4.0 Existing & Future Land Use Summary

Highly accurate land use/land cover data was produced for Pike River watershed using several processes. First, the most recent land use/land cover data from SEWRPC and the Village of Mount Pleasant was obtained and mapped in GIS. Next, 2010 USDA aerial photography of the watershed was overlaid on regional and municipal data so that discrepancies could be corrected. Finally, uncertainties in land uses and cover types were field verified and corrected if needed to produce the land use/land cover data and map for Pike River watershed (Table 11; Figure 32).

4.1 Existing Land Use/Land Cover

Agricultural use comprises the most acreage in the watershed 14,174.5 acres (38.5%) followed by single-family residential 6,686.0 acres (18.1%), open space 4,140.9 acres (11.2%), and transportation 3,579.2 acres (9.7%). Most agriculture is located across the western half and central portions of the watershed while single-family homes cover much of the eastern half and northern portions of the watershed. Open space, as defined by vacant and unused lands, wooded areas, and open space belonging to commercial or residential lands with greater than 50% manicured turf or open land, is dispersed across the watershed with much of it concentrated around the main stem of the Pike River. Transportation uses, spread across the watershed and including some larger access routes, make up the fourth largest land cover in the watershed.

Table 11. Current land use/land cover classifications and acreage.

Land Use	Area (acres)	% of Watershed
Agricultural	14,174.5	38.5%
Airport	438.2	1.2%
Cemeteries	121.1	0.3%
Commercial – Under Development	11.4	0.0%
Commercial/Retail	1,152.6	3.1%
Government/Institutional	1,008.9	2.7%
Industrial	1,790.2	4.9%
Industrial – Under Development	12.1	0.0%
Industrial/Business Park	0.0	0.0%
Landfill	202.2	0.5%
Mobile Homes	66.3	0.2%
Multi-Family Residential	997.1	2.7%
Open Space	4,140.9	11.2%
Open Space – Recreational	915.6	2.5%
Open Water	341.7	0.9%
Residential – Under Development	342.4	0.9%
Residential – Commercial Mixed Use	0.0	0.0%
Single-Family Residential	6,686.0	18.1%
Transportation	3,579.2	9.7%
Utility Facilities	102.3	0.3%
Wetlands	781.8	2.1%
Total	**36,864.6**	**100.0%**

Noteworthy-Land Use/Land Cover Definitions:

Agricultural: Land 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.

Airport: Landing strips, runways, those unused lands adjacent to the landing strips and runways, air terminal, airplane storage area, hangars, and airport-related maintenance and storage areas.

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

Commercial – Under Development: Lands committed to commercial use but not yet fully developed, but where development activity is visible on the aerial photograph.

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.

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.

Industrial – Under Development: Lands committed to industrial use but not fully developed with development activity visible on the aerial photograph.

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

Mobile Homes: Mobile home parks, all homes with only a small yard identified.

Multifamily Residential: 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.

Open Spaces: Vacant and unused lands, wooded areas, and open space belonging to commercial or residential lands with greater than 50% manicured turf or open land.

Open Space – Recreational: Outdoor recreational areas including public and private parks, golf courses, campgrounds, zoos, fairgrounds, botanical gardens, swimming beaches, boat launching sites, etc. and adjacent landscaped or mowed lawn areas, maintenance areas, shelters, restrooms, and other support buildings.

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

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

Single-Family Residential: Entire lots of single family homes for lots less than five acres. For residential lots of more than 5 acres, only the house, garage, driveways, and small yard were included.

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

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

Wetlands: Land cover that includes all wetlands on public and private land characterized by both hydric soils and the growth of hydrophytes.

A few other common land use/cover types include industrial (1,790.2 acres; 4.9%), commercial/retail (1,152.6 acres; 3.1%), government/institutional (1,008.9 acres; 2.7%), multi-family residential (997.1 acres; 2.7%), and recreational open space (915.6 acres; 2.5%). The majority of the industrial uses are found in the northern portions of the watershed and adjacent to the Kenosha Regional Airport. The bulk of the commercial and retail uses are found in the northern portions of the watershed as well. Multi-family residential is found throughout much of the developed portions of the watershed and especially in the southeastern portion. Recreational open space is also dispersed throughout the watershed with larger recreational areas including Petrifying Springs Park, Sanders Park, and the Maplecrest Country Club in the town of Somers.

Total open space land uses comprised of agricultural lands, parks, golf courses, open turf areas, woodlands, open water, and wetlands make up 20,354.5 acres or 55% of the watershed. Developed land uses account for the remaining 16,510.1 acres or 45% of the watershed.

