3.9 Existing & Future Land Use/ Land Cover

2012 Land Use/Land Cover

Highly accurate land use/ land cover data was produced for Wind Point watershed using several sources of data. First, the most recent land use/land cover data from Southeastern Wisconsin Regional Planning Commission (SEWRPC) was used as a base layer. Recent aerial photography of the watershed was also overlaid on SEWRPC land use data in GIS so that additional discrepancies could be corrected. Finally, several corrections were made to land use based on field notes taken by Applied Ecological Services, Inc. (AES) during the fall 2012 watershed resource inventory and suggestions made by stakeholders. 2012 land use/land cover data and map for Wind Point watershed is included in Table 9 and depicted on Figure 19.

Residential areas combined are the most abundant land use in the watershed. Medium density single family residential comprises 1,544.6 acres or 12.9% of the watershed followed by low density at about 1,182 acres/10%, high density at 673.6 acres/5.6%, and multifamily at 410.5 acres/3.4%. Most residential development is located in the northern portion of Racine, throughout Caledonia, and the southern portion of South Milwaukee. Residential development is also common along Lake Michigan in Wind Point and Caledonia.

Vacant land is the second most abundant land use/cover in the watershed at 1,649 acres or 13.8%. This land use includes private and public property that generally has not been developed for human purposes or land that was once developed but is no longer in use such as abandoned industrial areas. Large areas of vacant land can be found in parks and natural areas and unused turf areas surrounding features such as John H. Batten Airport and two wastewater treatment plants.

Transportation land uses such as railroads, streets, highways, and airport runways make up the third largest land use/cover in the watershed at about 1,631 acres or 13.5% of the watershed.

Agricultural land dominated the watershed from the late 1800s to the 1990s. Cropland is now the fourth largest land use with about 1,111.2 or 9.3% in production. Agricultural areas are spread out through portions of Caledonia with large crop fields remaining between 6 Mile Road and the County line.

Industrial is another important land use in the watershed at about 726 acres or 6% of the watershed. Most industrial use is associated with We Energies in the central portion of the watershed with other scattered industrial parcels in the northern portion of the watershed.

Table 9. 2012 land use/land cover classifications and acreage.

Land Use	Area (acres)	% of Watershed
Cemetery	32.6	0.3
Commercial/Retail	274.1	2.1
Cropland	1,111.2	9.3
Cultural/Recreational	582.6	4.9
Government/Institutional	326.8	2.7
Industrial	725.7	6.1
Landfill	43.7	0.4
Residential (Low Density ≥ 0.45 ac ≤1.43 ac)	1,181.7	9.9
Residential (Medium Density ≥ 0.16 ac ≤0.44 ac)	1,544.6	12.9
Residential (High Density ≤ 0.15 ac)	673.6	5.6
Residential-Multifamily	410.5	3.4
Residential-Under Development	116.9	1.0
Open Water	44.4	0.4
Other Agricultural	29.4	0.2
Pastureland	170.0	1.4
Quarry/Mining	163.0	1.4
Transportation	1,631.4	13.6
Utilities	366.5	3.1
Vacant Land	1,649	13.8
Wetlands*	356.3	3.0
Woodland	500	4.2
Total	11,945.0	100

**Wetland acreage is based off SEWRPC2000 land use mapping and not 2005 SEWRPC wetland inventory.*

Above: Typical high density residential area in S. Milwaukee

In addition, total open space land uses such as agricultural lands, vacant land, open water, wetlands, cultural, recreational, and woodlands make up 4,453.5 acres or 37.3% of the watershed. Many natural areas can be found in public parks including Bender Park, Cliffside Park, Tabor Woods, and other parcels owned by Caledonia Conservancy. Developed land uses account for the remaining 7,491.5 acres or 62.7% of the watershed.

We Energies

We Energies is the trade name of two utility subsidiaries of Wisconsin Energy Corporation. We Energies serves over 2.2 million customers including those in portions of Wisconsin, and Michigan's Upper Peninsula. The environment is important to We Energies as the corporation's mission includes a commitment to enhance the quality of life in the areas it serves.

We Energies' Oak Creek Power Plant is located almost entirely within Wind Point watershed and occupies more than 400 acres of land on the shore of Lake Michigan within the City of Oak Creek. The site contains two coal-based power plants that run four steam turbines that typically operate 24 hours a day. The byproduct of burning coal is fly ash which is transported to nearby landfills. In addition, Oak Creek Plant uses up to 1.5 million gallons of cooling water from Lake Michigan every day.

WE Energies Oak Creek Power Plant

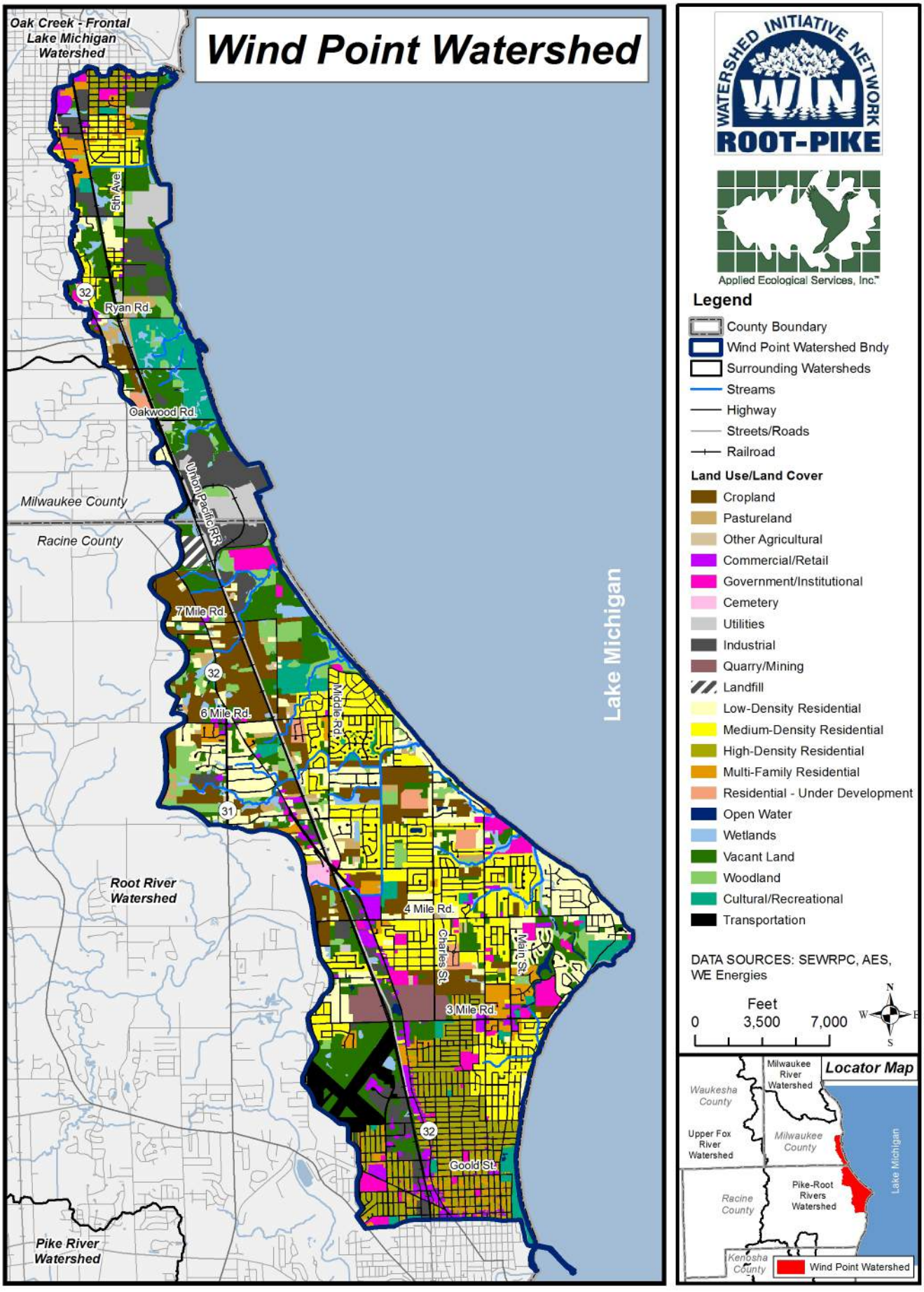


Fig. 19: Land Use/Land Cover

Land Use/Land Cover Definitions:

*Cropland, Other Agricultural, Pastureland: L*and use that includes out-buildings and barns, row & field crops and fallow field farms and pasture, includes dairy and other livestock agricultural processing. Also includes nurseries, greenhouses, orchards, tree farms, and sod farms.

Cemetery: Local and regional cemeteries of any size and related administration buildings, maintenance areas, and landscaped areas within the cemetery ownership.

Commercial/Retail: Land use that includes food and drug stores, eating and drinking places, general merchandise stores, legal, insurance, and real estate offices, doctors offices, personal services, business services, shopping malls and their associated parking, single structure office/hotels.

Cultural/Recreational: Land use that includes parks, playgrounds, athletic fields, museums, zoos, historic sites, amphitheaters, stadiums, race tracks, conference centers, fairgrounds, and amusement parks.

Government/Institutional: Land use that includes administration, safety, assembly, group quarters, medical facilities, educational facilities, government buildings, religious facilities, and others.

Industrial: Land use that includes manufacturing and processing, industrial, warehousing and wholesale trade, such as mineral extraction, associated parking areas, truck docks, etc.

Landfill: Those areas in which landfill operations and dumps and associated activities have taken place.

Residential-Low Density: Land use that includes single family homes and farmhouses and immediate residential area around them with lot sizes ≥ 0.45 ac ≤1.43 ac and impervious cover less than 20%.

Residential-Medium Density: Land use that includes single family homes and farmhouses and immediate residential area around them with lot sizes ≥ 0.16 ac ≤0.44 ac and impervious cover around 30%.

Residential-High Density: Land use that includes single family homes and farmhouses and immediate residential area around them with lot sizes ≤ 0.15 ac and impervious cover around 50%.

Residential-Multifamily: Land use that includes multifamily residences of more than one family per residence. These include duplex and townhouse units, apartment complexes, condominiums, and associated parking.

Residential – Under Development: Lands committed to residential use but not yet fully developed.

Open Water: Land cover that includes rivers, streams and canals, lakes, reservoirs, and lagoons.

Quarry/Mining: Place where dimension stone of aggregate (sand, gravel, crushed rock) is mined. Also includes all grounds associated with the mining operation.

Transportation: Land use that includes railroads, rail rapid transit and associated stations, rail yards, linear transportation such as streets and highways, and airport transportation.

Utilities: Land use that includes communication and utilities such as telephone, radio and television towers, dishes, gas, sewage pipeline, utility plants, rights-of-way, power transmission lines, waste water facilities, etc.

Vacant Land: Land cover that includes private and public property that generally has not been developed for any human purpose or land that was once developed but is no longer in use.

Wetlands: Land cover that includes all wetlands on public and private land characterized by both hydric soils and the growth of hydrophytes. Note: wetland mapping is based off SEWRPC 2000 land use data and not 2005 wetland inventory.

Woodland: Land cover generally consisting of remnant or second growth forest.

Future Land Use/Land Cover Predictions

Table 10 and Figure 20 compare 2012 land use/land cover acreage to predicted future land use/land cover acreage that was determined from available municipal comprehensive plans and SEWRPC data. The largest loss of current land use/land cover acreage is expected to occur on cropland and pastureland where approximately 968 acres of the existing 1,111 acres (83% decrease) is expected to be converted to mostly low and medium density single family residential and commercial/retail. The majority of these changes are expected to occur in the central and northern portions of the watershed within the municipalities of Caledonia and Oak Creek. A significant loss of vacant land is also expected as 989 acres of the existing 1,649 acres (40% decrease) is predicted to become mostly residential. Finally, the remaining 500 acres of woodland is expected to decrease by at least 25% as residential development expands meaning it will be important to develop around these remaining woodlands if possible using conservation/low impact development design standards.

Table 10. Comparison between 2012 and predicted future land use/land cover statistics.

