5.0 Causes/Sources of Impairment & Reduction Targets

5.1 Causes & Sources of Impairment

According to WDNR's 2012 Water Quality Report and Section 303d List (WDNR, 2012), none of the tributary streams in Wind Point watershed are listed as impaired for any of their "Designated Uses" because they have not been assessed by WDNR. However, the findings of this report combined with water quality sampling results suggest moderate impairment of the tributary streams caused by channelization, streambank erosion, draining of wetlands, and high nutrient and *E. coli* in agricultural and urban stormwater runoff.

Wind Point watershed also has six beaches: North Beach, Zoo Beach, Shoop Park Beach, Parkway Beach, Wind Point Beach, and Bender Park Beach. Many beaches along Lake Michigan are routinely monitored for *E. coli* according to federal criteria set for open waters of the Great Lakes. None of the beaches sampled along Wind Point watershed are listed as impaired. However, recent sampling by the Racine Health Department in 2013 of the beaches along Wind Point watershed found *E. coli* levels that were nearly double the standard.

Causes and sources of water quality impairment are typically derived from WDNR's 303(d) impaired waters information. However,

WDNR does not list any of the water bodies in Wind Point watershed as impaired. Hence, impairment information was obtained via the watershed characteristics inventory, water quality monitoring, and input from watershed stakeholders during Phase I and Phase II meetings with specific comments originating from the "Wind Point Watershed Environmental Issues Identification Survey" conducted by UW Extension (Appendix G). It is also important to note that there are also non-water quality related impairments in the watershed such as habitat degradation, loss of open space, hydrologic and flow changes, and reduced groundwater infiltration. Many different causes and sources are related to these impairments. Table 32 summarizes all *known* or *potential* causes and sources of watershed impairments.

Table 32. *Known* and *potential* causes and sources of watershed impairment.

Impairment	Cause of Impairment	Known or Potential Source of Impairment
Wind Point Watershed Tributaries & Outfalls		
Water Quality/Fish & Aquatic Life	Nutrients- *known impairment*: (Phosphorus)	Streambank & ravine erosion Agricultural row crop runoff Residential, Ag, and commercial lawn fertilizer Failing septic systems Livestock & horse farm operations (manure) Pet waste Wastewater Treatment Plants
Water Quality/Fish & Aquatic Life	Sediment- *known impairment* (Total Suspended Solids/ turbidity)	Streambank & ravine erosion and headcutting Construction site runoff Urban runoff (roads, parking lots, building, homes, etc.) Agricultural row crop runoff Discharges from municipal storm sewer systems (MS4)
Water Quality: Contact	Bacteria - *known impairment (E.coli)*	Waterfowl/animal waste Urban stormwater runoff Septic system failures Illicit sewage discharges
Water Quality/Fish & Aquatic Life	Nutrients- *potential impairment:* (Nitrogen)	Streambank & ravine erosion Agricultural row crop runoff Residential, Ag, and commercial lawn fertilizer Failing septic systems Livestock & horse farm operations (manure) Pet waste
Water Quality/Fish & Aquatic Life	Chlorides (salinity)- *potential impairment*	Deicing operations on roads & other pavement;
Water Quality/Fish & Aquatic Life	Low dissolved oxygen- *potential impairment*	Heated stormwater runoff from urban areas Lack of natural riffles in tributaries
Water Quality: Contact	Petroleum hydrocarbons (oil & grease)- *potential impairment*	Railway derailments; Trucking cargo spills along major roads; General gas station, urban, and highway runoff; Illicit dumping Industry
Habitat Degradation	Invasive/non-native plant species in riparian and other natural areas- *known impairment* Recreational or Social Use Constraints- *Known impairment*	Spread from existing and introduced populations Off road vehicles Hiking off designated trails Dogs of leash Loss of wildlife habitat

Impairment	Cause of Impairment	Known or Potential Source of Impairment
Habitat Degradation	Loss and fragmentation of open space/natural habitat due to development & groundwater changes- *known impairment*	Inadequate protection policy Traditional development design Streambank, channel, and riparian area modification Lack of needed natural land management Lack of restoration and maintenance funds Wetland loss
Hydrologic and Flow Changes	Impervious surfaces- *known impairment*	Existing & future urban runoff Wetland loss Agricultural drain tiles
Aquifer Drawdown	Reduced infiltration & human use- *known impairment*	Groundwater wells Traditional development design Existing and future urban impervious surfaces Inadequate protection policy Wetland loss
Wind Point Watershed Beaches		
Recreational Restrictions	*E. coli* *Known impairment*	Waterfowl/animal waste Urban stormwater runoff Wastewater treatment plants Septic system failures Illicit sewage discharges