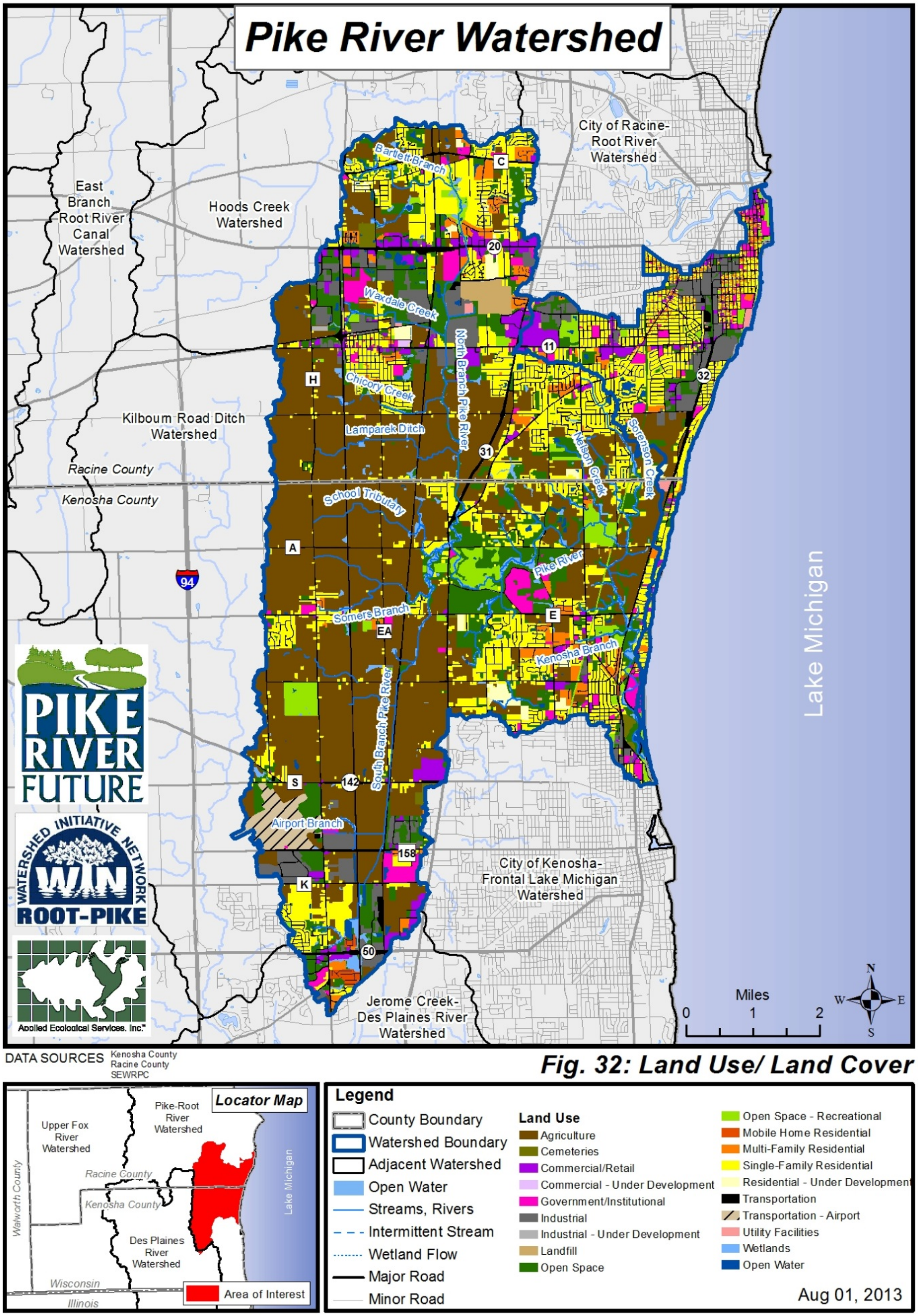


Fig. 32: Land Use/ Land Cover

4.2 Future Land Use/Land Cover Predictions

Information on predicted future land use/land cover for the watershed was first obtained from SEWRPC's 2035 Regional Comprehensive Plans for Kenosha and Racine counties, which was adopted by each local government with the exception of the City of Racine. The City of Racine adopted its own comprehensive plan and this was used to determine future land use/land cover for Racine. Available data was analyzed and GIS was used to map predicted land use/land cover changes. The results are summarized in Table 12 and depicted on Figure 33.

Table 12 compares existing land use/land cover acreage to predicted future (2035) land use/land cover acreage. The largest loss of a current land use/land cover is expected to occur on agricultural land (-10,721.3 acres; -29.1%) concentrated across the central and western portions of the watershed. This represents a massive conversion of agricultural lands to other more developed uses. Other losses occur on areas that are currently open lands (-352.9 acres; -1.0%) and residential areas that are under development (-342.4 acres; -0.9%) as these areas will eventually become developed.

Conversely, single-family residential development is predicted to increase the most (+7,076.9 acres; +19.2%) followed by industrial (+1,792.9 acres; +4.9%), industrial/business park (+1,028.7 acres; 2.8%), and commercial/retail (745.8 acres; +2.0%). The majority of the single-family residential development will occur across the central region of the watershed, namely in Somers, as agricultural land adjacent to expanding developed areas will be converted to new subdivisions. Most of the predicted industrial, industrial/business park, and commercial/retail developments are predicted to occur in the southwestern portion of the watershed, with some additional development in the northwest.

Table 12. Current and 2035 (predicted) land use/land cover, including percent change for each land use/land cover.

