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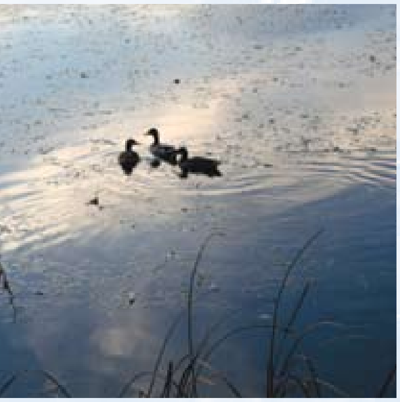
Lawrence Creek Watershed Plan

Technical Report




September 2008

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The planning process was coordinated by CMAP and KREP. Contributions to the plan include Jesse Elam, Kristin Heery, Lori Heringa, and Tim Loftus of CMAP, and Lisa Haderlein of KREP. Nathan Hill of KREP provided GIS consultation and map analysis. Hey and Associates, Inc. provided assistance with urban best management practices and ecosystem restoration recommendations. The authors gratefully acknowledge the many contributors to this planning process and especially thank the staff of the City of Harvard, McHenry County Conservation District, McHenry County Soil and Water Conservation District, Natural Resources Conservation Service, and McHenry County Health Department.

Finally, the authors wish to acknowledge the work and stewardship role of the Kishwaukee River Ecosystem Partnership. Prior to this planning process, KREP developed initial watershed plans for each of the 42 subwatersheds of the Kishwaukee River Basin. The KREP-developed watershed plan for Lawrence Creek was a valuable component to the award-winning Section 319 grant application. KREP's reputation, reconnaissance of watershed resources, and knowledge of the river basin proved useful throughout the planning process.

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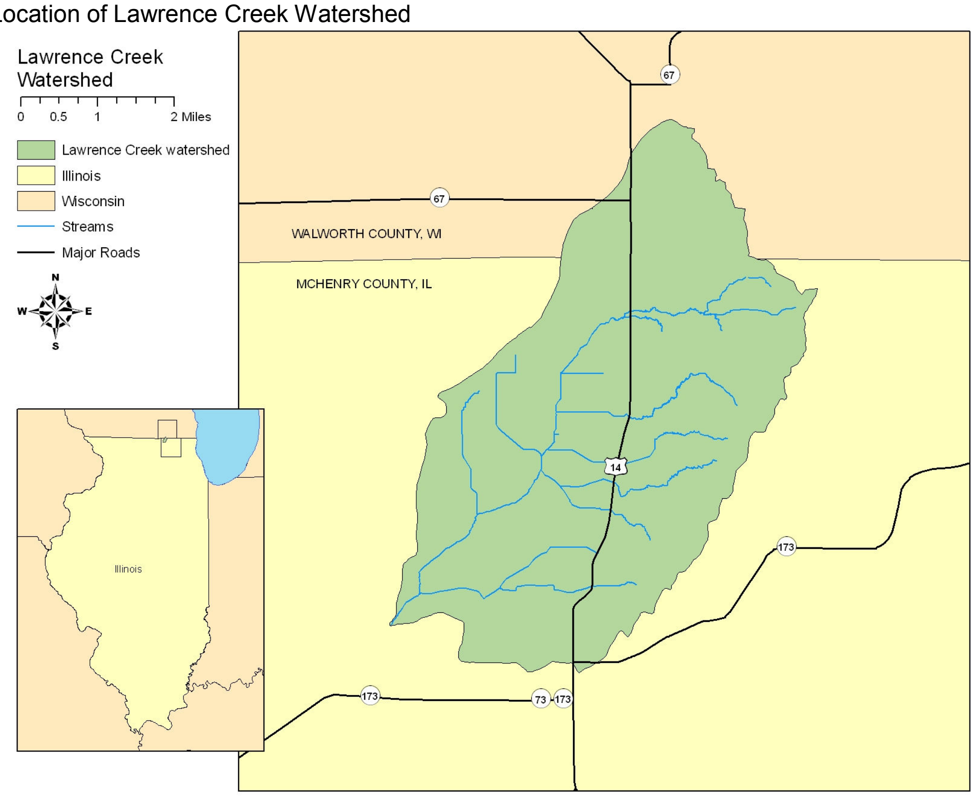
1. INTRODUCTION