Land Use/ Land Cover	Current Area (acres)	2012 % of Watershed	Predicted Area (acres)	Predicted % of Watershed	Change (acres)	Percent Change
Cemetery	32.6	0.3	73.9	0.6	+41.3	+127%
Commercial/Retail	274.1	2.1	327.5	2.7	+53.4	+19.5%
Cropland	1,111.2	9.3	193.5	1.6	-968.2	-83%
Cultural/Recreational	582.6	4.9	751.1	6.3	+388.6	+107%
Government/Institutional	326.8	2.7	326.8	2.7	0	0%
Industrial	725.7	6.1	509.0	4.3	-216.7	-30%
Landfill	43.7	0.4	43.7	0.4	0	0%
Residential (Low Density ≥ 0.45 ac ≤1.43 ac)	1,181.7	9.9	2,271.4	19.0	+1,089.7	+92%
Residential (Medium Density ≥ 0.16 ac ≤0.44 ac)	1,544.6	12.9	2,003.8	18.7	+459.2	+29.7%
Residential (High Density ≤ 0.15 ac)	673.6	5.6	744.6	6.2	+71.0	+10.5%
Residential-Multifamily	410.5	3.4	448.5	3.8	+38.0	+9%
Residential-Under Development	116.9	1.0	0	0	-116.9	+100%
Open Water	44.4	0.4	44.4	0.4	0	0%
Other Agricultural	29.4	0.2	15.1	0.1	-32.4	-68%
Pastureland	170.0	1.4	29.4	-0.2	-140.6	-83%
Quarry/Mining	163.0	1.4	202.4	+1.7	+39.4	+24%
Transportation	1,631.4	13.6	1,631.4	13.6	0	0%
Utilities	366.5	3.1	366.3	3.1	-0.2	-0.05%
Vacant Land	1,649	13.8	989.4	8.3	-829.1	-40%
Wetlands	356.3	3.0	355.5	3.0	-0.8	-0.2%
Woodland	500	4.2	374.7	3.1	-125.3	-25%

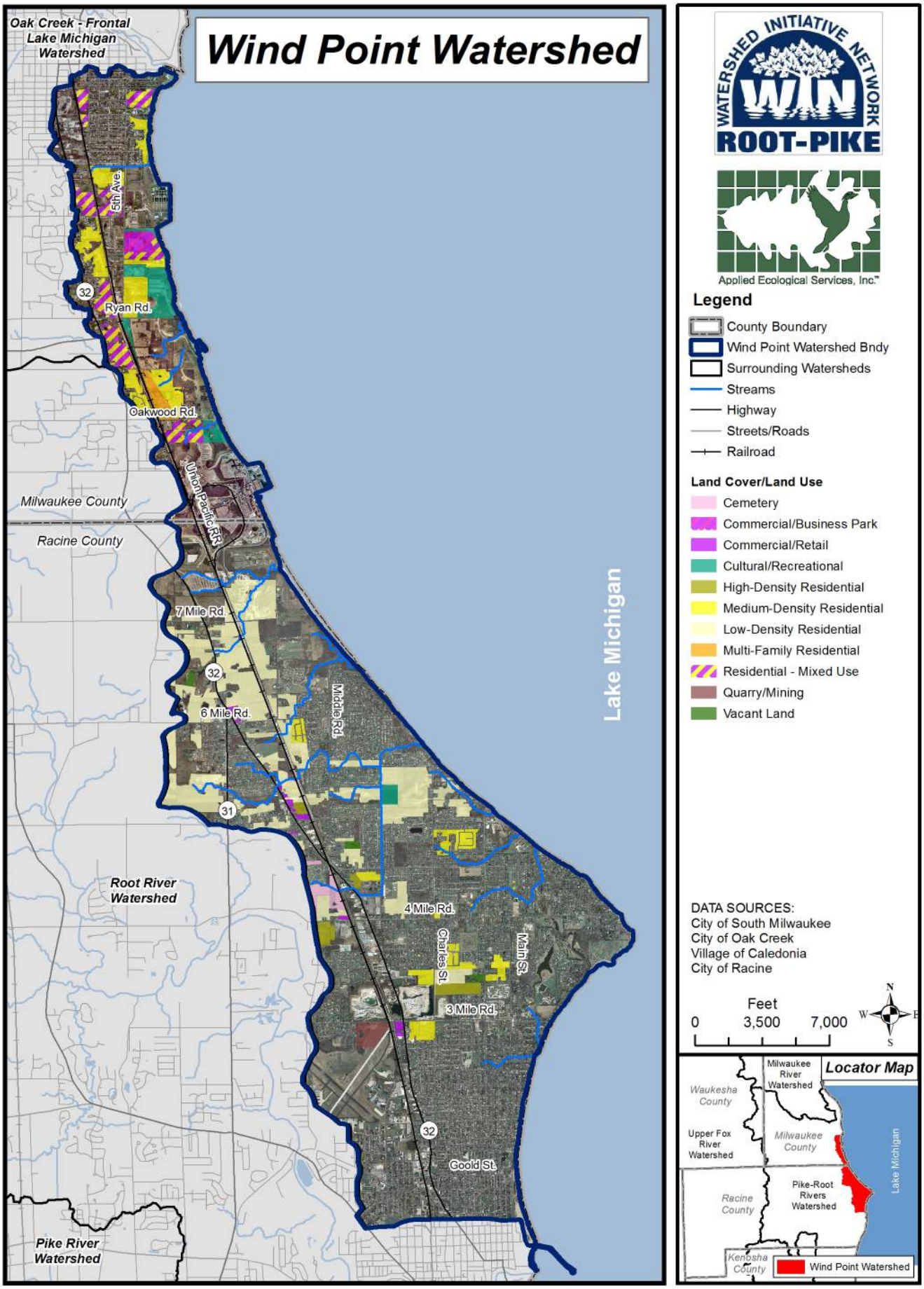


Fig. 20: Future Land Use/Land Cover

3.10 Impervious Cover Impacts

Impervious cover is defined as surfaces of an urban landscape that prevent infiltration of precipitation (Scheuler 1994). Imperviousness is an indicator used to measure the impacts of urban land uses on water quality, hydrology and flows, flooding/ depressional storage, and habitat related to streams (Figure 21). Based on studies and other background data, Scheuler (1994) and the Center for Watershed Protection (CWP) developed an Impervious Cover Model used to classify streams within subwatersheds into three quality categories: Sensitive, Impacted, and Non-Supporting (Table 11). In general, Sensitive subwatersheds have less than 10% impervious cover, stable stream channels, good habitat, good water quality, and diverse biological communities. Impacted subwatersheds have between 10% and 25% impervious cover, somewhat degraded streams, altered habitat, and decreasing water quality. Non-Supporting subwatersheds generally have greater than 25% impervious cover, highly degraded streams, degraded habitat, poor water quality, and poor-quality biological communities. In addition, runoff over impervious surfaces collects pollutants and warms the water before it enters a stream resulting in negative biological impacts.

Figure 21. Relationship between impervious surfaces, evapotransporation, & infiltration. Source: The Federal Interagency Stream Restoration Working Group, 1998 (Rev. 2001).

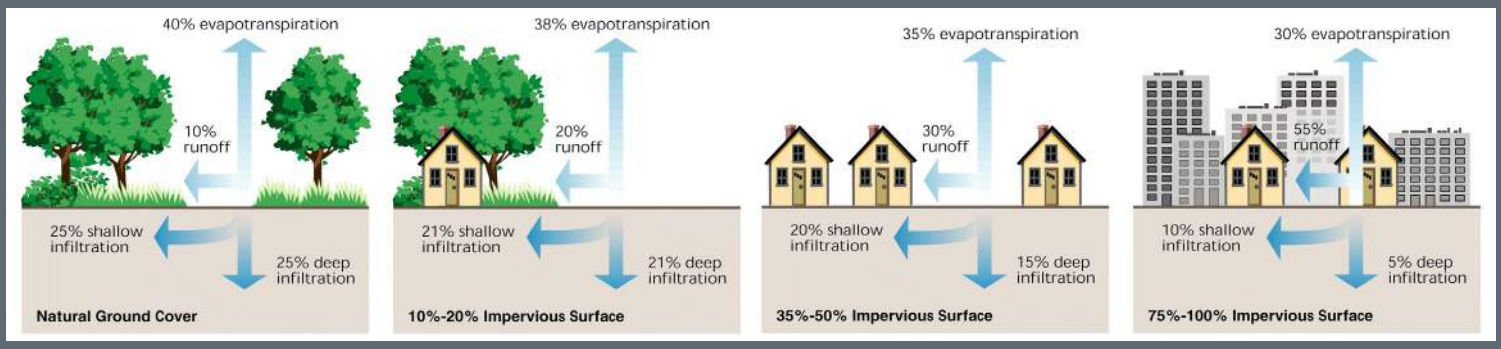


Table 11. Impervious category & corresponding stream condition via the Impervious Cover Model. Source: (Zielinski 2002)

Category	% Impervious	Stream Condition within Subwatershed
Sensitive	<10%	Stable stream channels, excellent habitat, good water quality, and diverse biological communities
Impacted	>10% but <25%	Somewhat degraded stream channels, altered habitat, decreasing water quality, and fair-quality biological communities.
Non-Supporting	>25%	Highly degraded stream channels, degraded habitat, poor water quality, and poor-quality biological communities.

Sensitive Stream

Impacted Stream

Non-Supporting Stream

The following paragraphs describe the implications of increasing impervious cover:

Water Quality Impacts
Imperviousness affects water quality in streams and lakes by increasing pollutant loads and water temperature. Impervious surfaces accumulate pollutants from the atmosphere, vehicles, roof surfaces, lawns and other diverse sources. During a storm event, pollutants such as nutrients (nitrogen and phosphorus), metals, oil/grease, and bacteria (*E. coli*) are delivered to streams and lakes. According to monitoring and modeling studies, increased imperviousness is directly related to increased urban pollutant loads (Schueler 1994). Furthermore, impervious surfaces can increase stormwater runoff temperature as much as 12 degrees compared to vegetated areas (Galli, 1990). Water temperatures exceeding 90°F (32.2°C) can be lethal to aquatic fauna and can generally occur during hot summer months.

Hydrology and Flow Impacts
Higher impervious cover translates to greater runoff volumes thereby changing hydrology and flows in streams. If unmitigated, high runoff volumes can result in higher floodplain elevations (Schueler 1994). In fact, studies have shown that even relatively low percentages of imperviousness (5% to 10%) can cause peak discharge rates to increase by a factor of 5 to 10, even for small storm events. Impervious areas come in two forms: 1) disconnected and 2) directly connected. Disconnected impervious areas are represented primarily by rooftops, so long as the rooftop runoff does not get funneled to impervious driveways or a stormsewer system. Significant portions of runoff from disconnected surfaces usually infiltrate into soils more readily than directly connected impervious areas such as parking lots that typically end up as stormwater runoff directed to a stormsewer system that discharges directly to a waterbody.

Flooding and Depressional Storage Impacts
Flooding is an obvious consequence of increased flows resulting from increased impervious cover. As stated above, increased impervious cover leads to higher water levels, greater runoff volumes, and high floodplain elevations. Higher floodplain elevations usually result in more flood problem areas. Furthermore, as development increases, wetlands and other open space decrease. A loss of these areas results in increased flows because wetlands and open space typically soak up rainfall and release it slowly via groundwater discharge to streams and lakes. Detention basins can and do minimize flooding in highly impervious areas by regulating the discharge rate of stormwater runoff, but detention basins do not reduce the overall increase in runoff volume.

Habitat Impacts
A threshold in habitat quality exists at approximately 10% to 15% imperviousness (Booth and Reinelt 1993). When a stream receives more severe and frequent runoff volumes compared to historical conditions, channel dimensions often respond through the process of erosion by widening, downcutting, or both, thereby enlarging the channel to handle the increased flow. Channel instability leads to a cycle of streambank erosion and sedimentation resulting in physical habitat degradation (Schueler 1994). Streambank erosion is one of the leading causes of sediment suspension and deposition in streams leading to turbid conditions that may result in undesirable changes to aquatic life (Waters 1995). Sediment deposition alters habitat for aquatic plants and animals by filling interstitial spaces in substrates important to benthic macroinvertebrates and some fish species. Physical habitat degradation also occurs when high and frequent flows result in loss of riffle-pool complexes.

Impervious Cover Estimate & Future Vulnerability

In 1998, the Center for Watershed Protection (CWP) published the Rapid Watershed Planning Handbook. This document introduced rapid assessment methodologies for watershed planning. The CWP released the Watershed Vulnerability Analysis as a refinement of the techniques used in the Rapid Watershed Planning Handbook (Zielinski 2002). The vulnerability analysis focuses on existing and predicted impervious cover as the driving forces impacting potential stream quality within a watershed. It incorporates the Impervious Cover Model described at the beginning of this subsection to classify Subwatershed Management Units (SMUs). SMUs are defined and examined in more detail in Section 3.3.

AES used a modified Vulnerability Analysis to compare each SMU's vulnerability to predicted land use changes across Wind Point watershed. Three steps were used to generate a vulnerability ranking of each SMU. The results were used to make and rank recommendations in the Action Plan related to curbing the negative effects of predicted land use changes on the watershed. The three steps are listed below and described in detail on the following pages:

Step 1: Existing impervious cover classification of SMUs based on 2012 land use/land cover

Step 2: Predicted future impervious cover classification of SMUs based on predicted land use/land cover changes

Step 3: Vulnerability Ranking of SMUs based on changes in impervious cover and classification

Step 1: Existing Impervious Cover Classification

Step 1 in the Vulnerability Analysis is an existing classification of each SMU based on 2012 land use/land cover and measured impervious cover. 2012 impervious cover was calculated by assigning an impervious cover percentage for each land use/land cover category based upon the United States Department of Agriculture's (USDA) Technical Release 55 (TR55) (USDA 1986). Highly developed land such as commercial/retail for example is estimated to have over 70% impervious cover while a typical medium density residential development exhibits around 25% impervious cover. Open space areas generally have less than 5% impervious cover. GIS analysis was used to estimate the percent impervious cover for each SMU in the watershed using 2012 land use/land cover data. Each SMU then received an initial classification (Sensitive, Impacted, or Non-Supporting) based on percent of existing impervious cover (Table 12; Figure 22).