5.2 Critical Areas, Management Measures & Estimated Impairment Reductions

For this watershed plan a "Critical Area" is best described as a location in the watershed where existing of potential future causes and sources of an impairment or existing function are significantly worse than other areas of the watershed. Seven Critical Area types were identified in Wind Point watershed and include: 1) poorly designed/functional detention basins; 2) large drained wetland complexes; 3) highly degraded stream and/or ravine reaches; 4) highly degraded riparian areas; 5) green infrastructure protection areas; 6) large row crop agricultural areas; 7) other potential sites not fitting the categories above. Short descriptions of each Critical Area type are included below. Table 33 includes summaries of the current condition at each Critical Area (by type) and recommended Management Measures with estimated nutrient and sediment load reductions expected. The list of Critical Areas is derived from a comprehensive list of measures found in the Action Plan section of this report. Figure 56 maps the location of each Critical Area.

Pollutant load reduction is evaluated for the majority of the Critical Area Management Measures 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 nutrient and sediment load reductions from the implementation of *agricultural* Management Measures. Estimate of nutrient and sediment load reduction from implementation of *urban* Management Measures is based on efficiency calculations developed by the EPA. EPA pollutant load reduction worksheets for each Critical Area Management Measure are located in Appendix E.

Critical Detention Basins

Critical detention basins are generally defined as existing basins that do not provide adequate ecological and water quality benefits in areas where these attributes are needed. By retrofitting these basins with native vegetation and other measures, stormwater can be improved while at the same time improving wildlife habitat and extending or creating green infrastructure. There are 8 critical detention basin retrofit opportunities. A summary covering specifics about detention basins in the watershed is included in Section 3.14.2.

Critical Wetland Restoration Sites

Critical wetlands restoration sites are generally associated with areas that where historically wetland prior to European settlement in the 1830s but were drained for agricultural or residential purposes. Many of these historic wetlands can be restored by breaking existing drain tiles and planting with native vegetation. Wetland restorations are among the most recommended projects to improve water quality, reduce flooding, and improve wildlife habitat. Critical Area status was assigned based on location, size, and restoration potential. There are 9 critical wetland restoration areas totaling 270 acres. A detailed summary of the extent of drained wetlands and potential wetland restoration opportunities in the watershed is included in Section 3.14.3.

Critical Stream and Ravine Reaches
Critical stream and ravine reaches are those with highly eroded banks and/or highly degraded channel conditions that are a major source of total suspended solids (sediment) carrying attached phosphorus and nitrogen. Bank stabilization using bioengineering and installation of artificial riffles in Critical Area areas will greatly reduce sediment and nutrient transport downstream while improving habitat and increasing oxygen levels. Four stream and/or ravine reaches (Trib B Reach 2, Trib D Reach 2, Trib E Reach 3, and Trib F Reach 4 totaling 8,685 linear feet were identified as Critical Areas. Section 3.14.1 includes a complete summary of streams and ravines in the watershed.

Critical Riparian Areas
Critical riparian areas are select locations adjacent to tributary reaches that are in poor ecological condition or areas lacking a buffer but with excellent ecological restoration and remediation potential to improve water quality and habitat conditions. Two riparian areas along Trib E Reach 1 and Trib G Reach 5 totaling 14,541 linear feet are considered Critical Areas. Section 3.14.1 includes a full summary of the riparian areas in the watershed.

Critical Green Infrastructure Protection Areas
Information obtained from predicted future land use data and green infrastructure sections of this plan led to identification of 11 critical green infrastructure protection areas totaling 1,403 acres. The significance is that these areas 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.

Critical Agricultural Land
It is well documented that agricultural land is a significant contributor of nutrients and sediment in watersheds. According to modeling, agricultural areas contribute 32% of the nitrogen loading, 16% of the phosphorus load, and 14.5% of the sediment load in the watershed. There are currently about 1,111 acres of crop land or 9% of Wind Point watershed. Seven agricultural areas totaling 975 acres were identified as Critical Areas based on their size and/or location in the watershed. Critical agricultural lands are those for which application of agricultural measures would reduce pollutant loading. Practices explored in this plan include conservation tillage (no till) for crop land.

