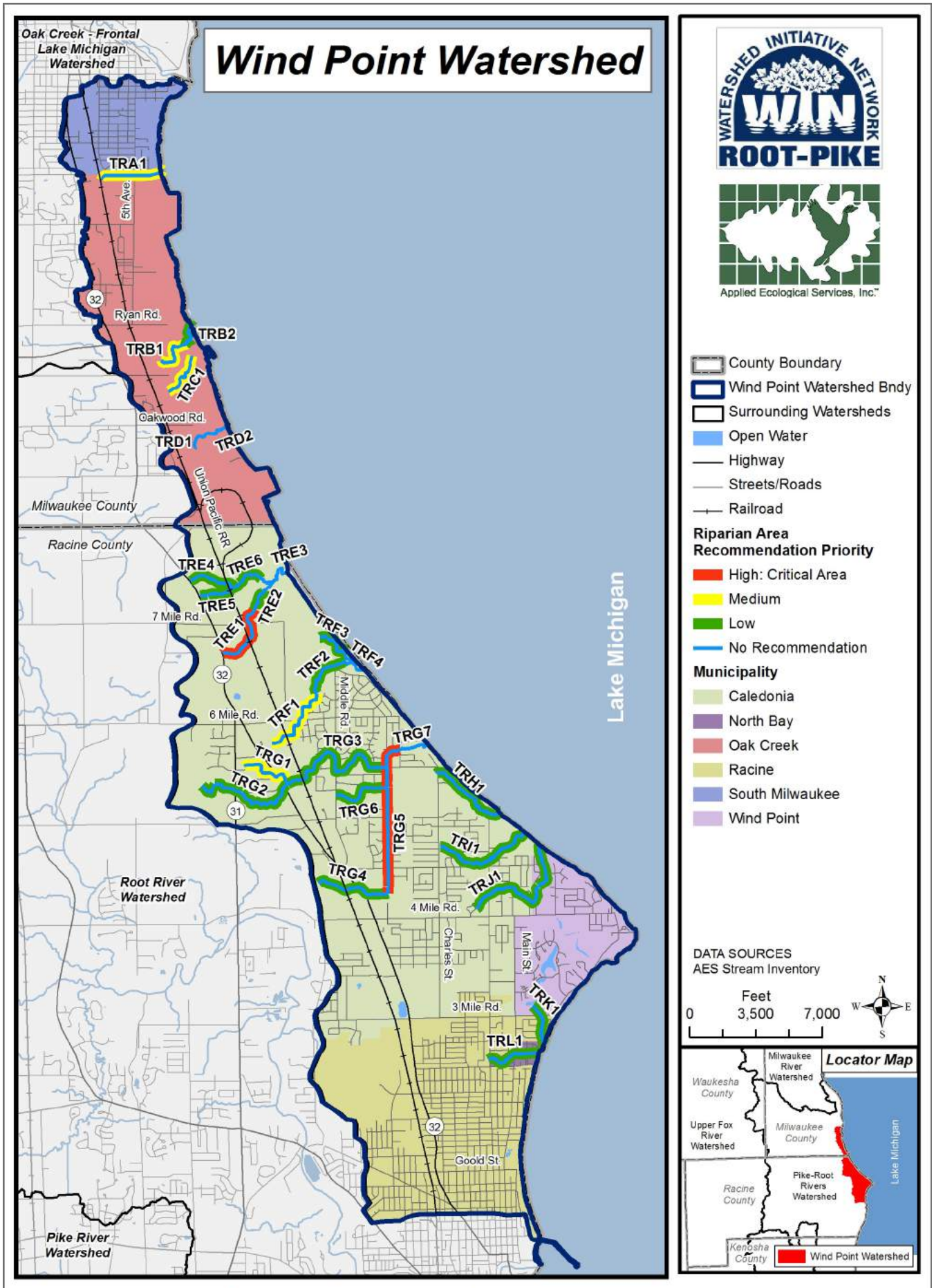


Fig. 71: Riparian Area Restoration & Maintenance Recommendations

6.2.5 Green Infrastructure Protection Area Recommendations

For this watershed plan, Green Infrastructure Protection Areas are best described as large, unprotected open parcels of land identified in Section 3.11 as part of the Wind Point green infrastructure network and that are currently undeveloped and where future development is planned. The significance is that these parcels are situated in environmentally sensitive or important green infrastructure areas where protecting and restoring or developing using "Conservation Design" or "Low Impact" design standards would best benefit watershed health. In total, 11 Green Infrastructure Protection Areas totaling 1,403 acres were identified.