To summarize, three SMUs (SMUs 6, 7, and 24) were classified as Sensitive, ten as Impacted (SMUs 2, 3, 4, 5, 10, 11, 12, 13, 16 and 17), and eleven as Non-Supporting (SMUs 1, 8, 9, 14, 15, 18, 19, 20, 21, 22 and 23) based on 2012 impervious cover estimates. Sensitive SMUs 6 and 7 are generally located between Ryan Road and Oakwood Road and include residential areas and Bender Park. Sensitive SMU 24 is associated with multiple small direct drainage areas along Lake Michigan that are mostly vacant land or natural areas. Most of the Impacted SMUs are found in Wind Point, Caledonia, and Oak Creek in areas of medium and large lot residential development. All of the Non-Supporting SMUs are associated with highly impervious industrial and high density residential development in Racine, Caledonia, Oak Creek, and South Milwaukee.

Table 12. 2012 & predicted future impervious cover by Subwatershed Management Unit.

SMU #	Step 1: Existing Impervious %	Existing (2012) Impervious Classification	Step 2: Predicted Impervious %	Predicted Impervious Classification	Percent Change	Step 3: Vulnerability
SMU1	55.3%	Non-Supporting	53.6%	Non-Supporting	-1.7%	Low
SMU2	23.5%	Impacted	31.2%	Non-Supporting	7.7%	High
SMU3	19.0%	Impacted	22.4%	Impacted	3.4%	Low
SMU4	23.1%	Impacted	32.2%	Non-Supporting	9.1%	High
SMU5	14.3%	Impacted	7.4%	Sensitive	-6.9%	Low
SMU6	5.3%	Sensitive	18.5%	Impacted	13.2%	High
SMU7	6.2%	Sensitive	22.7%	Impacted	16.5%	High
SMU8	27.5%	Non-Supporting	37.3%	Non-Supporting	9.8%	Medium
SMU9	44.8%	Non-Supporting	44.8%	Non-Supporting	0%	Low
SMU10	17.3%	Impacted	20.9%	Impacted	3.6%	Low
SMU11	15.3%	Impacted	20.4%	Impacted	5.1%	Medium
SMU12	23.9%	Impacted	29.3%	Non-Supporting	5.4%	High
SMU13	21.1%	Impacted	27.4%	Non-Supporting	6.3%	High
SMU14	30.1%	Non-Supporting	33.5%	Non-Supporting	3.4%	Low
SMU15	34.6%	Non-Supporting	36.0%	Non-Supporting	1.4%	Low
SMU16	21.8%	Impacted	21.8%	Impacted	0%	Low
SMU17	23.9%	Impacted	29.1%	Non-Supporting	5.2%	High
SMU18	52.4%	Non-Supporting	55.5%	Non-Supporting	3.1%	Low
SMU19	36.0%	Non-Supporting	36.0%	Non-Supporting	0%	Low
SMU20	54.9%	Non-Supporting	54.9%	Non-Supporting	0%	Low
SMU21	51.3%	Non-Supporting	51.3%	Non Supporting	0%	Low
SMU22	51.0%	Non-Supporting	51.2%	Non-Supporting	0.2%	Low
SMU23	60.4%	Non-Supporting	60.4%	Non-Supporting	0%	Low
SMU24	7.2%	Sensitive	10.0%	Sensitive	2.8%	Medium

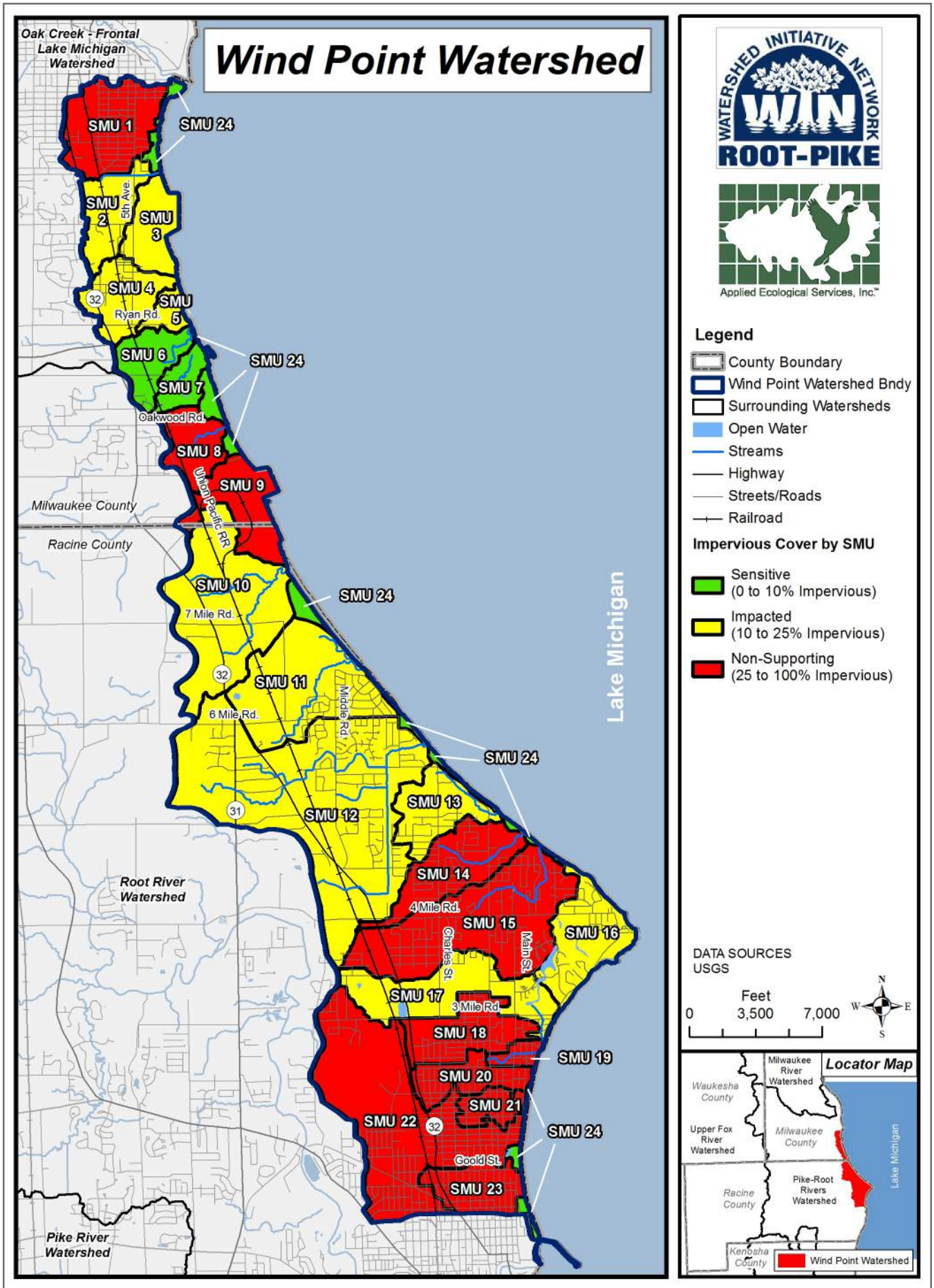


Fig. 22: Impervious Cover Classification by SMU based on 2012 Land Use/Land Cover

Step 2: Predicted Future Impervious Cover Classification
Predicted future impervious cover was evaluated in Step 2 of the vulnerability analysis by classifying each SMU as Sensitive, Impacted, or Non-Supporting based on predicted land use changes. Table 12 and Figure 23 summarize and depict predicted future impervious cover classifications for each SMU. This step identifies Sensitive and Impacted SMUs that are most vulnerable to future development pressure. SMUs 6 and 7 are predicted to change from Sensitive to Impacted while SMUs 2, 4, 12, 13, and 17 change from Impacted to Non-Supporting. These changes are attributed to mostly predicted residential and mixed use residential development. It is also interesting to note that SMU 5 is expected to change from Impacted to Sensitive as a result of abandoned industrial areas becoming recreational areas.

Step 3: Vulnerability Ranking
The vulnerability of each SMU to predicted future land use changes was determined by considering the following questions:

1. Will the SMU classification change?

2. Does the SMU classification come close to changing (within 2%)?

3. What is the absolute change in impervious cover from existing to predicted conditions?

Vulnerability to future development for each SMU was categorized as Low, Medium, or High:

Low = no change in classification; <5% change in impervious cover

Medium = classification close to changing (within 2%) and/or 5-10% change in impervious cover

High = classification change or close to changing (within 2%) and/or >10% change in cover

The vulnerability analysis resulted in 7 High, 3 Medium, and 14 Low ranked SMUs (Table 12; Figure 24). SMUs 2, 4, 6, 7, 12, 13, and 17 are ranked as highly vulnerable to future problems associated with impervious cover because each is expected to change classification from Sensitive to Impacted or Impacted to Non-Supporting. Predicted residential and mixed use residential concentrated in the northern and central portions of the watershed in areas that are currently agricultural are the largest source of increased impervious cover.

SMUs 8, 11, and 24 are ranked as moderately vulnerable to predicted land use changes. SMUs 8 and 17 exhibit between 5 and 10 percent increases in impervious cover while SMU 24 is Sensitive but nearly reaches Impacted status. Again, residential and mix use residential contribute most to increased impervious cover.

The remaining SMUs are not vulnerable to predicted future land use changes based on the Center for Watershed Protection's methodology.

The results of this analysis clearly point to the potential negative impacts of traditional development. It will be important to consider developing these area using Conservation/Low Impact Development standards that incorporate the most effective and reliable Stormwater Treatment Train practices whereby stormwater is routed through various water quality and infiltration Management Measures prior to being released from the development site. The use of Conservation/Low Impact Development is discussed in the Programmatic Action Plan section of this report.