Land Use/Land Cover	Current Area (acres)	Current % of Watershed	Predicted Area (acres)	Predicted % of Watershed	Change (acres)	Change (%)
Agricultural	14,174.5	38.5%	3,453.2	9.4%	-10,721.3	-29.1%
Airport	438.2	1.2%	438.2	1.2%	0.0	0.0%
Cemeteries	121.1	0.3%	121.1	0.3%	0.0	0.0%
Commercial – Under Development	11.4	0.0%	0.0	0.0%	-11.4	0.0%
Commercial/Retail	1,152.6	3.1%	1,898.4	5.1%	745.8	2.0%
Government/Institutional	1,008.9	2.7%	1,476.9	4.0%	467.9	1.3%
Industrial	1,790.2	4.9%	3,583.1	9.7%	1,792.9	4.9%
Industrial – Under Development	12.1	0.0%	0.0	0.0%	-12.1	0.0%
Industrial/Business Park	0.0	0.0%	1,028.7	2.8%	1,028.7	2.8%
Landfill	202.2	0.5%	202.2	0.5%	0.0	0.0%
Mobile Homes	66.3	0.2%	66.3	0.2%	0.0	0.0%
Multi-Family Residential	997.1	2.7%	1,075.6	2.9%	78.5	0.2%
Open Space	4074	11.1%	3,788.0	10.3%	-286.0	-0.1%
Open Space – Recreational	915.6	2.5%	1,123.7	3.0%	141.2	0.4%
Open Water	341.7	0.9%	338.9	0.9%	-2.8	0.0%
Residential – Under Development	342.4	0.9%	0.0	0.0%	-342.4	-0.9%
Residential – Commercial Mixed Use	0.0	0.0%	59.5	0.2%	59.5	0.2%
Single-Family Residential	6,686.0	18.1%	13,762.9	37.3%	7,076.9	19.2%
Transportation	3,579.2	9.7%	3,579.2	9.7%	0.0	0.0%
Utility Facilities	102.3	0.3%	102.3	0.3%	0.0	0.0%
Wetlands	781.8	2.1%	766.5	2.1%	-15.4	0.0%
Total	**36,864.6**	**100.0%**	**36,864.6**	**100.0%**	**0.0**	**0.0%**

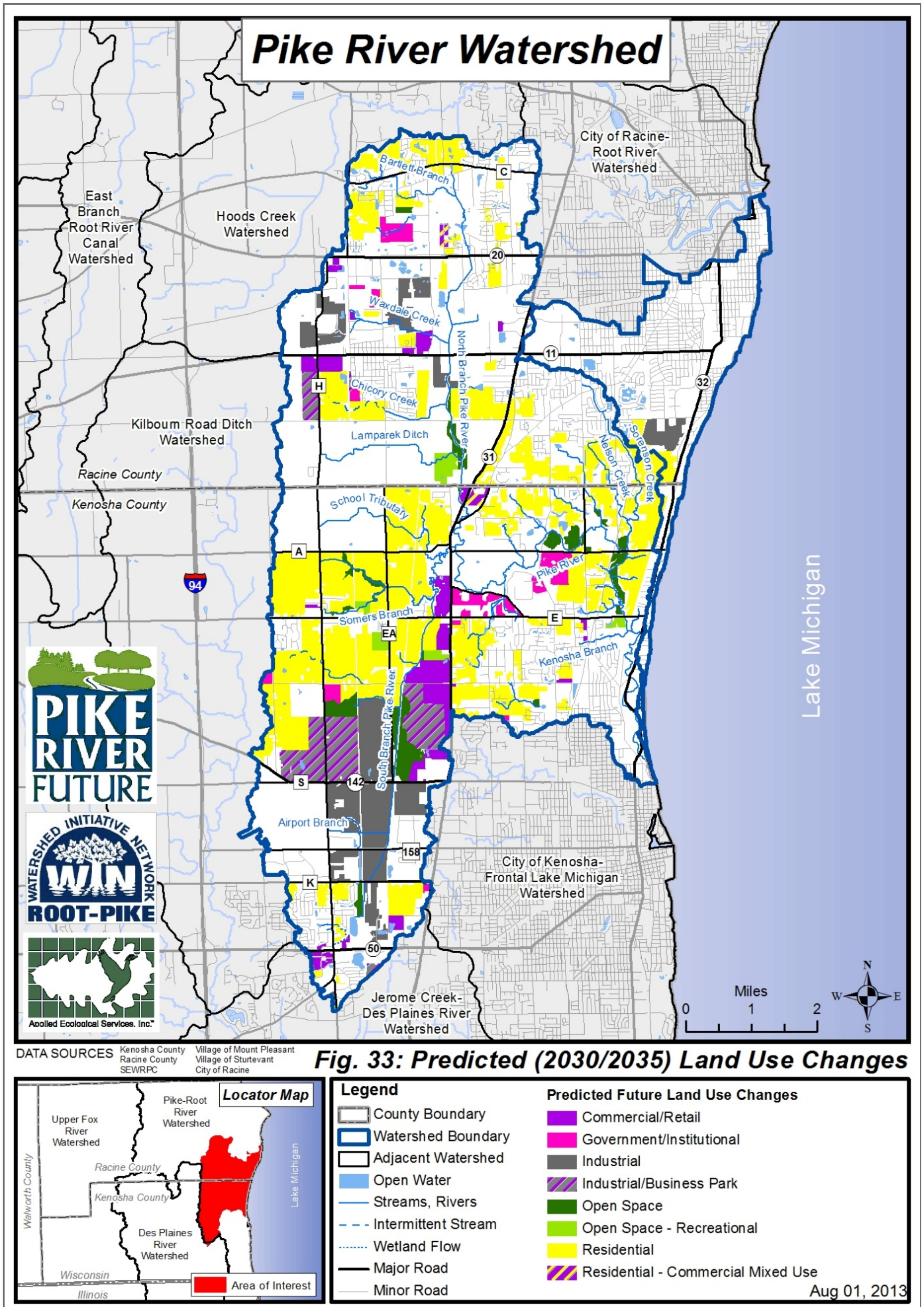
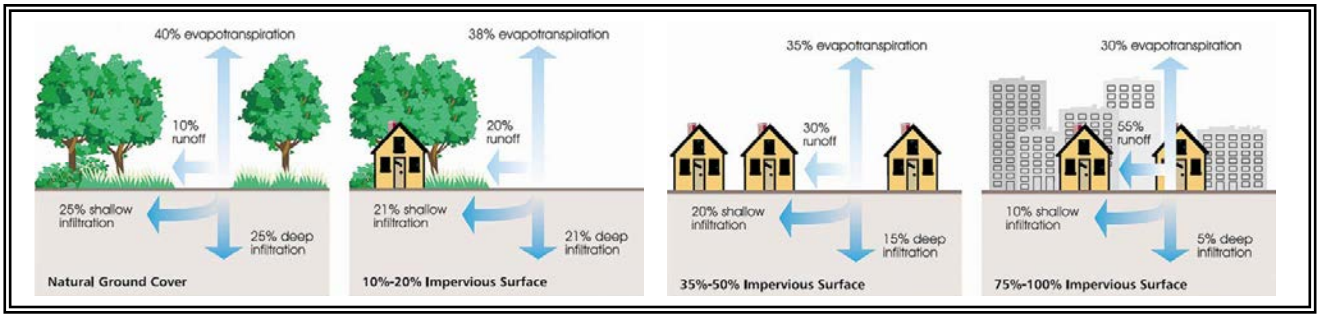