1.1 Overview

The Lawrence Creek Watershed (Hydrologic Unit Code 0709000603) is located in northwest McHenry County, Illinois, with headwaters stretching north into Walworth County, Wisconsin. Lawrence Creek is a mostly rural watershed dominated by agricultural land use in the upper reaches (>90 percent) while the lower portion of the watershed features a more mixed land-use pattern that includes the north side of the City of Harvard. Lawrence Creek has achieved only partial attainment for the aquatic life designation, but the Illinois EPA has been unable to identify either potential causes or sources of impairment[1]. Given the predominance of agricultural land use in the watershed, it is likely a combination of channelization, sedimentation, and nutrient enrichment that contribute to the poor water quality and degraded state of aquatic life. The Kishwaukee River Ecosystem Partnership (KREP), for example, has found that nearly two-thirds of all Lawrence Creek stream reaches are channelized, and heavily encroached upon by agriculture. At one time a permitted point-source discharge, the now-closed Big Creek Cattle Company, accounted for the entire flow of an upstream reach of Lawrence Creek during periods of low flow. However, there are no permitted industrial or municipal discharges to the creek at this point. The goal of this Plan is to protect a healthy aquatic community in Lawrence Creek. The recommendations offered below focus on enhanced implementation of agricultural best management practices and new policy recommendations aimed at both county and municipal levels of government.

Figure 1-1. Location of Lawrence Creek Watershed



Source: CMAP

[1] Illinois Integrated Water Quality Report and Section 303(d) List – 2006. Illinois EPA, Bureau of Water. IEPA/BOW/06-002

The Lawrence Creek Watershed encompasses 21.5 square miles, draining southwest, through the City of Harvard, before flowing into the Piscasaw Creek. The City of Harvard (population of 7,996 in the 2000 Census) is the primary municipality in the watershed, other than unincorporated county land in Alden and Chemung Townships. The stream itself is a high gradient, 4th order stream. More detailed descriptions of the watershed features can be found in the subwatershed report developed by KREP.[2]

1.2 Plan Guidance

There are two major sources of guidance for this plan. One is the U.S. Environmental Protection Agency guidelines for watershed-based plans[3] under the Clean Water Act (CWA) and for the award of CWA Section 319 grants to control nonpoint-source pollution, the type of pollution that includes sediment running off of cropland or oil from a parking lot but not a direct discharge from an industrial operation or a wastewater treatment plan. The guidelines specify that watershed plans should, at a minimum, contain the following nine elements:

(a) An identification of the causes and sources that need to be controlled to achieve pollutant load reductions estimated in this plan;
(b) An estimate of the load reductions expected for the management measures described under (c) below;
(c) A description of the non-point source management measures that will need to be implemented to achieve the load reductions estimated under (b) above;
(d) An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement this plan;
(e) An information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing the nonpoint source management measures that will be implemented;
(f) A schedule for implementing the non-point source management measures identified in this plan;
(g) A description of interim, measurable milestones for determining whether non-point source management measures or other control actions are being implemented;
(h) A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards; and
(i) A monitoring component to evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) above.

The other source of guidance is the product of the Basinwide Management Advisory Group (B-MAG), a collection of stakeholders who came together in 2003 to help Illinois EPA devise an alternative to the Facility Planning Area review process.[4] The B-MAG's main recommendation was for local governments, with assistance from an authorized agent, to develop watershed plans to control point source and nonpoint source pollution both now and in consideration of expected watershed change. The B-MAG also produced a framework for a watershed plan, as given in Table 1-1,[5] which was used for the overall organization of the plan. However, the major relevance of the B-MAG framework is that Illinois EPA is

[2] Lawrence Creek Subwatershed Plan prepared by KREP
http://131.156.41.151/KREP_PUBS/SUBWATERSHED_REPORTS/Lawrence%20Creek%20SW%20Summary.pdf
[3] Federal Register / Vol. 68, No. 205 / Thursday, October 23, 2003 / Notices. Environmental Protection Agency [FRL-7577-6] Nonpoint Source Program and Grants Guidelines for States and Territories. Pgs. 60653-60674.
[4] http://www.epa.state.il.us/water/watershed/facility-planning/.
[5] *Framework for a Basinwide Planning and Protection Pilot*, p. 29.
http://www.epa.state.il.us/water/watershed/facility-planning/basinwide-framework.pdf

expected to make permitting and financial assistance consistent with the watershed action plan, pending adoption by local governments and a public comment period.[6]