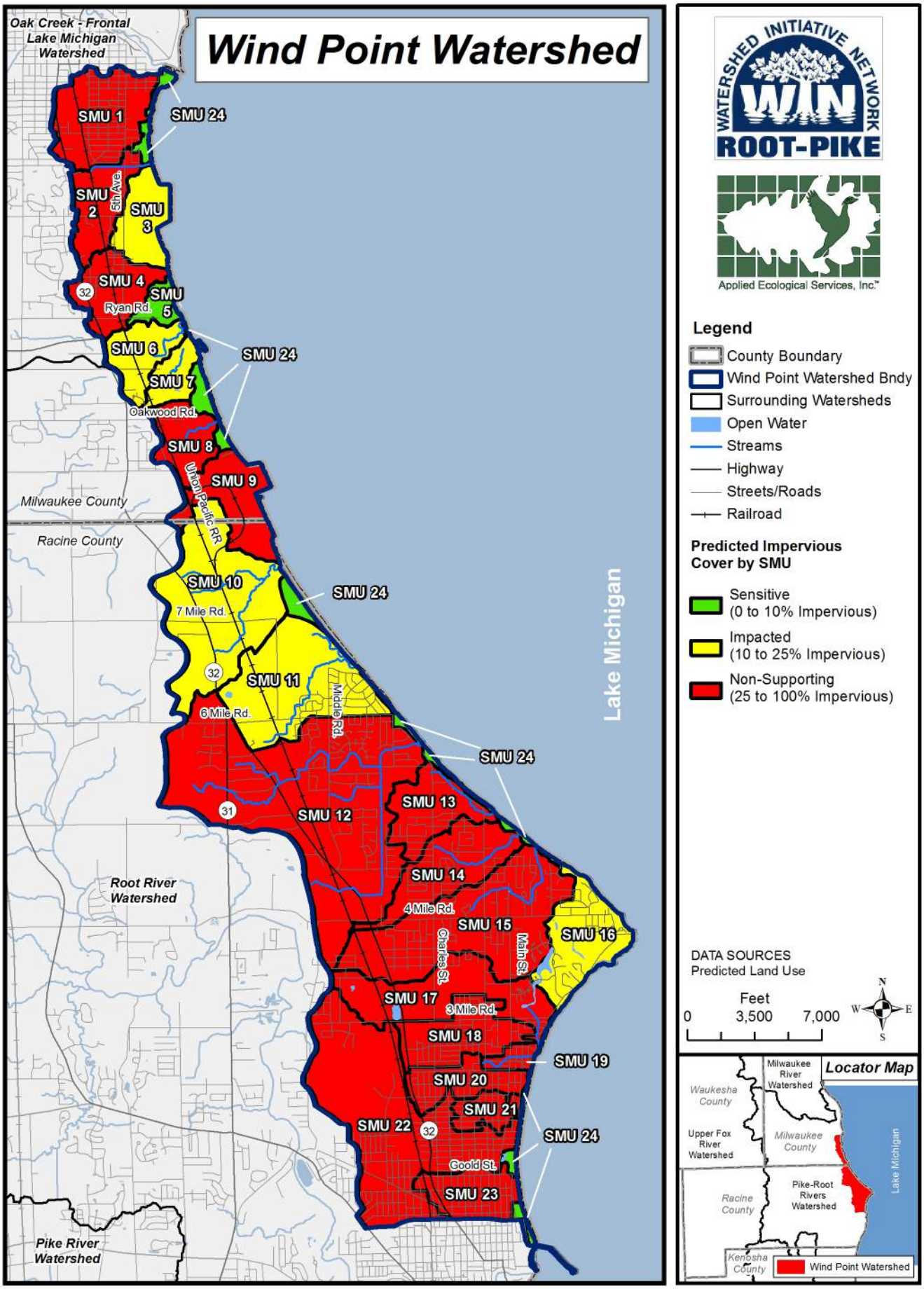


Fig. 23: Predicted Impervious Cover Classification by SMU

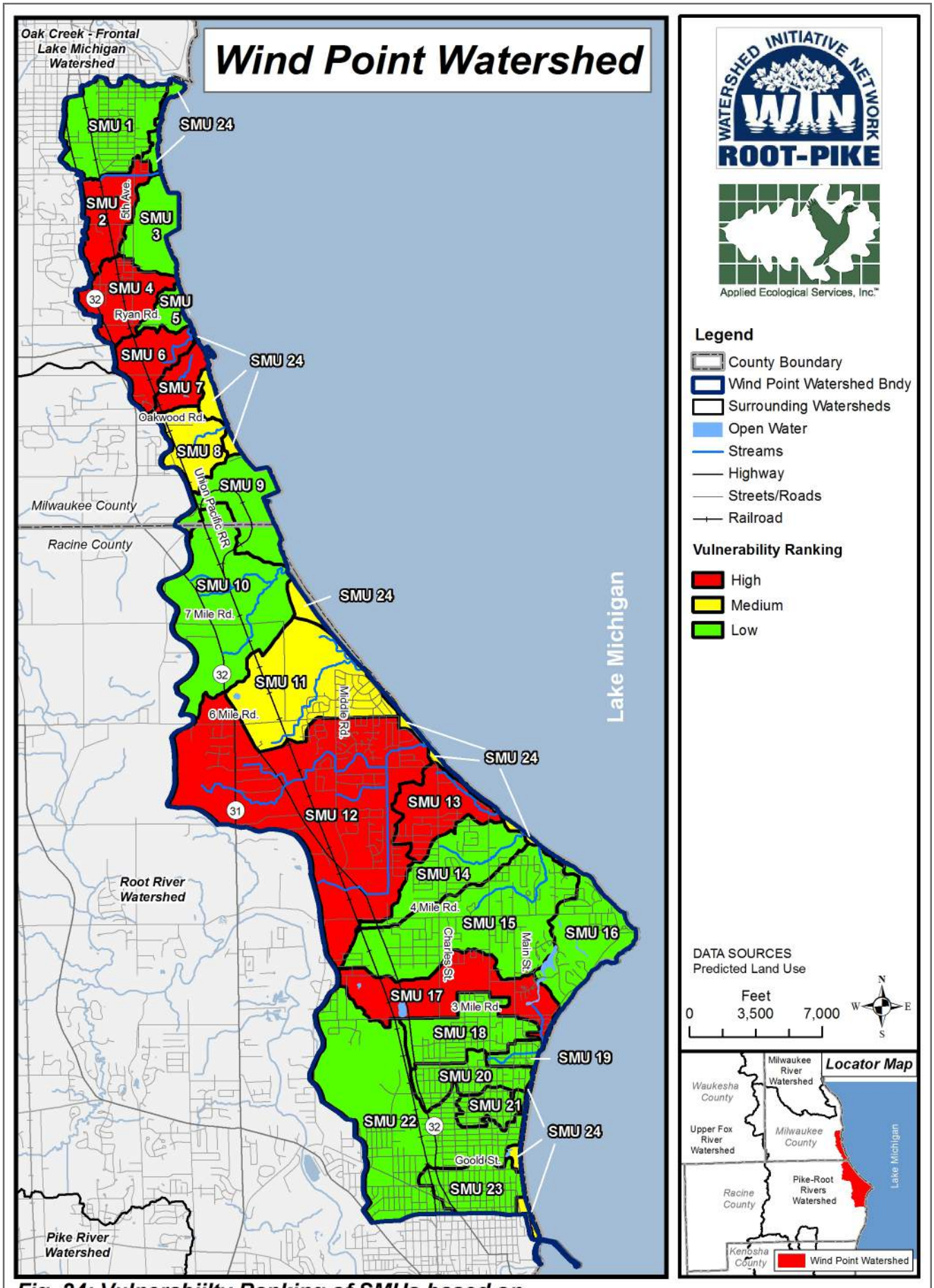


Fig. 24: Vulnerabiilty Ranking of SMUs based on Predicted Future Land Use/Land Cover Changes

3.11 Open Space Inventory, Prioritization, & Green Infrastructure Network

A major component of watershed planning includes an examination of open space to determine how it best fits into a "Green Infrastructure Network". Green infrastructure is best defined as an interconnected network of natural areas and other open space that conserves natural ecosystem values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife (Benedict 2006). Natural features such as stream corridors, wetlands, floodplain, woodlands, and grassland are the primary components of green infrastructure. Working lands such as farms parks/ ball fields, golf courses, school grounds, detention basins, and large residential parcels can also be considered green infrastructure components. A three step process was used to create a parcel-based Green Infrastructure Network for Wind Point watershed:

Step 1: All parcels of land in the watershed were categorized as open space, partially open space, or developed.

Step 2: All open and partially open parcels were prioritized based on a set of criteria important to green infrastructure.

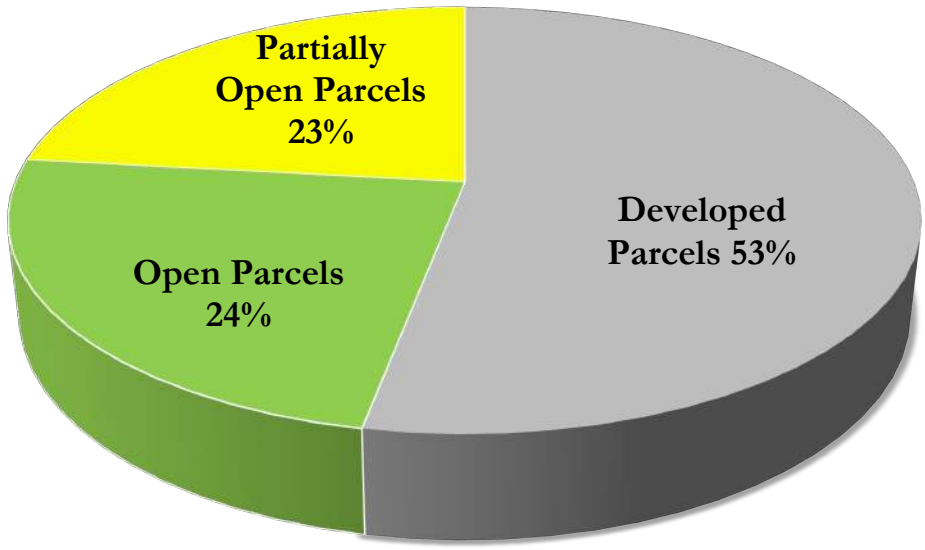
Step 3: Prioritized open and partially open parcels and some developed but linking parcels were combined to form a Green Infrastructure Network.

For this watershed plan, an "open space" parcel is generally defined as any parcel that is not developed such as a protected natural area or agricultural field. "Partially open" parcels have been developed to some extent, but the parcels still offer potential green infrastructure opportunities. Examples of partially open parcels include some school grounds, residential lots generally greater than two acres with minimal development, vacant industrial areas, and portions of airports. Parcels that are mostly built out such as medium and high density residential development, transportation, and commercial/ retail areas are considered "developed". Public versus private and protected versus unprotected status of open and partially open space parcels are other important green infrastructure attributes that are discussed in more detail below.

Open, Partially Open, & Developed Parcels

Step 1 in creating a Green Infrastructure Network was completed by categorizing all parcels in the watershed as "open", "partially open", or "developed" as described above. Figures 25 and 26 summarize and depict Step 1 results. Open space parcels comprise approximately 2,508 acres or 24% of the watershed. Open parcels range from less than 1 acre to 284 acres with a 15.9 acre average. Partially open parcels make up another 2,431 acres or 23% of the watershed. Partially open parcels range from less than 1 acre to 389 acres with a 18.2 acre average. Developed parcels account for the remaining 5,627 acres or 53% of the watershed. Most open and partially open parcels are located on agricultural land, County preserves, an airport, and large residential lots.

Figure 25. Distribution of open, partially open, and developed parcels.



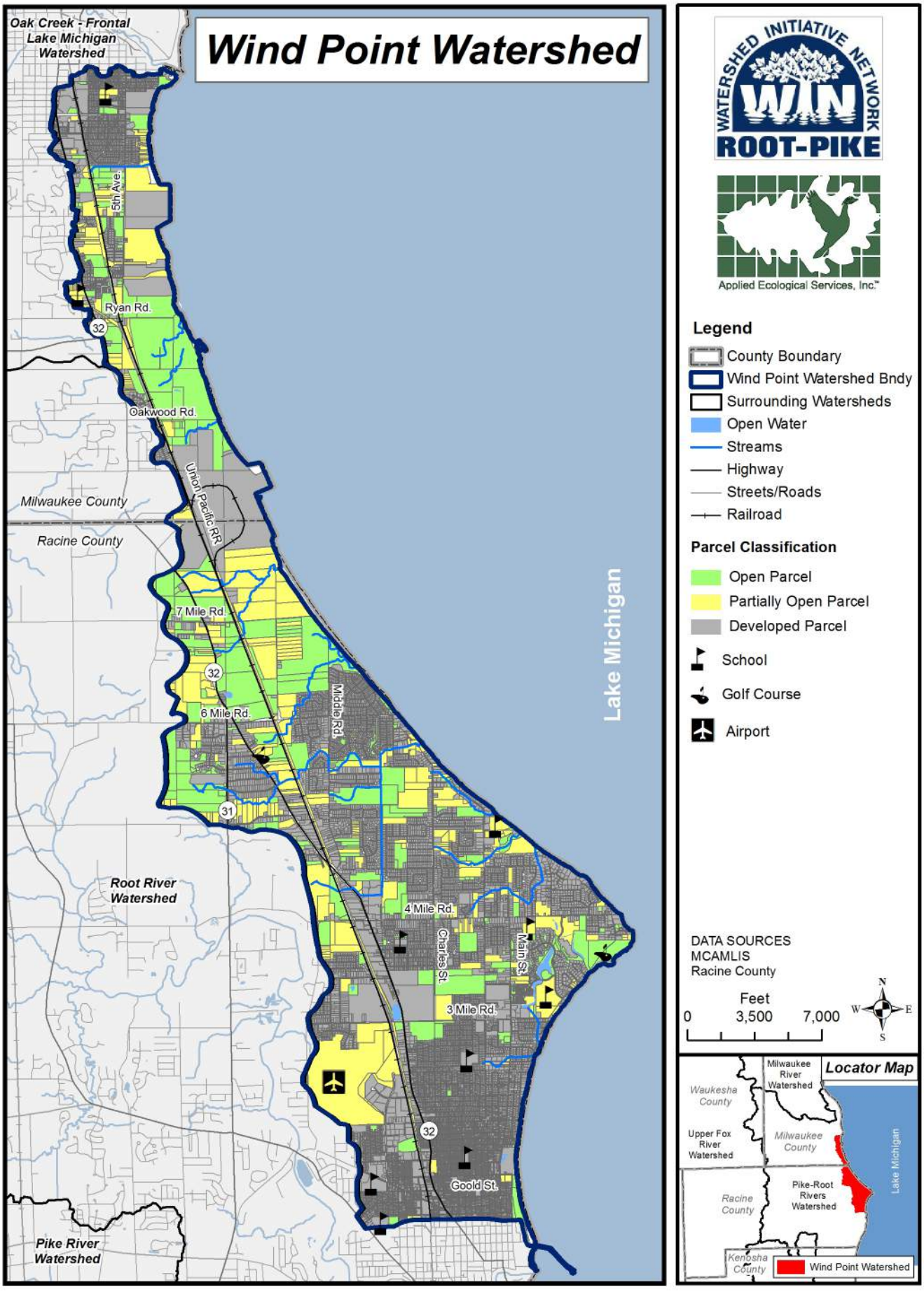


Fig. 26: Open, Partially Open, and Developed Parcels

Public/Private Ownership of Open and Partially Open Parcels

The public or private ownership of each open and partially open parcel was determined from available parcel data. Developed parcels are not included in this summary. Publicly owned parcels generally include those owned by state, county, municipal government, school districts, and park districts. Public open and partially open parcels account for 17% and 1% of the open and partially open acreage respectively (Figures 27 & 29). Private ownership types include residential, businesses, commercial, industrial, non-profit, agricultural, etc. Private open parcels comprise 34% of the open and partially open acreage whereas private partially open parcels comprise 48% (Figures 27 & 29). Public open and partially open parcels are mostly owned by counties and municipalities.

Protected Status of Open and Partially Open Parcels

Preservation of open space is critical to maintaining and expanding green infrastructure and is an important component of sustaining water quality, hydrological processes, ecological function, and the general quality of life for both wildlife and people. Without preservation, open space can be converted to other less desirable land uses in the future. Protected open and partially open parcels account for about 17% of the open and partially open parcel acreage in the watershed while unprotected open and partially open parcels account for the remaining 83% (Figures 28 & 30). Most protected open or partially open parcels are owned by counties, municipalities, homeowner associations, and non-profit groups such as Caledonia Conservancy.

Figure 27. Distribution of private and public open and partially open parcels.