Fig. 33: Predicted (2030/2035) Land Use Changes

4.3 Impervious Cover Impacts

Impervious cover is generally defined as the sum of roads, parking lots, sidewalks, rooftops, and other 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.

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 13). In general, Sensitive subwatersheds have less than 10% impervious cover, stable channels, good habitat, good water quality, and diverse biological communities whereas streams in Non-Supporting subwatersheds generally have greater than 25% impervious cover, highly degraded channels, 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. As a result, biological communities shift from sensitive species to ones that are more tolerant of pollution and hydrologic stress.



Source: The Federal Interagency Stream Restoration Working Group, 1998 (Rev. 2001).

Figure 34. Relationship between impervious surfaces, evapotransporation, & infiltration.

Table 13. Impervious categories and descriptions based on the CWP's Impervious Cover Model.

Category	% Impervious Cover	Subwatershed Description
Sensitive	10% or less	Generally exhibits very little impervious cover (≤10%), stable stream channels, excellent habitat, good water quality, and diverse biological communities.
Impacted	Greater than 10% and less than 25%	Generally possesses moderate impervious cover (11-25%), and somewhat degraded stream channels, altered habitat, decreasing water quality, and fair-quality biological communities.
Non-Supporting	Greater than 25%	Generally has high impervious cover (>25%), and highly degraded stream channels, degraded habitat, poor water quality, and poor-quality biological communities.

Source: (Zielinski 2002)

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 are conveyed 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). According to NR 102: Water Quality Standards for Wisconsin Surface Waters, the standard for fish and aquatic life waters is not to exceed 89°F.

Hydrology and Flow Impacts
Higher impervious cover translates to greater runoff volumes thereby changing hydrology and flows. 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.

4.4 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 below to classify Subwatershed Management Units (SMUs).

AES used a modified *Vulnerability Analysis* to compare each SMU's vulnerability to projected land use changes across Pike River watershed. Three steps were used to generate a vulnerability ranking of the SMUs. The results are 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 in the following pages:

Step 1: Initial classification of SMUs based on existing land use/land cover and impervious cover
Step 2: Future classification of SMUs based on predicted (2035) land use/land cover and impervious cover
Step 3: Vulnerability Ranking of SMUs based on changes in impervious cover

Step 1: Initial Classification
Step 1 in the Vulnerability Analysis is an initial classification of each SMU based on existing measured impervious cover. Calculating existing and predicted impervious cover in Pike River watershed begins with an analysis of land use/land cover. Existing impervious cover is calculated by assigning an impervious cover percentage for each land use/land cover category based upon the U.S. Department of Agriculture's (USDA) Technical Release 55 (TR55) (USDA 1986). TR55 provides estimates of impervious cover based on land use categories. GIS analysis is used to estimate the percent impervious cover for each SMU in the watershed using existing and predicted land use/land cover data. Each SMU then receives an initial classification (Sensitive, Impacted, or Non-Supporting) based on percent of existing impervious cover (Table 14; Figure 35).