Table 1-1. Framework for a Basinwide Planning and Protection Pilot

1. Inventorying and Assessment (more detailed than the State plan drawing on local information)
    a. Describe sources of water quality degradation;
    b. Identify current land uses;
    c. Assess existing local regulations; and,
    d. Describe and/or quantify existing protections such as NPDES permits, Phase II plans, existing ordinances, CRP and CREP acreage, etc.
2. Estimation of Future Needs and Concerns
    a. Estimate twenty-year (or different time period, as appropriate to the planning area) growth patterns and land uses;
    b. Estimate expected changes in sources of degradation in water quality ; and,
    c. Identify funding, site-specific projects, policy changes and other resources needed to continue and expand (if necessary) protection programs.
3. A Vision For The Watershed
    a. Outline issues and opportunities, incorporating local communities comprehensive and other plans;
    b. A vision for wastewater treatment and water supply and possibly other infrastructure;
    c. A vision for land use; and,
    d. A vision for protection and/or restoration of water quality.
4. Plan for Implementing the Vision
    a. Identify a plan for protection and/or restoration of water quality;
    b. Identify steps needed to achieve surface water quality protections;
    c. Identify steps needed to protect groundwater quality;
    d. Estimate pollutant reductions that will be achieved through implementing protections;
    e. Identify tools that could be used to achieve these goals;
    f. Identify monitoring and enforcement tools for use by state and local officials;
    g. Identify the amount of funding and technical assistance needed to implement the watershed plan, possible funding and technical assistance sources, site-specific projects, policy changes, and steps to secure the needed resources;
    h. Identify ways to ensure consistency with local communities plans; and,
    i. Set a schedule for implementing the actions identified in steps a. through h.
5. Metrics for Evaluation
    a. Identify interim, measurable milestones for determining whether the action steps above are being implemented;
    b. Criteria to determine whether pollutant reductions are occurring and progress is being made toward water quality goals; and,
    c. A monitoring and evaluation plan to evaluate the effectiveness of the Watershed Plan and its implementation.

1.3 The Planning Process

The planning process in the Lawrence Creek Watershed was designed to be stakeholder driven and inclusive of citizens and elected officials alike. Meetings were co-facilitated by staff from both CMAP and the Land Conservancy of McHenry County. While each meeting had an agenda, the format for

[6] *Ibid.*

discussion was interactive and informal. Meeting location was consistently the Harvard Diggins Public Library at 900 East McKinley Street in Harvard.

Watershed planning was launched with a well-attended meeting in April 2007. Six additional stakeholder meetings were conducted during 2007 and stakeholders met four more times in 2008. Thus, a total of eleven stakeholder meetings took place over the eighteen month planning period. Participation was generally very good and consistent, including some landowners and officials who attended the meetings.

A compendium of meeting agendas and attendee sign-in sheets is included in the Appendix.

2. INVENTORY AND ASSESSMENT

2.1 Sources of Water Quality Degradation

2.1.1 DATA AVAILABILITY

The Illinois Pollution Control Board is charged with assigning designated uses to streams. In order to protect those designated uses, it develops water quality standards specific for each use. There are seven different designated uses in Illinois, as listed in the left hand column in Table 2-1. Five of the uses apply to Lawrence Creek. The Illinois EPA has found that Lawrence Creek was not supporting the aquatic life designated use and can be considered impaired. Generally, determinations of impairment are made through the Intensive Basin Survey program in which Illinois EPA and DNR sample various streams in a river system every five years. However, the impairment in Lawrence Creek was determined through a one-time sampling of the stream in 1993 as a part of a Facility Related Stream Survey. The facility of concern at the time, Big Foot Cattle Company, has since ceased operation. Yet the impairment designation has been carried forward to the publication of the 2006 *Integrated Water Quality Report*, the document which lists the water bodies in the state which are not meeting their designated uses.