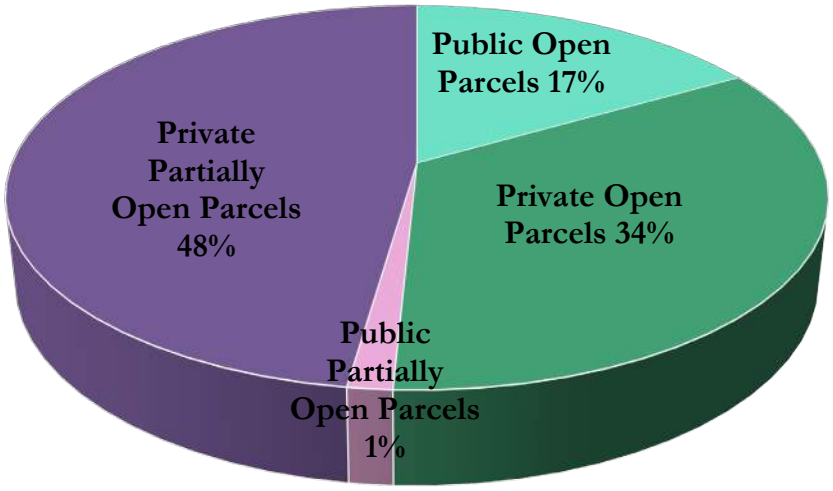
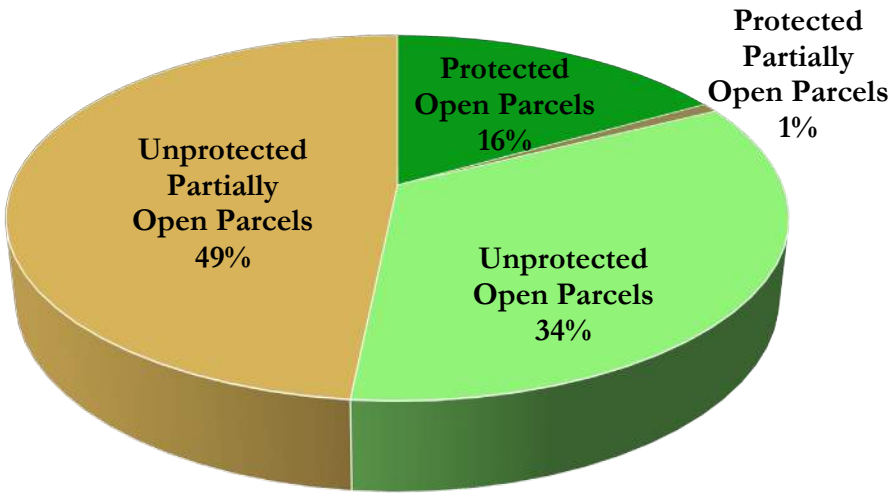


Figure 28. Distribution of protected and unprotected open and partially open parcels.



The most critical unprotected open and partially open parcels are agricultural lands. Most agricultural areas will likely be developed to residential unless agricultural preservation tools are leveraged. Utilizing the Wisconsin Working Lands Initiative and future development that incorporates conservation design or low impact development will be extremely important in many of these areas to improve water quality and reduce stormwater runoff volume.

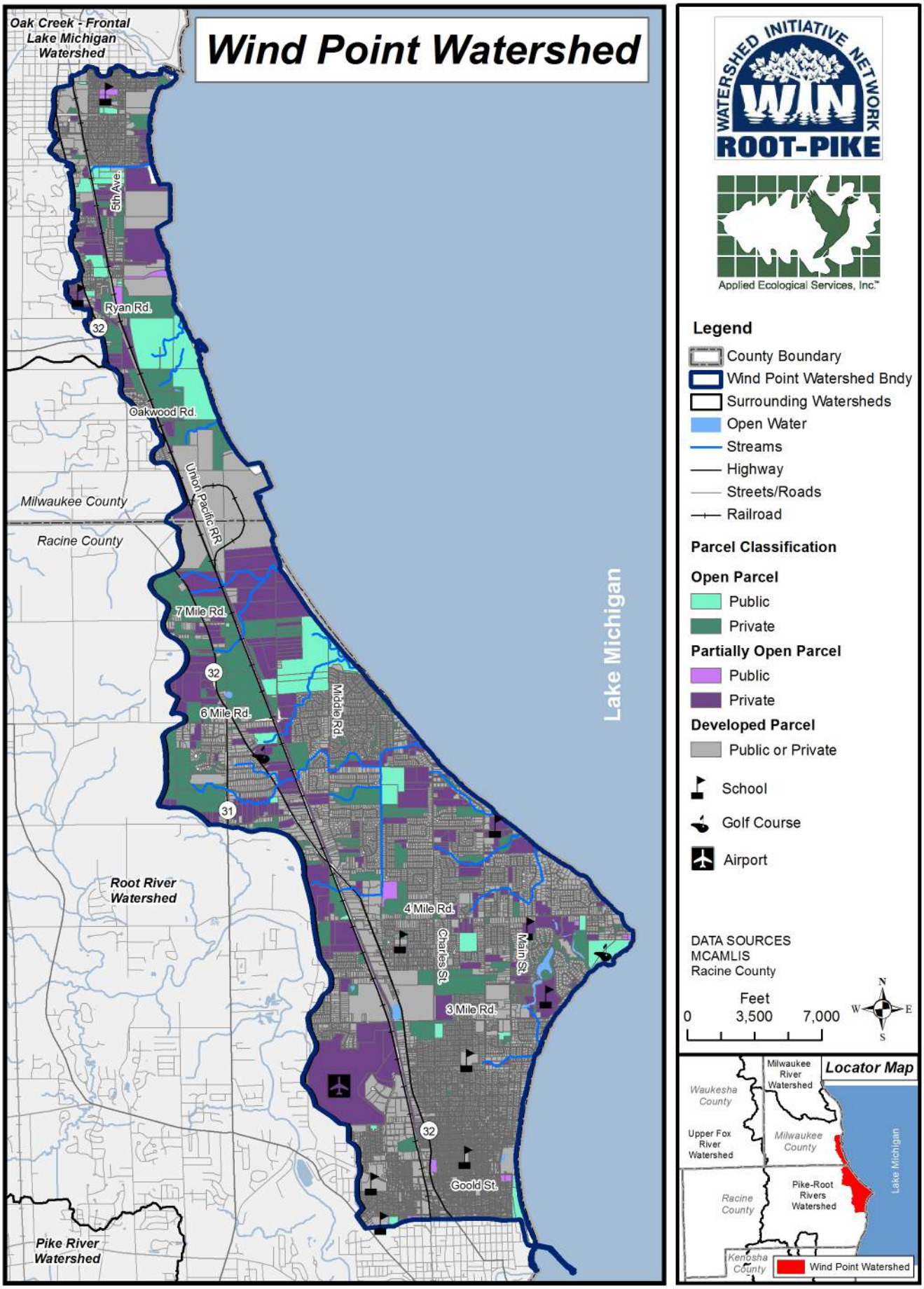


Fig. 29: Public vs. Private Ownership of Open and Partially Open Parcels

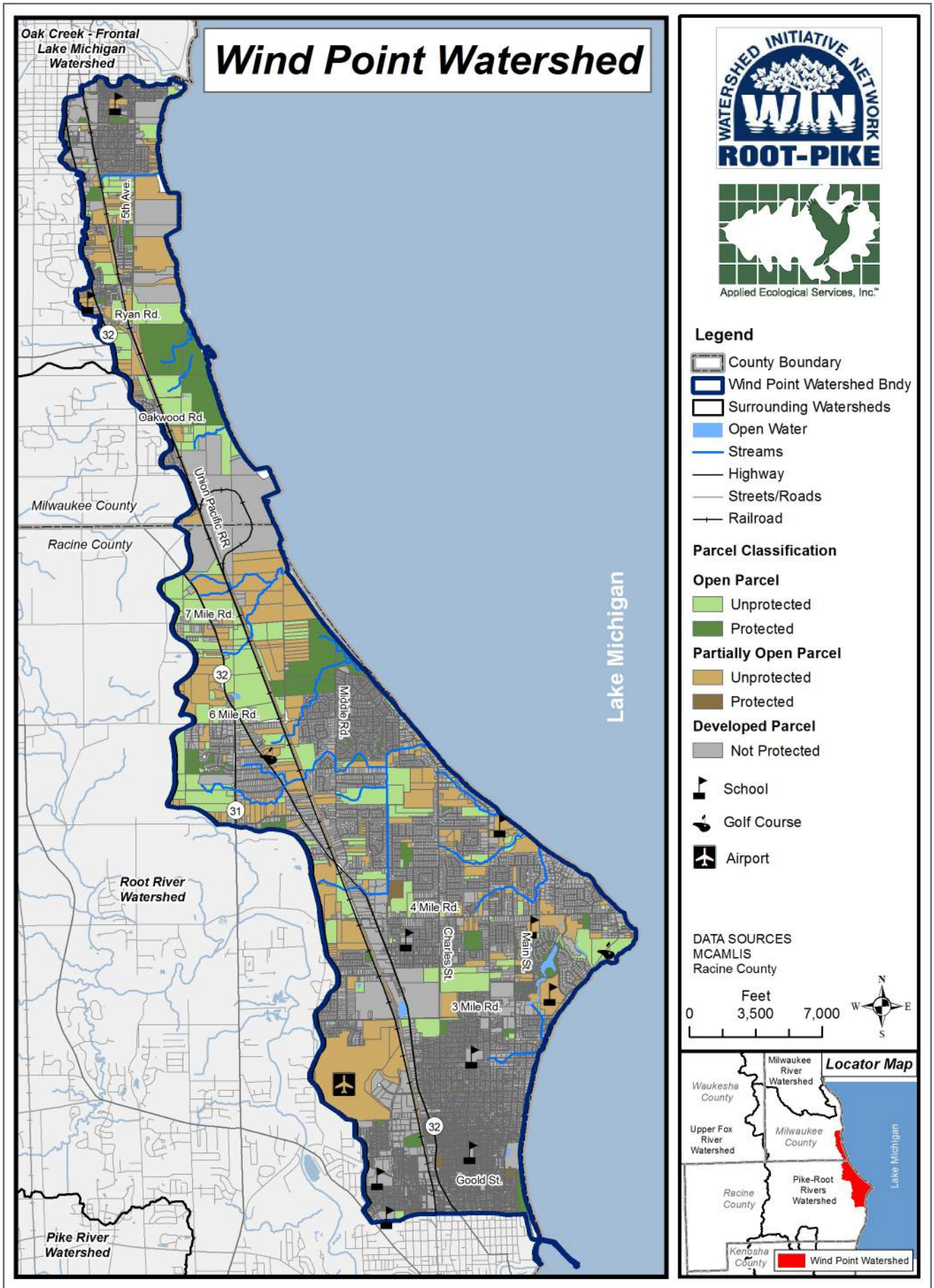


Fig. 30: Protection Status of Open and Partially Open Parcels

Open Space Parcel Prioritization

Step 2 in creating a Green Infrastructure Network for Wind Point watershed was completed by prioritizing open and partially open parcels. For this step, 10 prioritization criteria important to green infrastructure were examined via a GIS analysis (Table 13). If an open or partially open parcel met a criterion it received one point. If the parcel did not meet that criterion, it did not receive a point. This process was repeated for each open and partially open parcel and for all criteria. The prioritization process was not completed for developed parcels. The total points received for each parcel were summed to determine parcel importance for developing the Green Infrastructure Network; parcels with the highest number of points are more important to green infrastructure than parcels that met fewer criteria.

The combined possible total of points any one parcel can accumulate is 10 (10 of 10 total criteria met). The highest total value received by a parcel in the weighting process was 9 (having met 9 of 10 criteria). After completion of the prioritization, parcels were categorized as "High Priority", "Medium Priority", or "Low Priority" for green infrastructure based on point totals. Parcels meeting 6-9 of the criteria are designated High Priority for inclusion into the Green Infrastructure Network while parcels meeting 3-5 criteria are designated Medium Priority. Parcels with a combined value of 0-2 are categorized as Low Priority but are not necessarily excluded from the Green Infrastructure Network based on their location or position as linking parcels.

Figure 31 depicts the results of the parcel prioritization. First, Bender Park and Cliffside Park, the two largest protected parks in the watershed, are High Priority green infrastructure and form *hubs*. Many of the Medium Priority parcels are currently private vacant, agricultural, or large lot residential adjacent to High Priority parcels and frequently form *corridors* along streams and the Lake Michigan coast. Low Priority parcels are generally smaller isolated private residential or agricultural parcels. John H. Batten Airport (Batten International Airport) is a larger Low Priority area that meets few green infrastructure criteria but still forms a large hub of open space.

Table 13. Criteria used to prioritize parcels for a Green Infrastructure Network.