Four SMUs are classified as Sensitive, eight as Impacted, and eight as Non-Supporting based on existing impervious cover. The four Sensitive SMUs (SMU 8, 9, 12, and 13) are located in the western portion of the watershed. These SMUs are located in areas where agriculture is the most prevalent land use. Most of the Impacted SMUs (SMU 1, 6, 7, 10, 11, 16, 17, and 18) are located across the middle of the watershed where suburban residential development dominates. The majority of the Non-Supporting SMUs (SMU 2, 3, 4, 5, 14, 15, 19, and 20) are associated with highly impervious land uses surrounding the more densely populated areas of Racine, Kenosha, Mount Pleasant, and Sturtevant.

Step 2: Future Classification
Predicted (by 2035) impervious cover was evaluated in Step 2 of the vulnerability analysis by classifying each SMU as Sensitive, Impacted, or Non-Supporting. Figure 36 depicts predicted 2035 impervious cover classifications for each SMU. This step identifies Sensitive and Impacted SMUs that are most vulnerable to future development pressure. SMUs 1, 6, 9, 10-13, and 16-18 changed impervious classification compared to existing conditions. SMUs 1, 6, 10, 11, and 16-18 changed

from Impacted to Non-Supporting. SMU 9 changed from Sensitive to Impacted, while SMUs 12 and 13 changed from Sensitive to Non-Supporting. These changes are attributed to predicted commercial, industrial, and residential development that will increase impervious cover.

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 projected conditions?

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

Low = no change in classification; <10% change in impervious cover
Medium = classification change and/or >10% change in impervious cover
High = classification change, particularly within a sensitive area and/or >10% change in impervious cover

The vulnerability analysis resulted in 9 High, 4 Medium, and 7 Low ranked SMUs (Table 14; Figure 37). SMUs 1, 5, 9-13, 17, and 18 are ranked as highly vulnerable to future problems associated with impervious cover. SMUs 12 and 13 are expected to change classification and both are expected to see at least a 30% increase in impervious cover. SMUs 1, 6, 10, 11, 17, and 18 are classified as Impacted based on existing conditions but could see a 8-37% increase in impervious cover based on future land use predictions and are all expected to change classification to Non-Supporting. SMU 9 is expected to change classification from Sensitive to Impacted and see an 8% increase in impervious cover.

SMUs 4, 7, and 14 are ranked as moderately vulnerable to predicted land use changes because each is likely to see at least a 10% increase in impervious cover, but none of these are predicted to change in classification. SMU 16 is also ranked as moderately vulnerable as it is expected to change classification from Impacted to Non-Supporting, but its overall change in impervious cover should be less than 10%

The results of this analysis clearly point to the middle-western portion of the watershed as the critical area where future development could result in negative impacts to Pike River downstream. It will be important to develop this area using Conservation Design or Low Impact Design (LID) standards that incorporate the most effective and reliable Stormwater Treatment Train practices whereby stormwater is routed through various Management Measures prior to being released from the site. Currently, there are no conservation or low impact design ordinances in the Pike River watershed.

Table 14. Existing & predicted (2035) impervious cover for Subwatershed Management Units (SMUs).

SMU #	Step 1: Existing Impervious %	Existing (2012) Impervious Classification	Step 2: Predicted Impervious %	Predicted Impervious Classification	Percent Change	Step 3: Vulnerability
SMU1	17.3%	Impacted	31.2%	Non-Supporting	13.9%	High
SMU2	34.4%	Non-Supporting	40.9%	Non-Supporting	6.5%	Low
SMU3	36.4%	Non-Supporting	46.1%	Non-Supporting	9.7%	Low
SMU4	30.2%	Non-Supporting	47.9%	Non-Supporting	17.7%	Medium
SMU5	38.5%	Non-Supporting	44.8%	Non-Supporting	6.3%	Low
SMU6	10.2%	Impacted	34.0%	Non-Supporting	23.8%	High
SMU7	10.8%	Impacted	21.2%	Impacted	10.4%	Medium
SMU8	3.4%	Sensitive	3.6%	Sensitive	0.2%	Low
SMU9	4.3%	Sensitive	12.3%	Impacted	8.0%	High
SMU10	12.1%	Impacted	48.9%	Non-Supporting	36.8%	High
SMU11	11.4%	Impacted	30.8%	Non-Supporting	19.4%	High
SMU12	5.0%	Sensitive	36.9%	Non-Supporting	31.9%	High
SMU13	5.1%	Sensitive	54.2%	Non-Supporting	49.1%	High
SMU14	29.9%	Non-Supporting	59.2%	Non-Supporting	29.3%	Medium
SMU15	34.5%	Non-Supporting	43.8%	Non-Supporting	9.3%	Low
SMU16	13.7%	Impacted	22.6%	Non-Supporting	8.9%	Medium
SMU17	21.0%	Impacted	33.5%	Non-Supporting	12.5%	High
SMU18	17.3%	Impacted	33.1%	Non-Supporting	15.8%	High
SMU19	33.2%	Non-Supporting	38.2%	Non-Supporting	5.0%	Low
SMU20	45.5%	Non-Supporting	48.6%	Non-Supporting	3.1%	Low