Other Management Measure Sites
One site, that does not fit into the management measure categories above, is considered a Critical Areas. There is significant bluff erosion along 4,500 linear feet of the Lake Michigan coast from Fitzsimmons Rd. (within Bender Park) south to Elm Rd. (We Energies owned land). However, it remains unknown at this time how much of this erosion is natural versus accelerated erosion due to human influences. Therefore, it is recommended that a feasibility study be conducted to determine the need for and cost of stabilizing the eroded bluff using approaches similar to the bluff stabilization used on the north portion of the bluff at Bender Park.

Table 33. Critical Areas, existing conditions, Management Measures, & estimated nutrient, sediment, and bacteria load reductions.

Critical Area	Existing Condition/Description	Recommended Critical Area Management Measure	Nutrient & Sediment Load Reduction
Detention Basins			
4B	Series of existing linear dry bottom detention features with mown turf grass slopes and concrete channels on MMSD South Shore WWTP property.	Design and implement project to retrofit existing detention features to create linear bioinfiltration swales planted with native vegetation. Project would enhance and expand on existing green infrastructure to along Lake Michigan.	TSS = 423 tons/yr TN = 336 lbs/yr TP = 42 lbs/yr Bacteria = 78%
20D	Existing wetland bottom detention basin servicing Baywood Estates Subdivision. Basin is dominated by invasive species and a 400 lf low flow concrete channel with turf grass slopes enters the basin from the south.	Design and implement project to alter low flow concrete channel and plant side slopes with native vegetation. Replant detention area with native wetland vegetation.	TSS =6.5 tons/yr TN =33 lbs/yr TP =10 lbs/yr Bacteria = 78%
21A	Existing dry bottom basin with mown turf grass servicing adjacent subdivision. Basin is located adjacent to Tributary G Reach 3.	Design and implement project to naturalize detention basin by replacing turf grass with native vegetation to improve water quality, wildlife habitat, and green infrastructure connection.	TSS = 5 tons/yr TN = 52 lbs/yr TP = 6 lbs/yr Bacteria = 88%
21A	Existing dry bottom basin with mown turf grass servicing adjacent subdivision. Basin is located at headwaters of Tributary G Reach 6.	Design and implement project to naturalize detention basin by replacing turf grass with native vegetation to improve water quality, wildlife habitat, and green infrastructure connection.	TSS = 5 tons/yr TN = 52 lbs/yr TP = 6 lbs/yr Bacteria = 88%
31A	Large dry bottom regional detention basin servicing over 500 acres of surrounding development. Basin consists of low flow concrete channels and mown turf grass. Basin is also located at headwaters of Tributary J.	Design, permit, and install project to retrofit exiting detention basin by altering low flow channels and creating wetland and prairie storage areas that would provide water quality benefits, wildlife habitat and, green infrastructure.	TSS=136 tons/yr TN=996 lbs/yr TP=260 lbs/yr Bacteria=78%
37C	Large excavated pond used as detention for Prairie School and other surrounding development. Pond buffer is prairie north of Prairie School and generally weedy old field vegetation in other areas. Some moderate erosion is occurring around portions of the shoreline.	Design and implement project to alter outlet structure and concrete channel then naturalize entire pond shoreline and emergent zone to create wetland detention for water quality, wildlife, and green infrastructure benefits.	TSS=55 tons/yr TN=328 lbs/yr TP=87 lbs/yr Bacteria=78%
39B	Existing dry bottom detention basin within Vidian Chelsak Park along the south side of 3 Mile Rd. Vegetation in the basin consists of mown turf grass.	Design and implement project to replace turf grass and revegetate with native vegetation to improve water quality, wildlife, and green infrastructure benefits while reducing long term maintenance costs. Project would also be good demonstration for public.	TSS = 22 tons/yr TN = 148 lbs/yr TP = 32 lbs/yr Bacteria = 88%
43A	Existing regional storage area that has been naturalized in part with native prairie and wetland vegetation. Several invasive species are common on the site.	Implement a monitoring and management program to keep invasive species under control and to ensure the storage area performs as designed.	TSS=280 tons/yr TN=1,800 lbs/yr TP=456 lbs/yr Bacteria=78%