Green Infrastructure Criteria
1. Open/partially open parcels that intersect FEMA 100-year floodplain
2. Open/partially open parcels within 0.25-miles of any headwater stream
3. Open/partially open parcels that include a wetland
4. Open/partially open parcels that include an ADID wetland
5. Open/partially open parcels that are within 100 feet of a stream or open water
6. Open/partially open parcels in a "Highly Vulnerable" Land Use/Land Cover SMU
7. Open/partially open parcels adjacent to or including private or public protected open space
8. Open/partially open parcels that include an existing or planned trail
9. Open/partially open parcels that include SEWRPC environmental corridors
10. Open/partially open parcels that include "Highly Productive Agricultural Land"

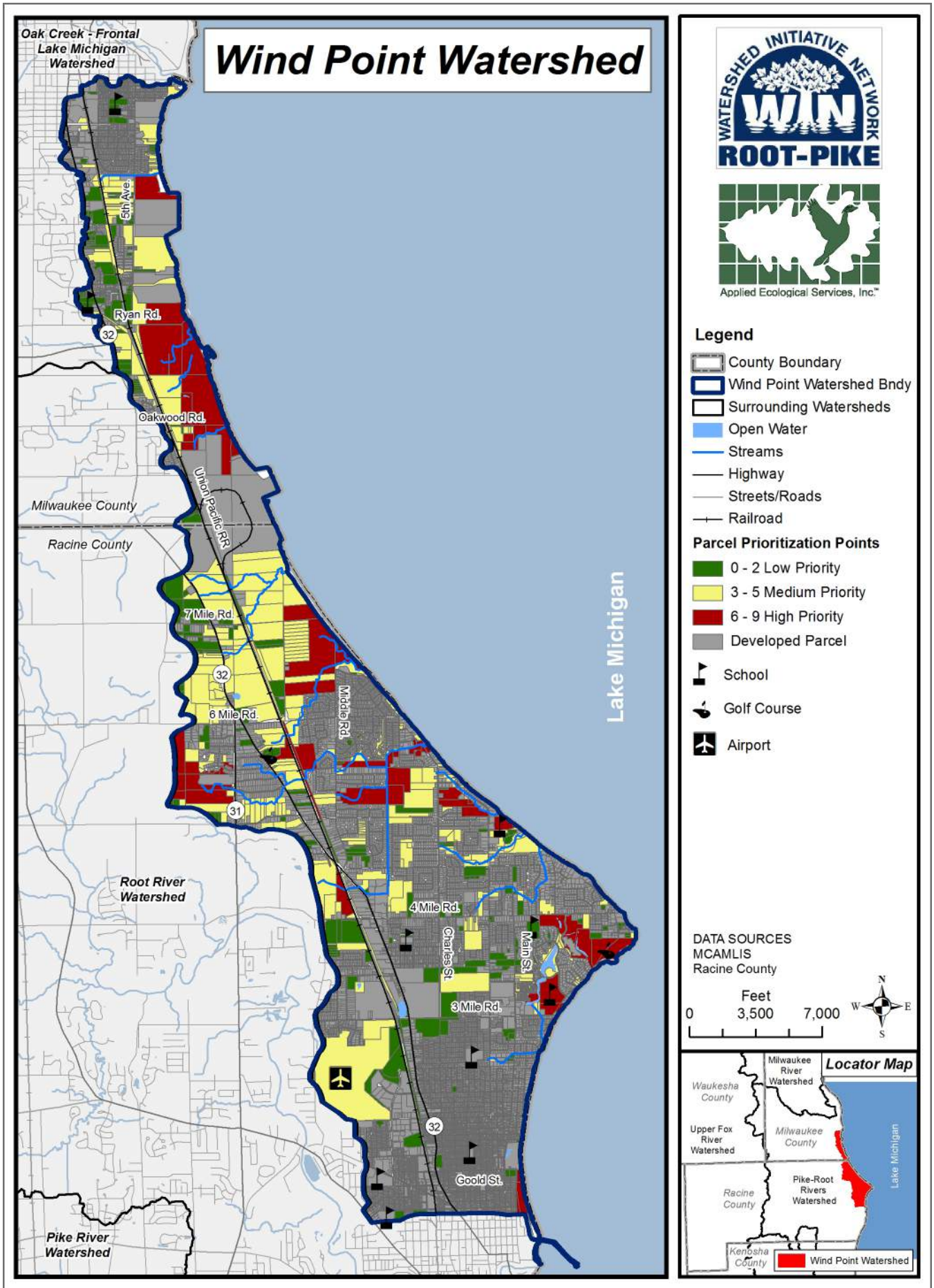
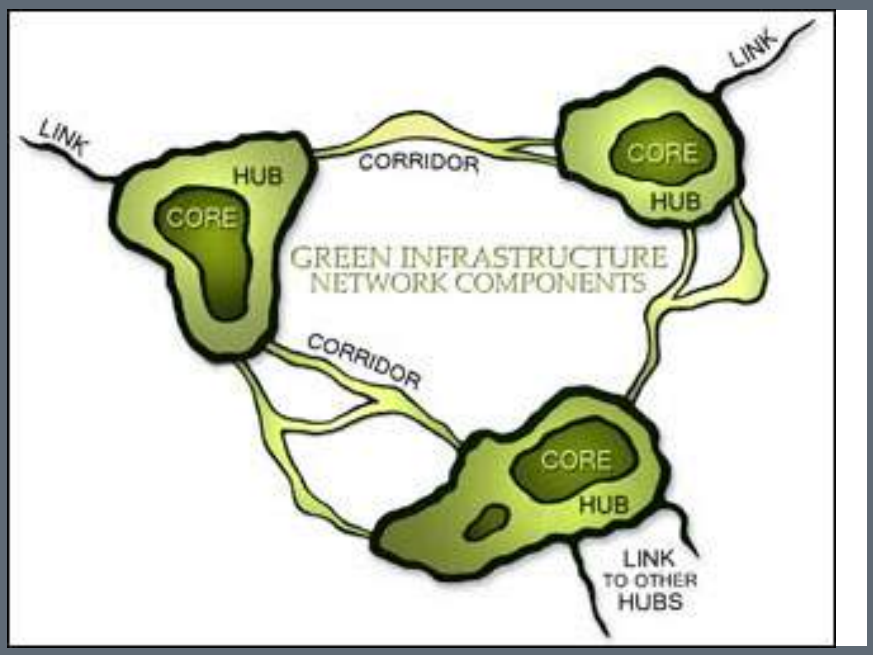
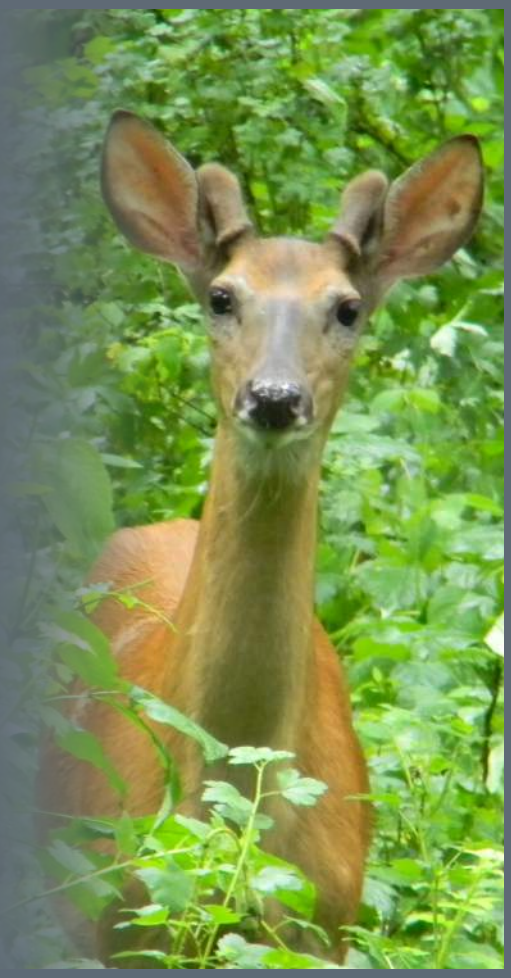


Fig. 31: Open Space Parcel Prioritization

Green Infrastructure Network

A Green Infrastructure Network is a connected system of *Hubs* and linking *Corridors*. Hubs generally consist of the largest and least fragmented areas such as Bender Park and Cliffside Park, and several agricultural areas. Corridors are generally formed by smaller private/unprotected parcels along streams and Lake Michigan shoreline. Corridors are extremely important because they provide biological conduits between hubs. However, most parcels forming corridors are not ideal green infrastructure until residents, businesses, industries, and farmers embrace the idea of naturalizing stream corridors. Unique to Wind Point watershed is a utility corridor system extending from We Energies Oak Creek plant and following the Union Pacific Railroad. Several sections of these corridors are being used for trails/bike paths.





(Left) Green Infrastructure components. Source: greeninfrastructure.net. Image (right): Wildlife utilize the green infrastructure network, traveling along corridors from hub to hub.

Green Infrastructure Network

The final step (Step 3) in creating a Green Infrastructure Network for Wind Point watershed involves laying out the network by using prioritized open space results from Step 2 as the base layer that includes all High Priority, nearly all Medium Priority parcels, and many Low Priority and developed parcels along streams and Lake Michigan coast corridors if they provided links, expanded existing green infrastructure, or were simply isolated sites such as protected parks. The decision was also made to include Vulcan Quarry areas north of 3 Mile Road as part of the Green Infrastructure Network because they could potentially be remediated and provide future green infrastructure when quarry operations are complete.

County and regional wide green infrastructure plans generally focus on natural features such as stream corridors, wetlands, floodplain, buffers, and other natural components. The Green Infrastructure Network created for Wind Point watershed captures all the natural components including SEWRPC's environmental corridors and other green infrastructure such as recreational parks, large residential lots, school grounds, and golf courses at the parcel level. Parcel level green infrastructure planning is important because land purchases, acquisitions, and land use changes almost always occur at the parcel level. A Green Infrastructure Network for Wind Point watershed is illustrated on Figure 32. Perhaps the most important aspect of green infrastructure planning is that it helps communities identify and prioritize conservation opportunities and plan development in ways that optimize the use of land to meet the needs of people and nature (Benedict 2006). Green infrastructure planning provides a framework for future growth that identifies areas not suitable for development, areas suitable for development but that should incorporate conservation or low impact design standards, and areas that do not affect green infrastructure. The Action Plan section of this report includes various programmatic and site specific green infrastructure recommendations.

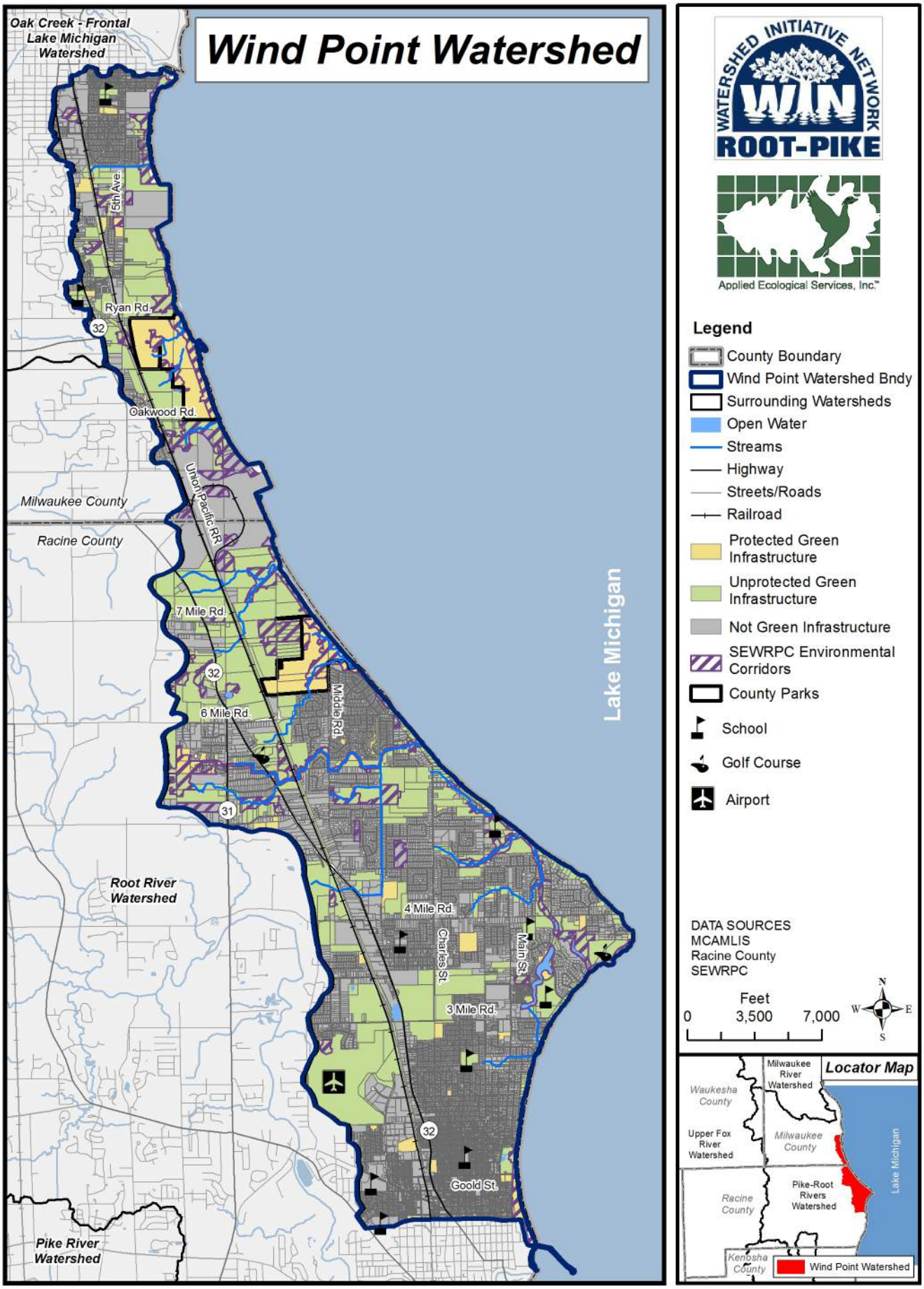


Fig. 32: Green Infrastructure Network

3.12 Highly Productive Agricultural Land

Agricultural preservation in Wind Point watershed can play a crucial role in retaining valuable open space as part of the green infrastructure network. These areas allow for increased groundwater infiltration as opposed to the conversion of these lands to more intense, urban uses. Southeastern Wisconsin Regional Planning Commission's (SEWRPC) 2006 Regional Land Use Plan for Southeastern Wisconsin: 2035, calls for the preservation of as much of the most productive farmland as practicable.