Most of the Green Infrastructure Protection Areas are situated along tributary corridors and currently consist primarily of agricultural or vacant land. One of the sites (GI1) is a USEPA Superfund Site. Many of these areas also harbor SEWRPC Environmental Corridors or are located adjacent to existing parks such as Bender Park and Cliffside Park.

Figure 72 shows the location of all 11 Green Infrastructure Protection Areas by site ID# while Table 41 includes action recommendations for each. All 11 sites are considered High Priority-Critical Areas. Cost estimates and schedules for implementing recommendations for these areas is not included due to the difficulty in determining how or if each site will be protected or developed. In addition, pollutant reduction estimates cannot be determined for these areas.

Green Infrastructure Protection Areas GI4 (top right) adjacent to Bender Park & GI1 (below) USEPA Superfund Site

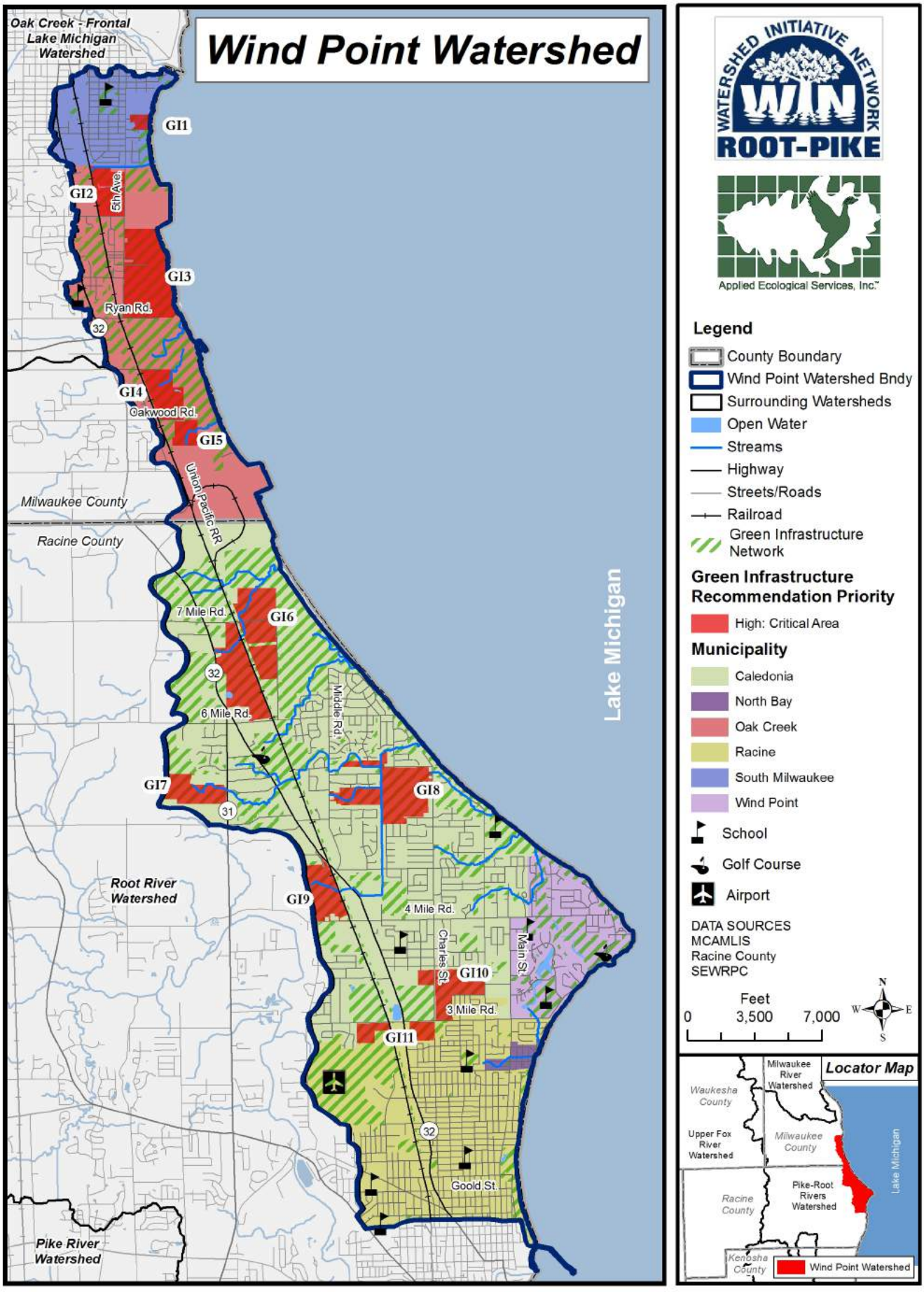


Fig. 72: Green Infrastructure Protection Area Recommendations

6.2.6 Agricultural Management Practice Recommendations

Row crop farming operations remain a significant land use in Wind Point watershed despite recent urban growth. By 2012, cropland accounted for approximately 1,111 acres or about 9% of the watershed. Most exiting cropland is located in the central and western portions of the watershed. In addition, many agricultural areas are slated for future residential and commercial development.

Agricultural land can be a significant contributor of nutrients and sediment to local streams when practices such as filter strips, grass swales, and "Conservation Tillage" (no till) farming are not in place.

Observations made during Applied Ecological Service's, field inventory in fall 2012 indicate that some practices such as grassed swales are in place but that conservation tillage and filter strips are not common practices. Pollutant load modeling estimates show that agricultural land in Wind Point watershed contributes most to nitrogen pollution (32%; 9,603 lbs/yr) and third highest phosphorus loading (16%; 2,523 lbs/yr). Agricultural land also is the second highest contributor of sediment loading at 14.5% or 1,386 tons/yr. These pollutant load contributions are significant, and according to pollutant reduction modeling, the use of conservation tillage on select larger fields could potentially reduce phosphorus loading by 2,422 lbs/yr, nitrogen loading by 4,517 lbs/yr, and sediment loading by 1,627 tons/yr.

Seven row crop agricultural areas totaling 975 acres were identified as High Priority-Critical Areas for potential nutrient and sediment reduction based on their size and/or location in the watershed. If agricultural management practices are used in these areas pollutant loading could be reduced. Practices recommended include conservation tillage and filter strips for row crop land. Figure 73 shows the location of all seven sites by ID# while Table 41 includes action recommendations for each. Note: cost estimates for implementing conservation tillage are not included because the costs are largely dependent on a farmer's available equipment and other factors.