Critical Area	Existing Condition/Description	Recommended Critical Area Management Measure	Nutrient & Sediment Load Reduction
Wetland Restoration Sites			
W9	3 acre turf grass swale in Shoop Park Golf Course that drains adjacent course areas and residential area no north south to wetland swale complex that flows east to Lake Michigan.	Restore wetland swale within golf course. A restored wetland would help filter pollutants, provide wildlife habitat, green infrastructure, and be a good demonstration project for the public to see.	TSS=7 tons/yr TN=36 lbs/yr TP=12 lbs/yr Bacteria=78%
W10	Approximately 7 acres of shallow ponds created via earthen dams along a historic wetland swale on land owned by the Johnson Foundation.	Remove earthen dams and restore wetland hydrology and native wetland plants to benefit water quality, wildlife habitat, and other green infrastructure benefits.	TSS=20 tons/yr TN=127 lbs/yr TP=39 lbs/yr Bacteria=78%
W14	9 acres of drained wetlands along the south side of Tributary I on private agricultural land that is slated for future residential development.	Incorporate wetland restoration in future conservation or low impact residential development plans by using most feasible areas as wetland detention and/or mitigation	TSS=2.5 tons/yr TN=24 lbs/yr TP=7 lbs/yr Bacteria=78%
W15	30 acres of drained wetlands adjacent to Crawford Park on private agricultural land that is slated for future residential development.	Incorporate wetland restoration in future conservation or low impact residential development plans by using most feasible areas as wetland detention and/or mitigation	TSS=8 tons/yr TN=49 lbs/yr TP=15 lbs/yr Bacteria=78%
W16	12 acres of drained wetlands on 20+ acre agricultural parcel that is adjacent to Tributary G. Parcel is slated for future residential development.	Incorporate wetland restoration in future conservation or low impact residential development plans by using most feasible areas as wetland detention and/or mitigation	TSS=4 tons/yr TN=27 lbs/yr TP=8 lbs/yr Bacteria=78%
W19	Primary agricultural land along Tributary G and abutting uncompleted Audubon Arboretum residential subdivision. Land is slated for future residential development.	Incorporate wetland restoration along Tributary G into future conservation development plans where feasible. Restored wetlands can be used as detention and/or wetland mitigation.	TSS=25 tons/yr TN=24 lbs/yr TP=37 lbs/yr Bacteria=78%
W20	Primary agricultural land along Tributary G on east end of parcel. Land is slated for future residential development. Area is also adjacent to SEWRPC Environmental Corridor.	Incorporate wetland restoration along Tributary G into future conservation development plans where feasible. Restored wetlands can be used as detention and/or wetland mitigation.	TSS=10 tons/yr TN=64 lbs/yr TP=24 lbs/yr Bacteria=78%
W21	16.5 acres of drained wetlands along Tributary G Reach 3. Land is currently agricultural and slated for future residential development. Area is also adjacent to SEWRPC Environmental Corridor.	Incorporate wetland restoration in future conservation or low impact residential development plans by using drained wetlands along Tributary G as wetland/ floodplain detention and/or mitigation.	TSS=7 tons/yr TN=43 lbs/yr TP=13 lbs/yr Bacteria=78%
W22	46.5 acres of drained wetland within Cliffside Park abutting Tributary F. The majority of the existing vegetation here is comprised of old field species.	Investigate possibility to restore hydrology and native vegetation as part of a potential wetland mitigation bank.	TSS=3 tons/yr TN=10 lbs/yr TP=7 lbs/yr Bacteria=78%