Table 2-1. Designated uses and impairments in Lawrence Creek

Designated Use	Applies to Lawrence Creek?	Assessed in 2006 303(d) list?	Impaired?
Aquatic Life	Y	N	Y
Fish Consumption	Y	N	—
Public and Food Processing Water Supplies	N	—	—
Primary Contact	Y	N	—
Secondary Contact	Y	N	—
Indigenous Aquatic Life	N	—	—
Aesthetic Quality	Y	N	—

Illinois EPA primarily uses biological data to assess whether streams are supporting the aquatic life designated use. These data are combined into an index for fish (the Index of Biotic Integrity) and an index for various animals like insect nymphs, snails, and others collectively called macroinvertebrates (the Macroinvertebrate Biotic Index). As shown in Table 2-2, a score of less than 41 on the Index of Biotic Integrity or a score of more than 5.9 on the Macroinvertebrate Biotic Index indicates that a stream is not supporting aquatic life. (Increasing values of the Macroinvertebrate Biotic Index indicate lower quality.) In the 1993 survey, MBI scores suggested that Lawrence Creek was moderately impaired and that the industrial discharge contributed to the impairment. Since then no MBI studies have been conducted.

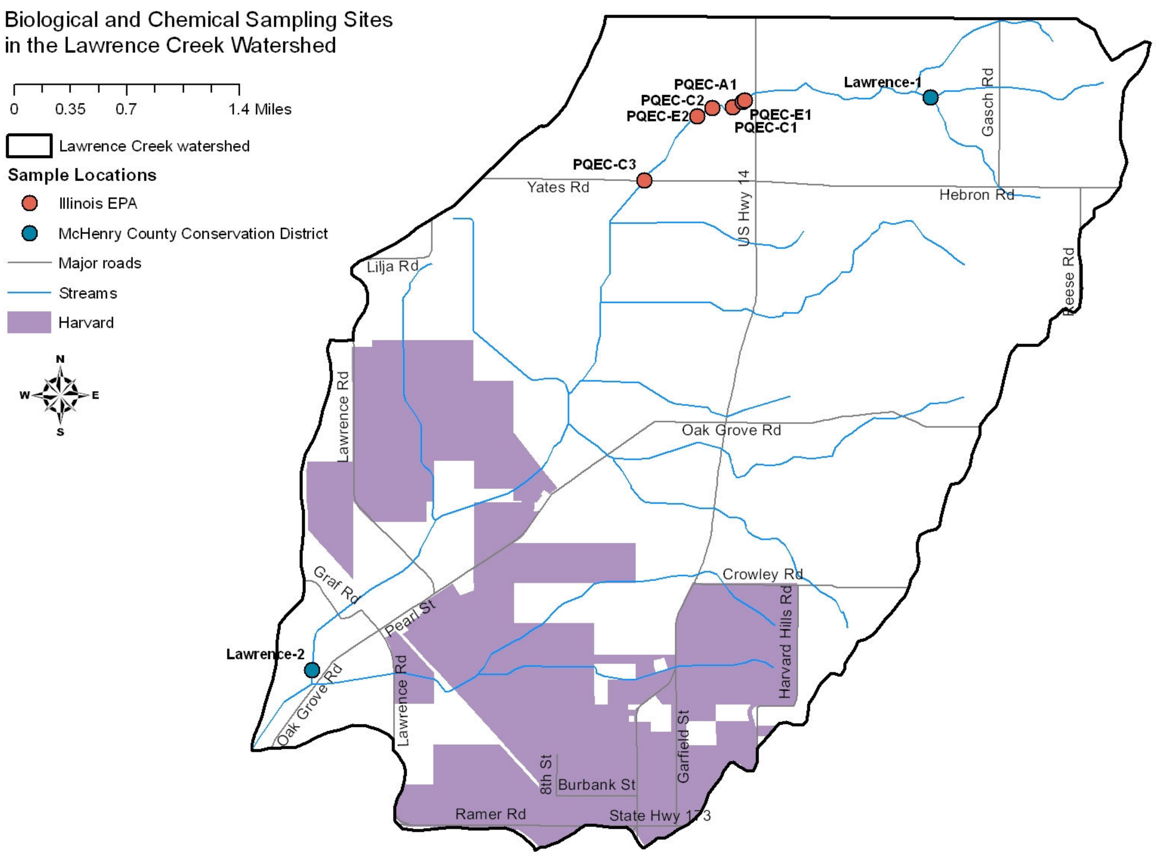
Table 2-2. Biological indicators of aquatic life impairment

Biological Indicator			
Index of Biotic Integrity (IBI)	≤ 20	$20 < IBI < 41$	≥ 41
Macroinvertebrate Biotic Index (MBI)	> 8.9	$5.9 < MBI < 8.9$	≤ 5.9
Interpretation			
Impairment Status	Severe Impairment	Moderate Impairment	No Impairment
Designated Use Support	Not Supporting	Not Supporting	Fully Supporting
Resource Quality	Poor	Fair	Good