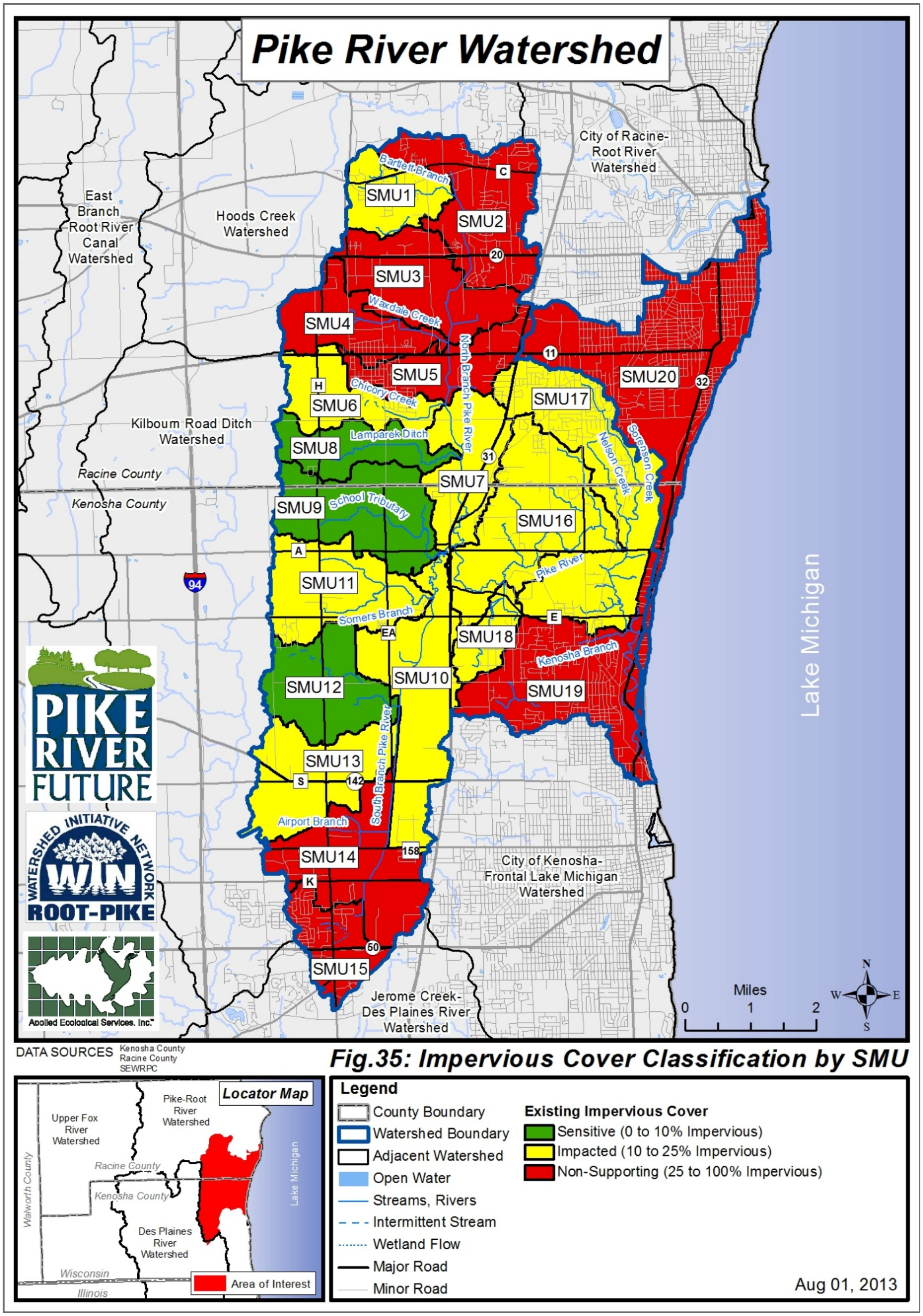


Fig.35: Impervious Cover Classification by SMU

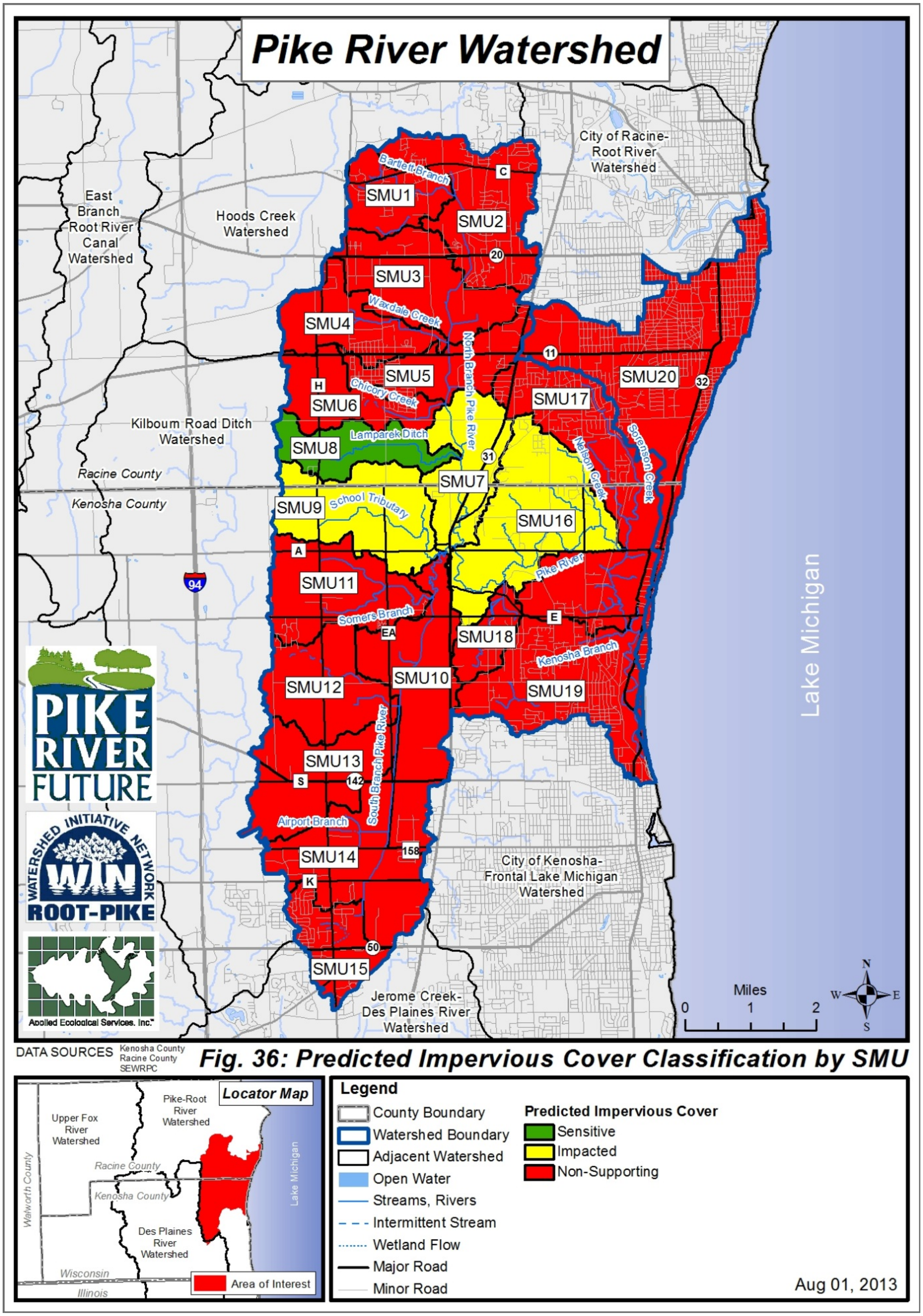


Fig. 36: Predicted Impervious Cover Classification by SMU

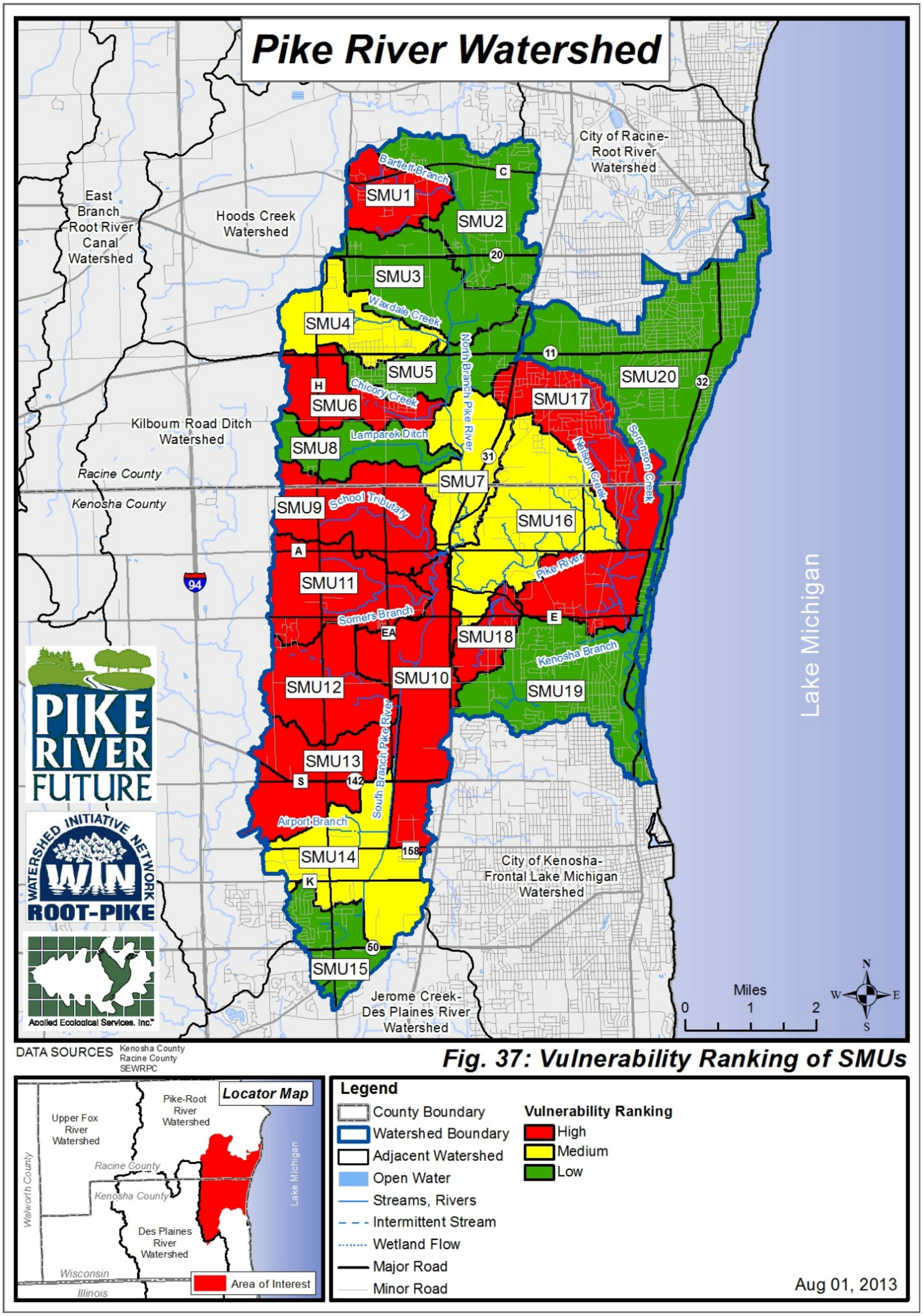


Fig. 37: Vulnerability Ranking of SMUs

4.5 Conservation Design

(paraphrased from SEWRPC's The Conservation Subdivision Design Process, 2010)

"Conservation 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. The preserved open space is typically preserved or restored natural areas that are integrated with newer natural stormwater 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. "Conservation Design" is also known as cluster or open space design.