Example of conservation tillage (no till) farming

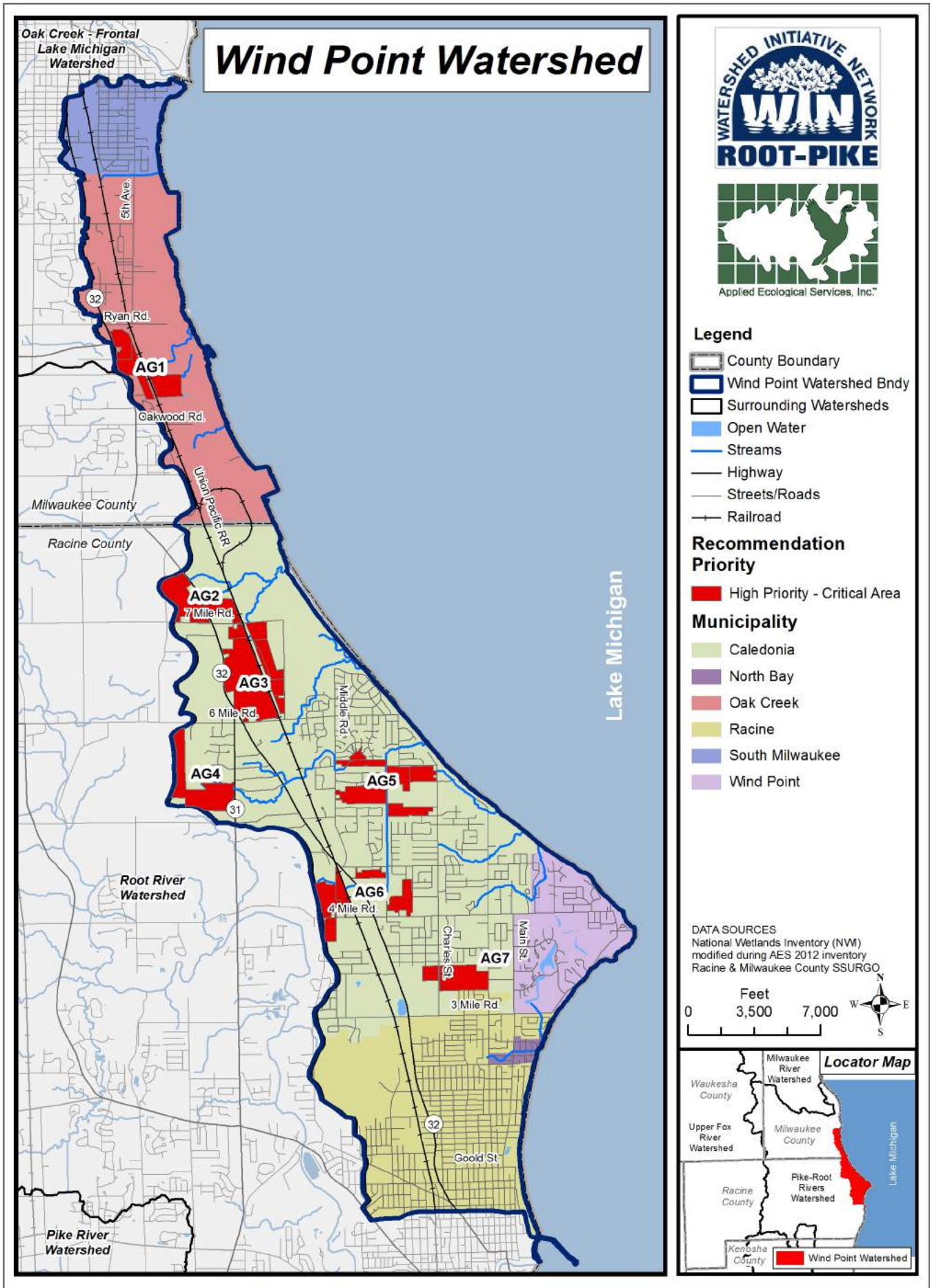


Fig. 73: Agricultural Land Management Recommendations

6.2.7 Other Management Measure Recommendations

While completing the inventory of Wind Point watershed, Applied Ecological Services, Inc. (AES) noted potential Management Measures that fit under miscellaneous other categories. Detailed field investigation datasheets for these projects can be found in Appendix B. Figure 74 shows the location of all "Other Management Measure" recommendations by ID# while Table 41 lists details about each recommendation within the appropriate jurisdictional boundary. Potential projects include:

1. Dump site cleanup at corner of Lake Shore Dr. & Menomonee Ave.
2. Approximately 4,500 linear feet of severe bluff erosion along Lake Michigan from Fitzsimmons Rd. south the Elm Rd.
3. Bioswale BMP between 6 Mile Rd. and Tributary G.
4. Bioswale BMP at Crestview Park.
5. Bioswale BMP between 4 ½ Mile Rd. and Tributary G.
6. Detention basin need within Ravine Bay Estates Subdivision.
7. Naturalization of rough areas as Shoop Park Golf Course.
8. Rain garden opportunity at St. Rita School.
9. Bioswale BMP in Sundance Subdivision/Batten Airport.
10. Naturalization of turf grass areas at Batten Airport.
11. Rain garden opportunity at Douglas Park parking lot.
12. Bioswale BMP at Second Presbyterian Church.
13. Rain garden opportunity at Trinity Lutheran Church
14. Rain garden opportunity at Roosevelt Elementary School.
15. Park/ stormwater retrofit at Racine Municipal Parking Area.
16. Rain garden opportunity at St. Johns Church.