Source: Integrated Water Quality Report (2006)

The McHenry County Conservation District collected fish data at two sample points along the stream, measuring the Index for Biotic Integrity at these points. One site was sampled in 1995, the other in 2005; no chemical analysis was performed during this sampling (Figure 2-1, Table 2-3). The 1995 measurement suggested moderate impairment, but it was taken near the headwaters where IBI is potentially less reliable. Ten years later, MCCD took fish samples near the mouth of the stream and calculated an IBI score (44) that indicated good conditions. The two MCCD data points and the Facility Related Stream Survey represent the only available information on biological conditions in the stream. In order to fully support aquatic life use and have "good" resource quality, the Index of Biotic Integrity should be above 41 and the Macroinvertebrate Biotic Index below 5.9. Available data are inconclusive in regard to the actual impairment status of Lawrence Creek and need to be supplemented by a monitoring program such as that described in Section 6.

Figure 2-1.



Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map.
Source: CMAP, IEPA, and McHenry County Conservation District.

Table 2-3. Water quality and biological sample points

Point	Organization	Year	MBI	IBI
PQEC – A1	Illinois EPA	1993	6.0	—
PQEC – C1	Illinois EPA	1993	7.3	—
PQEC – C2	Illinois EPA	1993	7.7	—
PQEC – C3	Illinois EPA	1993	6.1	—
PQEC – E1 (Cattle Company discharge)*	Illinois EPA	1993	—	—
PQEC – E2 (Gravel Quarry discharge)*	Illinois EPA	1993	—	—
Lawrence #1	McHenry County Conservation District	1995	—	38
Lawrence #2	McHenry County Conservation District	2005	—	44

Note: Samples PQEC-C1, C2, and C3 were downstream of the Big Foot Cattle Company discharge
* Samples taken at discharges only measured chemistry.

2.1.2 CAUSES OF AQUATIC LIFE IMPAIRMENT

Once aquatic life is determined to be impaired, Illinois EPA tries to determine potential causes of impairment based, if possible, on exceeding numeric water quality standards, but on other measures if necessary. The Illinois EPA has attributed aquatic life impairment in Lawrence Creek to total nitrogen and total phosphorus downstream of the Big Foot Cattle Company discharge; above the discharge it considers the cause of impairment to be unknown. Other chemical parameters measured for the Facility Related Stream Survey (FRSS) were largely within applicable limits (Table 2-4). Concentrations of ammonia nitrogen did exceed limits, but only at the Big Foot Cattle Company discharge sampling site (E1). The downstream concentration was elevated, although it was within the General Use Standard. In addition, elevated levels of conductivity, nitrate and nitrite, phosphorus, COD, BOD, sodium, potassium, aluminum, boron, and strontium were found downstream of the discharge, but all were within General Use Standards. Samples seem to indicate that although the now-inactive meat packer did impact the stream, recovery was quick and downstream locations felt little impact.

Table 2-4. Water quality data from Illinois EPA

	Constituent (mg/L)						
Sample Point	TSS	NH4-N	TP	DO	COD	BOD	NO2+NO3
A1 (upstream of Big Foot discharge)	6	0.02	0.03	10.05	12	2	0.4
E1 (Big Foot Cattle Company discharge)	8	6.2	2.6	2.07	53	8	32
C1 (downstream of Big Foot discharge)	6	0.91	0.64	8.25	20	4	8.1
C2 (downstream of Big Foot discharge)	3	0.05	0.57	15.14	18	—	8.4
E2 (Quarry discharge)	32	0.04	0.03	9.87	5	—	6.8
C3 (downstream of discharges)	9	0.01	0.03	11.96	5	—	6.7

Source: Data collected for IEPA Facility-Related Stream Survey Report, 1993.