Figure 38. Conventional vs. Conservation Development Design (Elkhorn, WI).

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:

Prairie Crossing, Grayslake IL

Step 1: Identify and analysis of existing site conditions including: all natural resources, conservation areas, potential restoration areas, natural drainage systems and their connections, physical features, and scenic areas.

Step 2: Delineation of preservation areas.

Step 3: Design of the lots and transportation system.

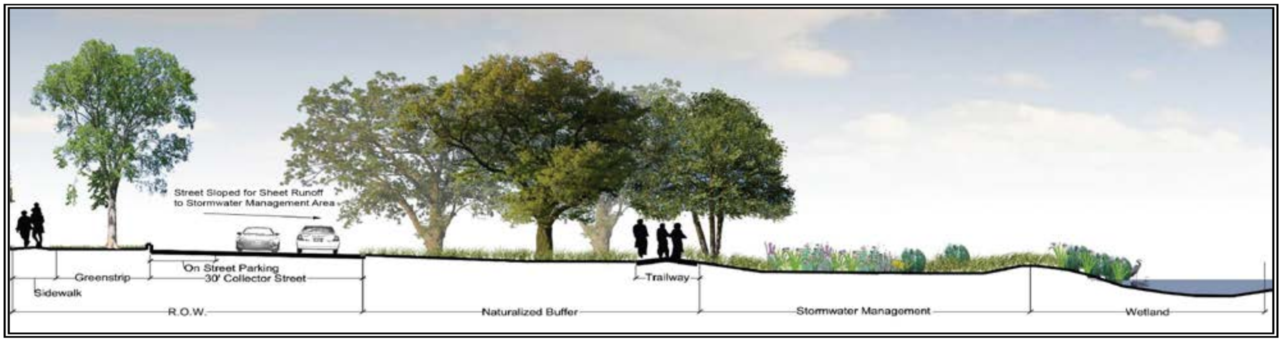


Figure 39. Example of stormwater treatment train within conservation development.

4.6 Low Impact Development (LID)