Images: Bluff erosion (top left), rain garden opportunity at Trinity Lutheran Church (top right), parking lot retrofit Opportunity in Racine (bottom left), and rain garden opportunity at Roosevelt elementary school (bottom right).

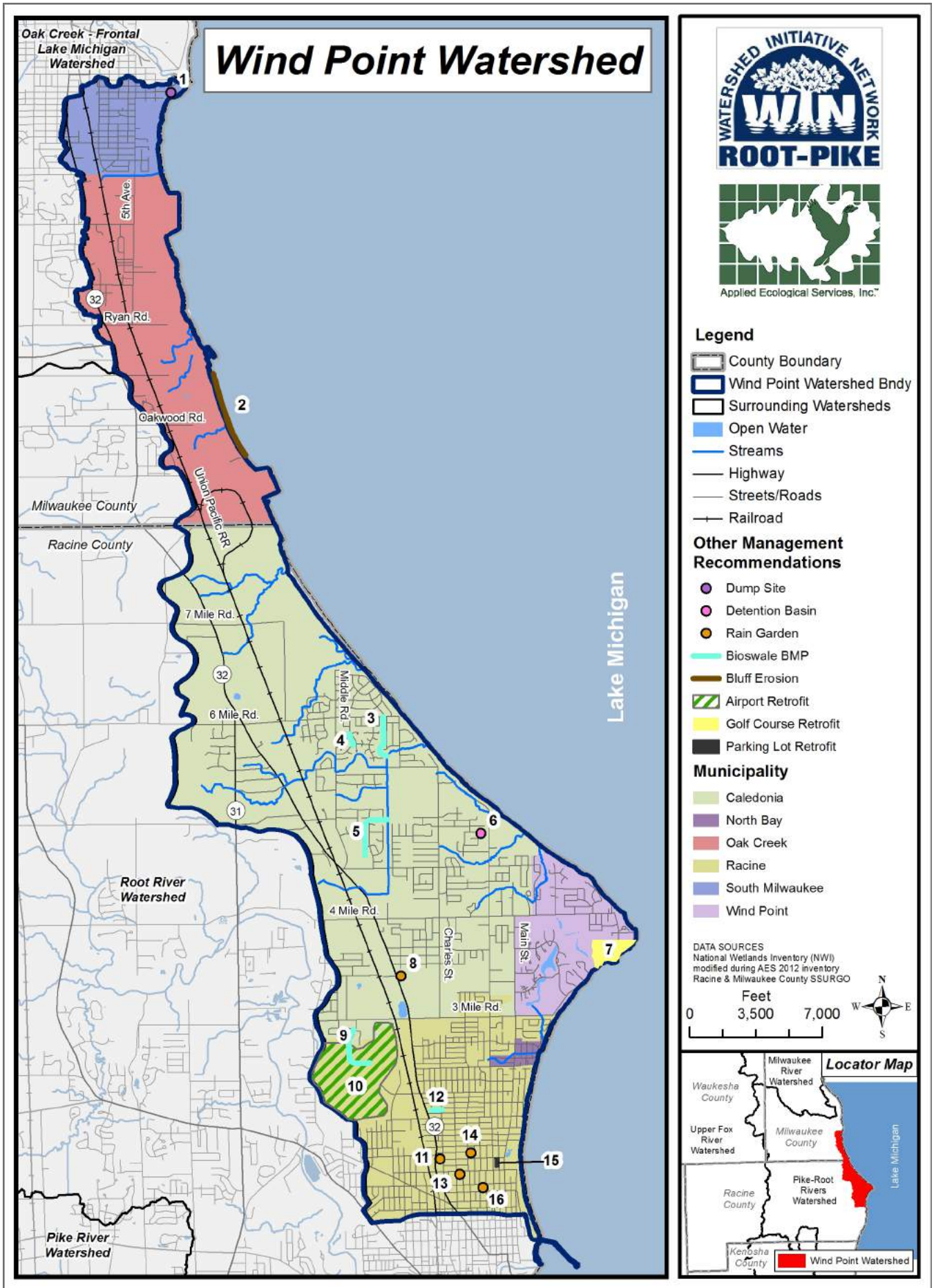


Fig. 74: Other Management Measures