Critical Area	Existing Condition/Description	Recommended Critical Area Management Measure	Nutrient & Sediment Load Reduction
Stream & Ravine Stabilization			
Tributary B Reach 2 (TRB2)	1,497 lf of stream within Bender Park that is naturally meandering but with moderately to highly eroded streambanks resulting from a headcut. Reach is bordered immediately by young mesic woodland.	Design, permit, and implement project to stabilize headcut and selectively stabilize highly eroded areas using bioengineering techniques. In addition, install up to five artificial riffles/grade controls within the stream channel.	TSS = 69 tons/yr TN = 137 lbs/yr TP = 69 lbs/yr Bacteria = n/a
Tributary D Reach 2 (TRD2)	1,537 lf of tributary (to Lake Michigan) on land owned by We Energies. Upper portion of reach is naturally meandering but exhibits highly eroded streambanks. About 500 lf along the downstream portion of the reach is a deep ravine with severe erosion prior to joining Lake Michigan.	Design, permit, and implement project to stabilize highly eroded stream and ravine slopes using a combination of bioengineering and hard armoring approaches. Grade controls will also be needed within the channel to control flow velocities.	TSS=1,753 t/yr TN =3,506 lbs/yr TP =1,753 lbs/yr Bacteria = n/a
Tributary E Reach 3 (TRE3)	3.201 lf of tributary/ravine (to Lake Michigan) on land owned by We Energies (Rifle Range Ravine). A headcut is located at upper portions of reach followed by a deeply incised ravine exhibiting severely eroded slopes.	Design, permit, and implement project to stabilize headcut and highly eroded ravine slopes using a combination of bioengineering and hard armoring approaches. Grade controls will also be needed within the channel to control flow velocities.	TSS=5,510 tons/yr TN=11,019 lbs/yr TP =5,510 lbs/yr Bacteria = n/a
Tributary F Reach 4 (TRF4)	2,450 lf of tributary/ravine (to Lake Michigan) on land owned by Racine County (Cliffside Park Ravine). Two headcuts are located at upper portions of reach where it meets Reaches 2 & 3. This is followed by a moderately incised ravine exhibiting highly eroded slopes.	Design, permit, and implement project to stabilize headcuts and highly eroded ravine slopes using a combination of bioengineering and hard armoring approaches. Grade controls will also be needed within the channel to control flow velocities.	TSS=906 tons/yr TN=1,812 lbs/yr TP =906 lbs/yr Bacteria = n/a
Riparian Areas			
Tributary E Reach 1 (TRE1)	3,468 lf of tributary with a narrow degraded riparian buffer of invasive shrubs and trees in most agricultural areas.	Achieve SEWRPC recommended Goals of 75 whereby 75% minimum of the total stream length should be naturally vegetated and 75 foot wide minimum riparian buffer established.	TSS =5.5 tons/yr TN = 103 lbs/yr TP = 11 lbs/yr Bacteria = 37%
Tributary G Reach 5 (TRG5)	8,073 lf of tributary between Crawford Park and Novak Rd. within a human created drainage ditch with concrete low flow channel. Side slopes are mown turf grass.	Design and implement project to restore native prairie and wetland vegetation along buffer areas to create green infrastructure connection benefits. A bike or walking trail could also be constructed.	TSS =75 tons/yr TN = 984 lbs/yr TP = 154 lbs/yr Bacteria = 37%

Critical Area	Existing Condition/Description	Recommended Critical Area Management Measure	Nutrient & Sediment Load Reduction
Green Infrastructure Protection Areas			
GI1	18 acres on public land that is currently a USEPA Superfund Site along the Lake Michigan coast. This parcel is slated for future residential development.	Incorporate Conservation Design or Low Impact design standards into future development plans to preserve green infrastructure benefits along Lake Michigan.	Pollutant reduction cannot be assessed via modeling
GI2	90 acres on private parcels at headwaters of Tributary A & also including SEWRPC Environmental Corridors. Parcels are slated to become residential development in the future.	Incorporate Conservation or Low Impact design standards into future development plans.	Pollutant reduction cannot be assessed via modeling
GI3	250 acres of mostly vacant brownfields within Oak Creek know as the Lakefront Redevelopment Area. In 2011 the City produced and adopted a redevelopment plan for the site that includes redevelopment incorporating green infrastructure.	Implement development concepts outlined in the City Redevelopment Plan and stabilize shoreline to prevent bluff erosion.	Pollutant reduction cannot be assessed via modeling
GI4	95 acres of private agricultural and vacant land adjacent to Bender Park and slated for future residential development.	Milwaukee County Department of Parks consider purchasing and restoring parcels to increase open space/green infrastructure adjacent to Bender Park.	Pollutant reduction cannot be assessed via modeling
GI5	36 acres of land currently owned by We Energies but slated for future residential/mixed use development. Parcels also include SEWRPC Environmental Corridors.	Incorporate Conservation or Low Impact design standards into future development plans.	Pollutant reduction cannot be assessed via modeling
GI6	334 acres on private agricultural and vacant parcels along surrounding Tributary E Reach 1 and abutting Cliffside Park to the southeast. Parcels are slated for future residential development and also contain SEWRPC Environmental Corridors.	Incorporate Conservation or Low Impact design standards into future development plans.	Pollutant reduction cannot be assessed via modeling
GI7	85 acres on private agricultural land and woodland at headwaters of Tributary G Reach 2. SEWRPC Environmental Corridors are also included on these parcels. Parcels are slated for future residential development.	Incorporate Conservation or Low Impact design standards into future development plans.	Pollutant reduction cannot be assessed via modeling
GI8	228 acres of land on parcels that are primarily agricultural and slated for future residential development along Tributary G Reaches 5 & 6. The unfinished “Arboretum” subdivision and SEWRPC Environmental Corridors are also located within this area.	Incorporate Conservation or Low Impact design standards into future development plans.	Pollutant reduction cannot be assessed via modeling