"Low Impact Design" 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 process that promote water infiltration, native plant evapotransiration and stormwater reuse.

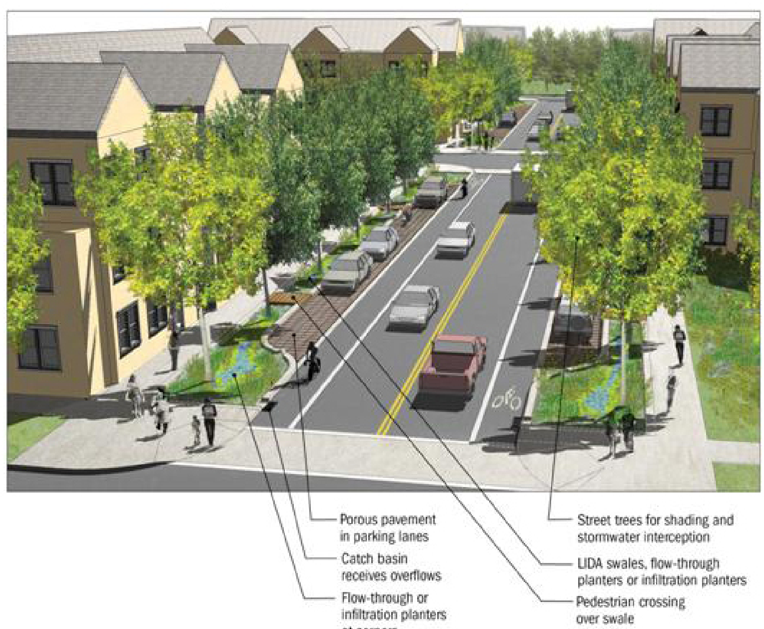


Figure 40. Greener Streetscape using LID practices. Source: Washington County, 2012.

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 raingardens 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 Metropolitian Sewerage District has been influential in determining pollutant reductions for various LID methodologies. Below is a list of possible practices, as described by MMSD in, "Evaluation of Stormwater Reduction Practices (MMSD 2003)."

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