SEWRPC defines the most productive farmland (National Prime Farmlands) according to the agricultural capability of the soils on that land – specifically those classified by the U.S. Natural Resources Conservation Service (NRCS) as Class I and Class II soils. Agricultural land classified as Class III soils are categorized as Farmland of Statewide Significance. In Wind Point watershed, 1,195 acres have been classified as National Prime Farmlands worthy of preservation. Farmlands of Statewide Significance account for 58 acres. Figure 33 depicts the location of the National Prime Farmlands, as well as Farmlands of Statewide Significance. The SEWRPC's 2035 Land Use Plan, written in 2006 while development pressure was still at its height, called for much of these Prime National Farmlands in Caledonia to eventually be reserved for low density residential growth, despite agricultural preservation goals, because of its location on the fringe of regional urban development.

Since that plan was written, housing pressure has since tapered back due to unforeseen changes in the housing market and economy and the 2009 Wisconsin Working Lands Initiative was introduced which includes the Farmland Preservation Program, Agricultural Enterprise Area Program, and the Purchase of Agricultural Conservation Easement Program. An opportunity may exist to expand agricultural preservation within Wind Point watershed.

Agricultural land west of St Hwy 32 in Caledonia

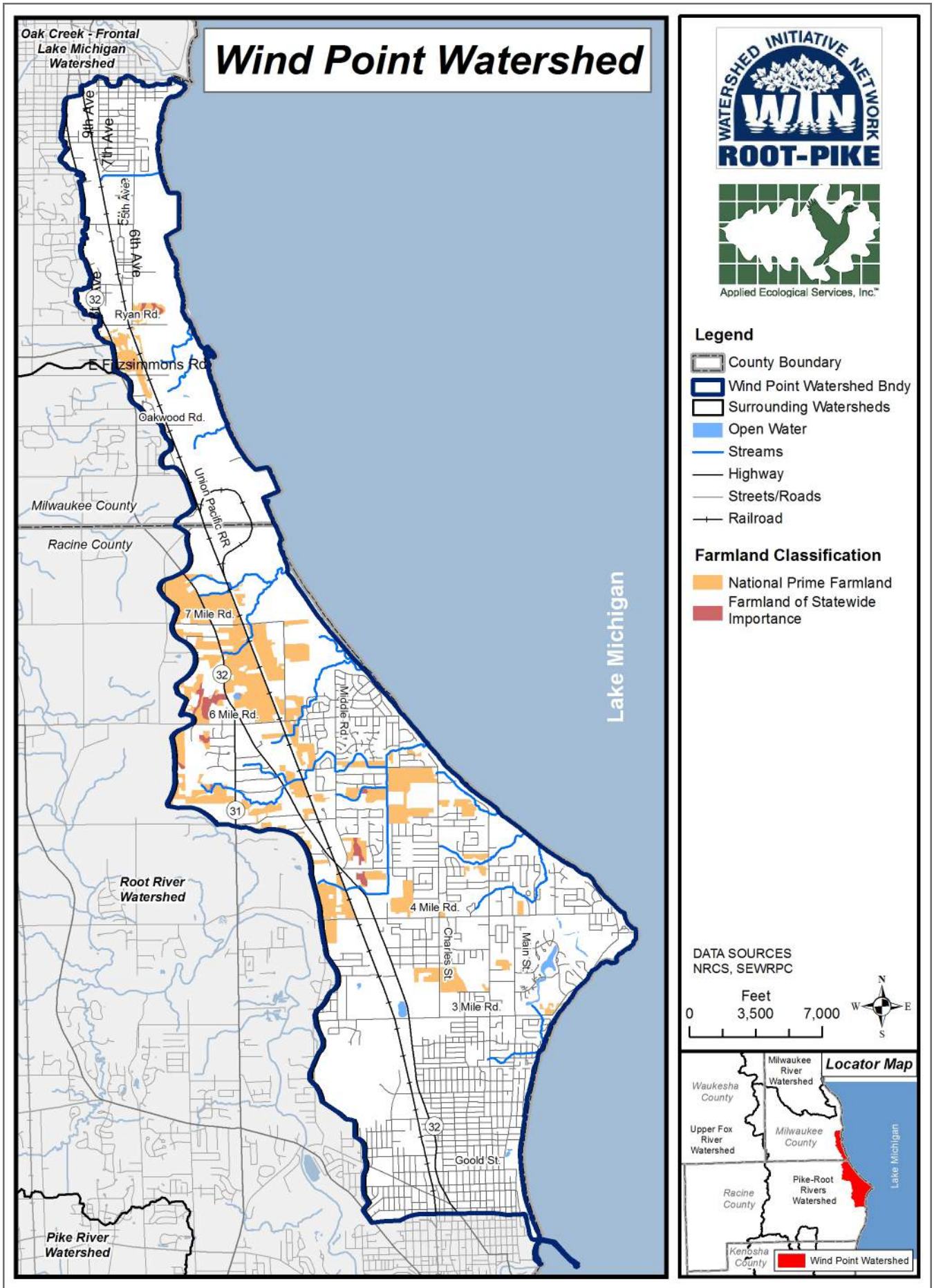


Fig. 33: Highly Productive Farmland

3.13 Important Natural Areas

Wetlands, woodlands, beach/foredune, and other natural features that fall within concentrated corridors of the natural resource base are all considered "Important Natural Areas" within Wind Point watershed. Many of these areas are public and owned/managed by local county, non-profit, or municipal entities. Important Natural Areas often provide high quality habitat for and harbor uncommon or even threatened and endangered (T&E) species. These areas also provide large greenway corridors that interconnect land and waterways, support native species, maintain natural ecological processes, and contribute to the quality of life for communities of people. 1,293 acres of SEWRPC Environmental Corridors, 130 acres of ADID areas, and 819 acres in other Natural Areas are located in the watershed (Table 14; Figures 34 & 35).

Table 14. Important natural area summary data.

Natural Area	Size (acres)	Description
SEWRPC Environmental Corridors		
Primary Environmental Corridors	801	≥ 400 acres in size, two miles long, and 200 feet in length
Secondary Environmental Corridors	66	≥ 100 acres in size and one mile long, unless they connect primary environmental corridors
Isolated Natural Resource Area	426	200 feet wide down to a 5 acre minimum
ADID Wetlands, Lakes, & Ponds		
ADID Wetlands, Lakes, & Ponds	130	As delineated by USEPA, USACOE, & WDNR, with assistance provided by SEWRPC, in 2005
Other Important Natural Areas		
Cliffside Park: Woods, Clay Banks & Old Field	220	Natural area of regional significance - second-growth mesic woodland and ravine, rare clay bluffs and an adjacent old field with critical species habitat
Tabor Woods	38	Natural area of local significance - mesic, dry-mesic, and wet-mesic woodland; owned by Caledonia Conservancy
Power Plant Ravine Woods	32	Natural area of local significance - mesic woodland and a deep ravine that opens onto clay banks; critical species habitat
Oak Creek Power Plant Woods	18	Woodland and critical species habitat
Clay Ravine Woods	12	Woodland and clay ravine; critical species habitat
Bender Park	303	Woodland, ravine, meadow, and clay bluffs; critical species habitat
Oak Creek Bluffs and Beach	28	Provides critical species habitat
North Bay Ravine & Beach	2	Provides critical species habitat
North Beach Park	50	Beach and foredune complex
Beach North of MMSD Facility	15	Beach and foredune complex north of MMSD facility
Dominican Creek Ravine	18	Natural area of local significance - provides critical species habitat
Wind Point Ravine Woods	14	Provides critical species habitat
Neighborhood Central Walk	15	Second growth woodland with trail owed by Caledonia Conservancy