Critical Area	Existing Condition/Description	Recommended Critical Area Management Measure	Nutrient & Sediment Load Reduction
GI9	96 acres of land on parcels that are primarily agricultural and slated for future residential development and cemetery expansion at headwaters of Tributary G Reach 4.	Incorporate Conservation or Low Impact standards into future residential development plans and incorporate stormwater best management practices into cemetery expansion where feasible.	Pollutant reduction cannot be assessed via modeling
GI10	115 acres of land owned by Vulcan that is mostly agricultural and slated for future residential development.	Incorporate Conservation or Low Impact design standards into future residential development plans.	Pollutant reduction cannot be assessed via modeling
GI11	56 acres of land owned by Vulcan that is mostly vacant and slated for future residential development.	Incorporate Conservation or Low Impact design standards into future residential development plans.	Pollutant reduction cannot be assessed via modeling
Agricultural Land			
AG1	109 acres of agricultural land in row crop production	Implement conservation tillage (no till) with filter strips	TN= 507 lbs/yr TP= 272 lbs/yr TSS= 177 tons/yr
AG2	115 acres of agricultural land in row crop production	Implement conservation tillage (no till) with filter strips	TN= 548 lbs/yr TP= 294 lbs/yr TSS= 192 tons/yr
AG3	259 acres of agricultural land in row crop production	Implement conservation tillage (no till) with filter strips	TN= 1,138 lbs/yr TP= 610 lbs/yr TSS= 391 tons/yr
AG4	113 acres of agricultural land in row crop production at headwaters of Tributary G	Implement conservation tillage (no till) with filter strips	TN= 539 lbs/yr TP= 289 lbs/yr TSS= 189 tons/yr
AG5	159 acres of agricultural land in row crop production	Implement conservation tillage (no till) with filter strips	TN= 734 lbs/yr TP= 393 lbs/yr TSS= 255 tons/yr
AG6	132 acres of agricultural land in row crop production at headwaters of Tributary G	Implement conservation tillage (no till) with filter strips	TN= 620 lbs/yr TP= 333 lbs/yr TSS= 217 tons/yr
AG7	88 acres of agricultural land in row crop production	Implement conservation tillage (no till) with filter strips	TN= 431 lbs/yr TP= 231 lbs/yr TSS= 152 tons/yr
Other Management Measure Sites			
B1	Approximately 4,500 linear feet of severe/accelerated bluff erosion along Lake Michigan on land owned by Milwaukee Co. Parks and We Energies	Develop a feasibility study to determine the need for and costs of stabilizing the eroded bluff using approaches similar to the bluff stabilization work that was completed at Bender Park	Pollutant reduction cannot be assessed via modeling