Professional judgment suggests that in a largely agricultural watershed, the chemical parameters of concern would include nitrogen and phosphorus, even in the absence of a point source discharger. Sedimentation could also be expected to be high. Biological oxygen demand could be an issue with animal stock, but there are few operations in the watershed. The snapshot-in-time data collected during the FRSS provide some perspective on these parameters, at least in the upper part of the watershed. Total phosphorus was quite low except in the vicinity of the Big Foot discharge; it is below the 0.05 mg/L Illinois phosphorus standard for lakes and streams draining into lakes and below the USEPA stream criterion of 0.0725 mg/L.[7] The limited data in Table 2-3 suggest that elevated levels of total phosphorus were due entirely to the Big Foot Cattle Company discharge. Now that that discharger has ceased operation, phosphorus should not be considered a cause of impairment if there are no further data to suggest otherwise.

Total suspended solids (an indicator of sedimentation) levels were low, well below the 116 mg/L statistical guideline used by Illinois EPA (Table 2-5).[8] However, sediment levels are highly sensitive to streamflow and these data were collected during a period of below-average flow.[9] No site observations of siltation have been recorded. However, an agricultural watershed, especially one with highly erodible soils — as is the case east of the main stem and particularly east of US 14 — can be expected to have

[7] USEPA. 2000. *Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion VI.* EPA 822-B-00-017. Data are from Table 3d. http://www.epa.gov/waterscience/criteria/nutrient/ecoregions/rivers/rivers_6.pdf.

[8] The state uses its statistical guidelines as a “flag” to signal elevated concentrations rather than a definite target to be achieved by load reductions. The state’s statistical guideline is quite conservative; it is doubtful that the Illinois EPA’s guideline is protective, but then it is not billed as a standard or even a criterion.

[9] The nearest stream gage (USGS 05438500 Kishwaukee River at Belvidere) was at 245 cfs on the sample date (October 21, 1993) while mean streamflow over the period of record is 327. However, streamflow was above median.

pronounced sedimentation, particularly with the low levels of best management practice adoption natural resource agents have described in the watershed.

Nitrate/nitrite concentrations were low above the discharges and high below them, but they remained elevated well downstream even when concentrations of other parameters had returned to baseline, suggesting either that attenuation mechanisms had reached the limit of their effectiveness or that nonpoint source contributions downstream from the discharge kept concentrations elevated. These data were taken during below-average streamflow when nonpoint source contributions would be lower, but extensive tile drainage in the watershed may carry leached nitrate even during lower flow periods.[10] Thus, the limited data are inconclusive. Again, the ability to discern problems in the stream would be enhanced greatly by a monitoring program such as that recommended in Section 6.

Table 2-5. Basis for identifying causes of aquatic life impairment

	Numeric standard		Statistical guideline		Other	
Potential Causes of Impairment	Acute	Chronic	In water	In sediment	Narrative Standard	Recorded Observation
Sedimentation	—	—	TSS >116 mg/L	> 34% silt/mud substrate	Sludge or unnatural bottom deposits	Site-specific observation or knowledge
Total nitrogen	—	—	Nitrate + Nitrite >7.8 mg/L	Kjeldahl N >4,680 mg/kg	—	—
Total phosphorus	—	—	0.61 mg/L	2,800 mg/kg	—	—

Source: Integrated Water Quality Report (2006), pp. 45–46.