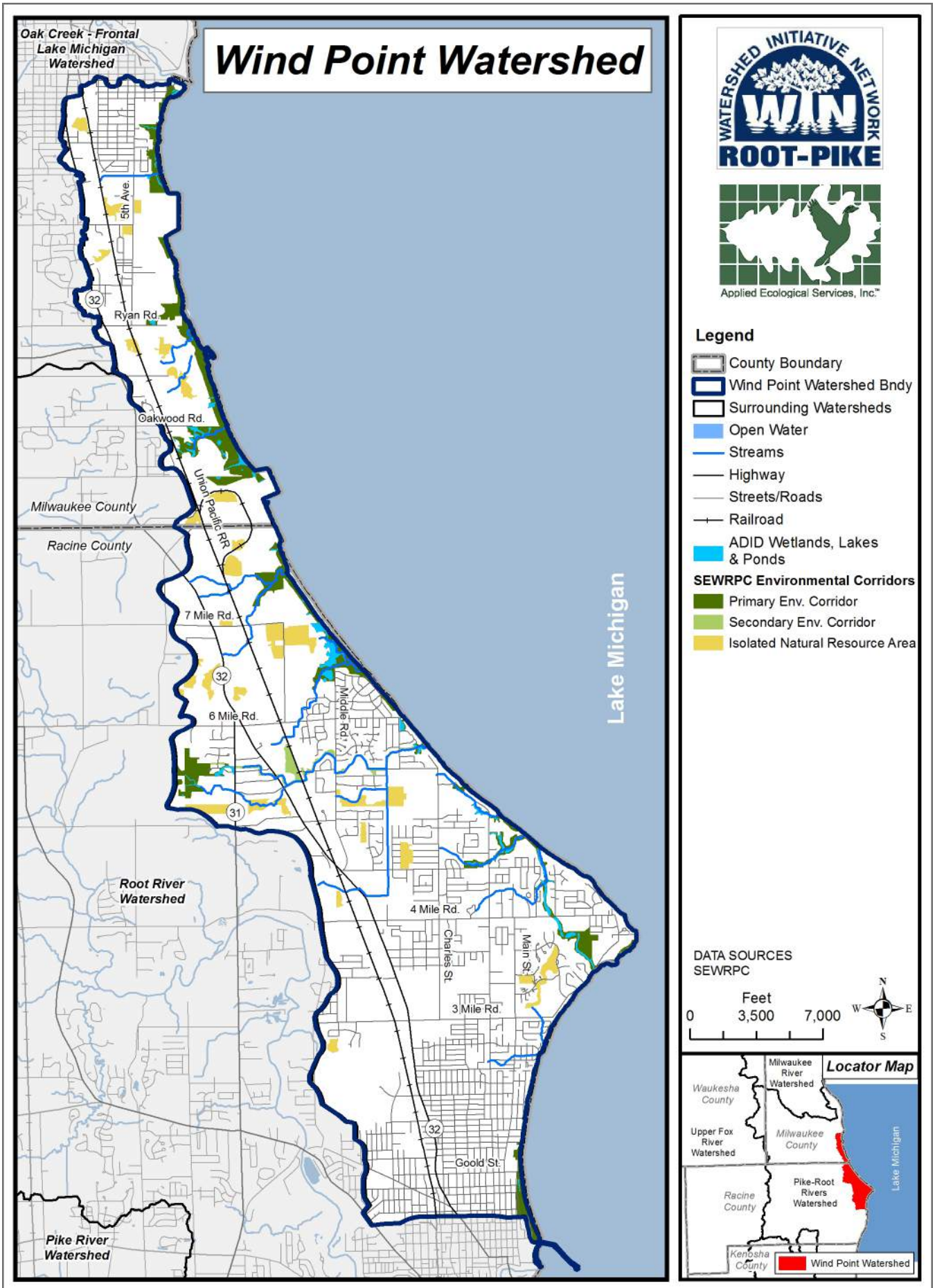


Fig. 34: ADID Wetlands, Lakes, & Ponds & SEWRPC Environmental Corridors

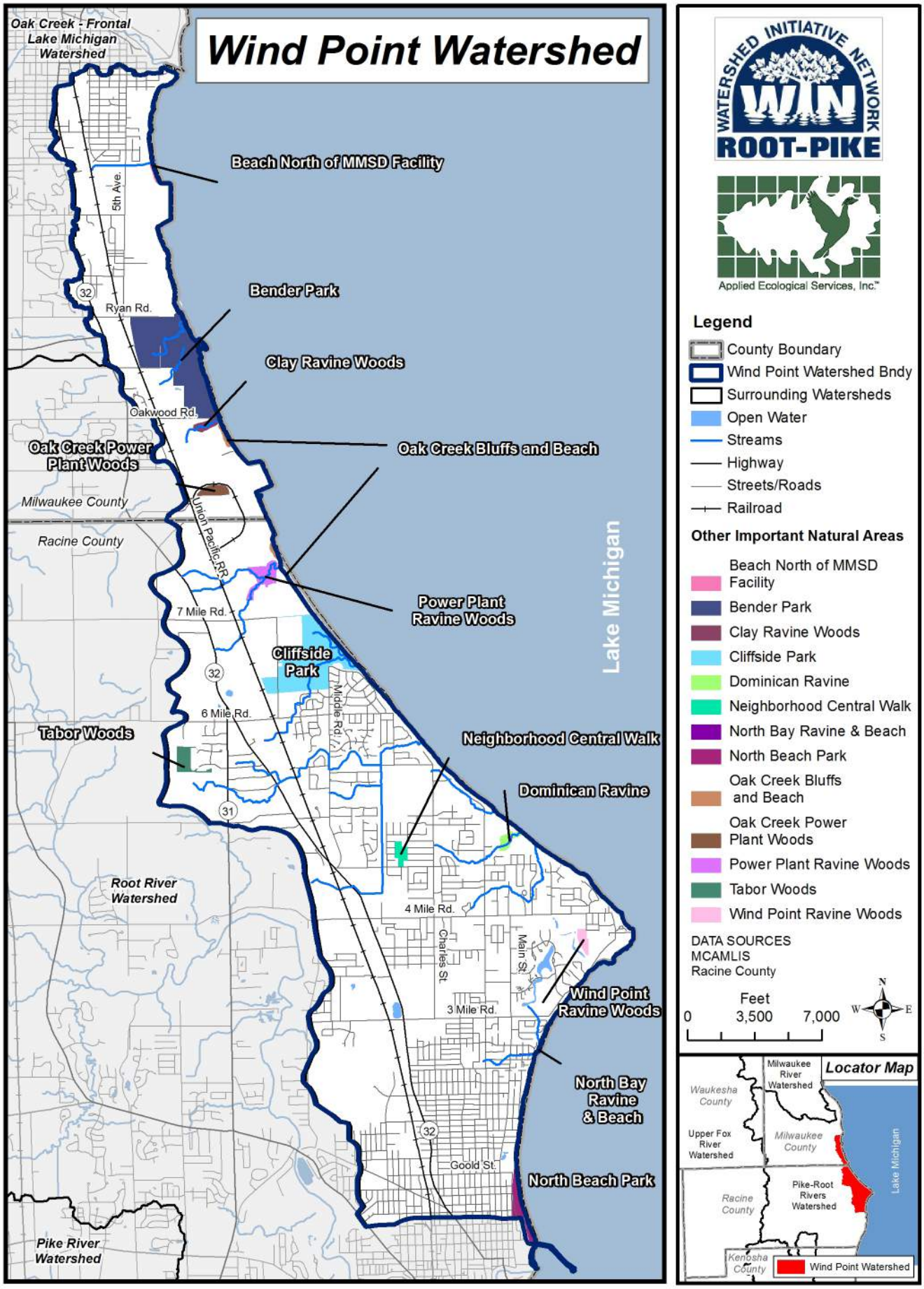


Fig. 35: Other Important Natural Areas

SEWRPC Environmental Corridors

As part of their regional planning efforts, Southeastern Wisconsin Regional Planning Commission (SEWRPC) identified primary and secondary environmental corridors within southeastern Wisconsin. These environmental corridors were designated in order to identify and protect important natural resources in the area. The Environmental Corridors for Wind Point watershed serve as an important catalogue of important natural areas within the watershed and form the backbone of the Green Infrastructure Network. The SEWRPC 2005 Environmental Corridors within Wind Point watershed are mapped on Figure 34.

SEWRPC's Environmental Corridors were determined based on the presence of water bodies, watercourses, wetlands, remnant plant communities, wildlife habitat areas, areas containing hydric or partially hydric soils, and areas of rugged terrain or high-relief topography. Additionally, the corridors take into account the relation of open space, historic sites, scenic areas, natural areas, and critical species habitat sites within the area. Primary and Secondary Environmental Corridors, as well as Isolated Natural Resource Areas were delineated for the planning area. Primary Environmental Corridors are defined as being at least 400 acres in size, two miles long, and 200 feet in length. Secondary Corridors are at least 100 acres in size and one mile long, unless they connect primary environmental corridors. Isolated Natural Resource Areas include those from 200 feet wide down to a 5 acre minimum (SEWRPC 2000).

Approximately 801 acres of Wind Point watershed lie within the Primary Environmental Corridor, according to SEWRPC's 2005 delineation. An additional 66 acres and 426 acres, respectively, fall within the Secondary Environmental Corridors and Isolated Natural Resource Areas. The majority of these Environmental Corridors extend along Lake Michigan and over some of the ravines and tributaries leading within Bender Park and Cliffside Park. Additional areas include Tabor Woods and Isolated Natural Resource Areas scattered throughout the watershed.

ADID Wetlands, Lakes, & Ponds

The United States Environmental Protection Agency (USEPA) has a planning process known as advanced identification of disposal areas (ADID) in place that is used to identify wetlands and other waters that are unsuitable for the discharge of dredged and fill materials (USEPA 2009). For Wind Point watershed, these identifications were made by the USEPA in conjunction with the United States Army Corps of Engineers (USACOE) and Wisconsin Department of Natural Resources (WDNR). The ADID wetland inventory was completed for Racine and Milwaukee Counties in 2005. SEWRPC provided technical assistance in producing these maps by combining this data with their Primary Environmental Corridors. These inventories identify wetlands where special protection should be implemented and enforced. There are 130 acres of ADID wetlands as shown on Figure 34.

Other Important Natural Areas

The Wisconsin Department of Natural Resources (WDNR) manages the State Natural Areas Program which works to identify ecological communities that remain predominantly undisturbed from pre-European settlement times. These areas have been assessed according to field inventories conducted by WDNR staff and account for the quality, diversity, extent of past disturbance, context within the greater landscape, and rarity of features. Areas that meet these qualifications and have also been identified as areas of statewide significance are designated as State Scientific Areas. Within Wind Point watershed no sites meet these qualifications; however several sites meet the qualifications for natural areas of regional or local significance. These include the regionally significant Cliffside Park Woods and Clay Banks and the locally significant Tabor Woods and Power Plant Ravine Woods. There are also a number of other sites that serve as critical species habitat for plants or wildlife.

Cliffside Park

Cliffside Park consists of over 220 acres of both natural and recreational areas in Caledonia and is owned by Racine County. The park includes Cliffside Park Woods (a second growth mesic woodland) and Clay Banks, listed as a natural area of regional significance, as well as Cliffside Park Old Field, containing critical species habitat. According to the WDNR, clay seepage bluffs such as those found at Cliffside Park are considered an endangered resource. Cliffside Park may be the best place to see the Lake Border moraines as they tower above the waters of Lake Michigan. Here the eroding clay bluffs are slowly entering the earliest stages of ravine formation, providing an opportunity to witness a dynamic landscape process in an urban area (WDNR 2012). Cliffside Park Woods and Clay Banks harbor uncommon bird species such as Cooper's hawk (*Accipiter cooperii*) and wood thrush (*Hylocichla mustelina*). The Old Field harbors rare birds such as bobolink (*Dolichonyx oryzivorus*), upland sandpiper (*Bartramia longicauda*), and grasshopper sparrow (*Ammodramus savannarum*). Uncommon plant species include buffaloberry (*Shepherdia canadensis*), yellowish gentian (*Gentiana alba*), stiff gentian (*Gentianella quinquefolia*), balsam poplar (*Populus balsamifera*), and blue-stemmed goldenrod (*Solidago caesia*). The park also includes camping, athletic fields, pavilions, and a playground.

Clockwise from top: Cliffside Park, wood thrush (Steve Maslowski), upland sandpiper (Johnathan Nightingale).

Ravines and Clay Seepage Bluffs

Ravines: "Generally, ravines are defined as steep-sided or V-shaped valleys that are larger than gullies but smaller than canyons. They may contain perennial or intermittent streams, but are typically formed when moving water incises and erodes a channel into the underlying material. (ICMP 2011)"

Clay Seepage Bluff: "Steep, clay bluffs occur along some stretches of the Great Lakes shorelines and less commonly inland on streams draining into Lake Superior and Lake Michigan. Vegetative cover ranges from forested with pines (*Pinus resinosa* and *P. strobus*), white cedar (*Thuja occidentalis*) and white birch (*Betula papyrifera*), to bare clay with only a few herbaceious present. Buffaloberry (*Sheperdia canadensis*) is a characteristic shrub, but more typically, alders (*Alnus incana* and *A. crispa*), as well as herbaceous species such as Canada goldenrod (*Solidago canadensis*) and pearly everlasting (*Anaphalis margaritacea*) are dominant. Both native and exotic pioneers such as fireweed (*Epilobium angustifolium*) and Canada thistle (*Cirsium arvense*) are common, especially on unstable sites. (Epstein 2012)"

Tabor Woods
Tabor Woods, a locally significant natural area, can also be found in Caledonia and consists of 38 acres owned by the Caledonia Land Conservancy. These holdings were named for the Czechoslovakian community that first settled the area (DeBoer 2011). Tabor Woods includes mesic, dry-mesic, and wet-mesic woodland areas and includes beech, hickory, oak, maple and walnut trees. The woodland includes both walking and horseback riding trails throughout the property.

Power Plant Ravine Woods, Oak Creek Power Plant Woods, & Clay Ravine Woods
Other locally significant natural area sites on We Energies property include the 32 acre Power Plant Ravine Woods along Tributary E, 12 acre Clay Ravine Woods along Tributary D, and 18 acre Oak Creek Power Plant Woods. The areas along the tributaries include mesic and dry-mesic woodland and deep ravines that open onto clay banks at Lake Michigan. Oak Creek Power Plant Woods includes mostly mesic woodland. A number of uncommon species are found there including the endangered blue-stemmed goldenrod (*Solidago caesia*). These sites are not open to the public.

Bender Park
Bender Park in Oak Creek is 303 acres and is owned by Milwaukee County. The natural landscape of the park varies including areas of upland and lowland hardwood forests, old orchards, beech forest, shrub-carr, surrogate grasslands, cattail marsh, sedge meadow, and planted prairie. Hiking trails, overlooks, beach access, and a boat launch are among the recreational amenities offered at the park.

Dominant canopy species found within the upland hardwoods include black walnut, American basswood, shagbark hickory, northern red oak, ironwood, and American beech. Dominant tree species found within lowland hardwood forests include eastern cottonwood, green ash, American basswood, black willow, American elm, and boxelder. The beech forest contains American beech, ironwood, northern red oak, and sugar maple. The majority of the upland shrub communities at Bender Park are in the process of natural succession and reverting back to woodlands. Red osier dogwood, gray dogwood, high-bush cranberry, small diameter ash trees, and hawthorn are all present within these areas. The surrogate grasslands at Bender Park have a mixture of old field and prairie plant species. Canada goldenrod, tall goldenrod, New England aster, calico aster, frost aster, common milkweed, big bluestem, Kentucky bluegrass, switch grass, and wild bergamot are prevalent. Prairie

This page: Tabor Woods in late fall. Right, top to bottom: Power Plant Ravine Woods.; Blue-stemmed goldenrod (Source: Bryan Hamlin); Bender Park entrance.

plantings are similar in composition to surrogate grasslands.

The natural communities at Bender Park harbor a number of uncommon, threatened, and endangered plant and animal species. A point count breeding bird survey conducted by DPRC staff in 2012 noted the presence of Henslow's sparrows (*Ammodramus henslowii*), a state-threatened species. Numerous species that the DPRC listed as local concern because they are breeding at only a handful of locations within Milwaukee County: bank swallow (*Riparia riparia*), alder flycatcher (*Empidonax alnorum*), American redstart (*Setophaga ruticilla*), chestnut-side warbler (*Dendrocia pensylvanica*), eastern kingbird (*Tyrannus tyrannus*), orchard oriole (*Icterus spurious*), and clay-colored sparrow (*Spizella pallida*). In addition, numerous species listed by the WDNR as species of concern have also been found breeding at the park: brown thrasher (*Toxostoma rufum*), northern harrier (*Circus cyaneus*), bobolink (*Dolichonyx oryzivorus*), eastern meadowlark (*Sturnella magna*), wood thrush (*Hylocichla mustelina*), blue-winged warbler (*Vermivora pinus*), field sparrow (*Spizella pusilla*), Dickcissel (*Spiza americana*), and the yellow-billed cuckoo (*Coccyzus americanus*). Finally, blue-stemmed goldenrod (*Solidago caesia*), rare variegated horsetail (*Equisetum variegatum*), and species of special concern slender bog arrow-grass (*Triglochin palustre*) and red trillium (*Trillium recurvatum*) are found at the park.

Recent WEPP surveys have confirmed the presence of western chorus (*Pseudacris triseriata*) and northern leopard frogs (*Rana pipiens*). DPRC staff also began conducting snake surveys throughout the summer and fall of 2011. To date, surveys have shown the presence of the northern red-bellied snake (*Storeria occipitomaculata*) and the Butler's gartersnake (*Thamnophis butleri*).

Oak Creek Bluffs & Beach, North Bay Ravine & Beach, & Beach North of MMSD

Other beach, foredune, and bluff natural areas in Wind Point watershed include Oak Creek Bluffs & Beach Clay Ravine Woods, North Bay Ravine & Beach, and Beach North of MMSD. All these sites potentially provide habitat for rare sea rocket (*Cakile edentula*), and species of special concern Ohio goldenrod (*Solidago ohioensis*), and false asphodel (*Tofieldia glutinosa*).

Dominican Creek Ravine, Wind Point Ravine Woods, & Neighborhood Central Walk

Dominican Creek Ravine is roughly 18 acres of woodland along Tributary I that was recently upgraded to a natural area of local significance due to species diversity and containing endangered blue-stemmed goldenrod (*Solidago caesia*). Wind Point Ravine woods is a small ravine woodland harboring red trillium (*Trillium recurvatum*), a State-designated special concern species. Neighborhood Central Walk is a 15 acre parcel located in Caledonia and owned by the Caledonia Land Conservancy. It contains a second growth woodland and neighborhood trails.

Background: North Bay Ravine & Beach; Inset: Sea rocket (Source: Eleanor Saulys).