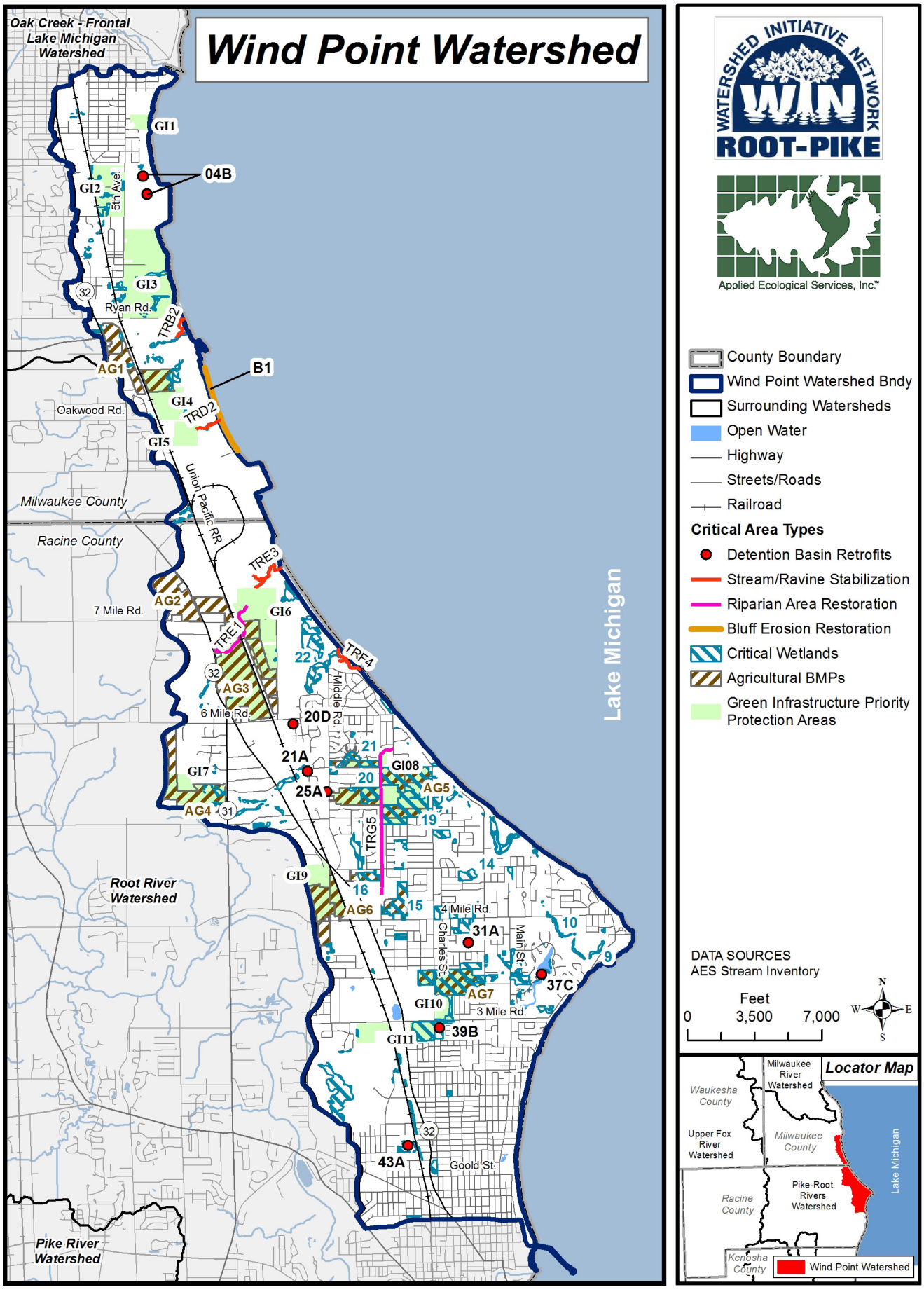

Fig. 56: Critical Areas

5.3 Watershed Impairment Reduction Targets

Establishing water quality "Impairment Reduction Targets" is important because these targets provide a means to measure how implementation of Management Measures at Critical Areas is expected to reduce watershed pollutants over time. Table 34 summarizes the basis for *known* pollution impairments and reduction targets. Reduction targets listed in Table 34 are based on documented information, modeling results, and/or water quality standards and criteria set by the Wisconsin DNR, USEPA (2000), and USGS (2006).

It is important to note that the assumption is made that percent decrease in sample concentration (mg/l) needed correlates to the percent reduction in annual load (lbs/yr or tons/yr) for phosphorus, nitrogen, and sediment reduction targets. In addition, Table 34 summarizing the load reduction of phosphorus, nitrogen, and total suspended solids (sediment) expected from addressing Critical Areas. *E. coli* is also included in Table 34 but pollutant reductions are not calculated because modeling is unable to predict *E. coli* removal efficiencies.

Watershed-Wide Reduction Targets for Phosphorus, Nitrogen, Suspended Solids & E. coli

Watershed-wide phosphorus and sediment reduction targets could be attained by addressing Critical Areas alone (Table 34). It is estimated that my implementing Critical Area projects, 11,886 lbs/yr of phosphorus (74%) and 10,910 tons/yr (100%) of sediment could be removed. Nitrogen levels already meet standards without having to install any Critical Area projects. However, it is estimated that 26,227 lbs/yr nitrogen or 88% of the total nitrogen load could be removed each year by implementing all Critical Area projects. It is now known if target *E. coli* levels can be attained because models to do predict removal efficiency.

Table 34. Basis for *known* impairments, reduction targets, & impairment reduction for pollutants from Critical Areas.

Impairment: Cause of Impairment	Basis for Impairment	Reduction Target	Reduction from Critical Area	Target Attainable?
Watershed-Wide Reduction Targets				
Phosphorus	16,058 lb/yr of phosphorus loading based on STEPL/ WinSLAMM models; 0.188 mg/l total phosphorus (weighted average) in water quality samples	**>60.1% or 9,605 lbs/yr reduction in phosphorus** loading to achieve 0.075 mg/l total phosphorus WDNR numeric criteria for streams in Wisconsin	899 lbs/yr or 5.6% reduction from critical detention basins	
			162 lbs/yr or 1.0% reduction from critical wetlands/swales	
			8,238 lbs/yr or 34.1% reduction from critical streams/ravines	
			165 tons/yr or 1% reduction from critical riparian areas	
			2,422 lbs/yr or 15.1% reduction from critical agricultural land	
			Unknown pollutant removal from critical GI protection areas	
TOTAL			**11,886 lbs/yr or 74% total phosphorus reduction from all Critical Areas**	Yes
Nitrogen*	29,807 lb/yr of total nitrogen loading based on STEPL/WinSLAMM models; 0.445 mg/l nitrogen (weighted average) in water quality samples	**0% or 0 lbs/yr reduction in nitrogen** loading needed to achieve 1.798 mg/l total nitrogen WDNR numeric criteria for streams in Wisconsin	3,745 lbs/yr or 12.6% reduction from critical detention basins	
			404 lbs/yr or 1.4% reduction from critical wetlands/swales	
			16,474 lbs/yr or 55.3% reduction from critical streams/ravines	
			1,087 tons/yr or 3.6% reduction from critical riparian areas	
			4,517 lbs/yr or 15.2% reduction from critical agricultural land	
			Unknown pollutant removal from critical GI protection areas	
TOTAL			**26,227 lbs/yr or 88% total nitrogen reduction from all Critical Areas**	Yes
Total suspended solids (sediment)	9,531 tons/yr of sediment loading based on STEPL/ WinSLAMM models; 85.8 mg/l total suspended solids (weighted average) in water quality samples	**>78% or 7,415 tons/yr reduction in sediment** loading to achieve 19 mg/l total suspended solids based on USGS numeric criteria in Great Lakes Region	932.5 lbs/yr or 9.8% reduction from critical detention basins	
			86.5 lbs/yr or 0.9% reduction from critical wetlands/swales	
			8,238 lbs/yr or 86.4% reduction from critical streams/ravines	
			80.5 tons/yr or 0.8% reduction from critical riparian areas	
			1,573 lbs/yr or 16.5% reduction from critical agricultural land	
			Unknown pollutant removal from critical GI protection areas	
TOTAL			**10,910 tons/yr or 100% sediment reduction from all Critical Areas**	Yes

Impairment: Cause of Impairment	Basis for Impairment	Reduction Target	Reduction from Critical Area	Target Attainable?
Bacteria *(E.coli)*	2,417 MPN/100ml *E.coli* (weighted average) in water quality samples	**>90.3% or 2,182 MPN/100ml reduction in E. coli** to achieve <235 MPN/100ml based on WDNR standard	Unknown reduction from critical detention basins	
			Unknown reduction from critical wetlands/swales	
			Unknown reduction from critical streams/ravines	
			Unknown reduction from critical riparian areas	
			Unknown reduction from critical agricultural land	
			Unknown pollutant removal from critical GI protection areas	
TOTAL			**Unknown sediment reduction from all Critical Areas**	Unknown

*Nitrogen levels in the watershed already meet WDNR numeric criteria without implementation of Critical Area projects