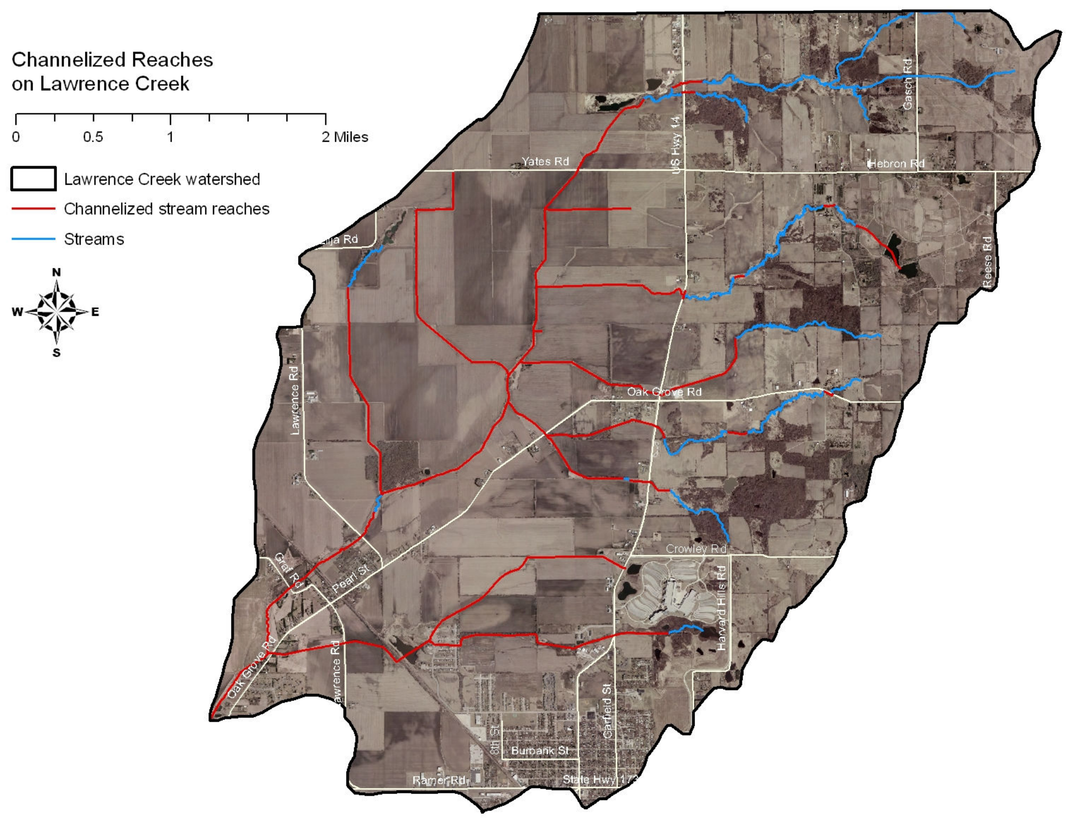
In addition to the possible causes of impairment discussed above, stakeholders living or working in the watershed have suggested a number of additional potential causes. For one, crop-protection chemicals, i.e., pesticides, are in use. In particular, aerial application of pesticides has been identified as a potential problem because of the likelihood that the chemicals are inadvertently sprayed into the stream. For another, irrigation is also practiced in some places in the watershed, and farmers have noted that withdrawals can decrease streamflow dramatically during the summer, which can be expected to impact aquatic life. Road salt application has also been mentioned as a contributor to aquatic life impairment.

Finally, channel and riparian conditions are closely connected to biological integrity because they partly determine habitat conditions for fish and macroinvertebrates. Riparian buffers in the area west of US 14 frequently are narrower than is appropriate for protecting water quality and for providing habitat benefits, although the hillier area to the east is generally within wide natural buffers. Professional judgment suggests that limited buffers tend to cause biological impairment and that plan recommendations should include stream buffers. Little information on current channel conditions is available, but reaches where channelization has occurred can be identified. Channelization has been quite extensive, as Figure 2-2 indicates, but not surprisingly it has been confined to the flatter area west of US 14 which is more suitable for row crops. Historic channelization involved straightening and cleaning debris from streams to increase conveyance, facilitating drainage and limiting the amount of cropland inundated during floods. However, this drastically simplified the aquatic environment and removed habitat features. Entrenched ditches have very narrow channels with no room for meandering, causing

[10] Evidence suggests that tile drainage increases the baseflow portion of the hydrograph, which then suggests that nitrate would also be more elevated than otherwise during a baseflow-dominated period. See Schilling, K.E.., and M. Helmers. 2008. Effects of subsurface drainage tiles on streamflow in Iowa agricultural watersheds: Exploratory hydrograph analysis.

the stream to cut away at the bank and resulting in further erosion and embankment. As long as they are not being actively "maintained" and are not too deeply incised, streams tend to recover somewhat from channelization by beginning to meander within their banks. This process should be aided where possible. How to do so depends on the context and the extent of recovery that can be hoped for. Fish habitat can be partly addressed by instream measures that do not attempt to reshape the channel, but more extensive measures are in order that serve to reconnect the floodplain to the river (i.e., address the deepening of the channel and remove the high spoil piles on the banks) or add sinuosity back to a straightened channel (i.e., remeandering). Natural remeandering will tend to occur if the banks are graded at a slope that allows the stream room to move laterally; the preferred grade is 3:1 (or better, 5:1).[11] The central point is that MBI and IBI, the biological endpoints of the plan, most likely will not improve by reducing nutrient and sediment inputs alone. Direct habitat and hydrological improvements to the stream will have to be made to accomplish this.

Figure 2-2.



Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map.
Source: Illinois Department of Natural Resources, Illinois Stream Information System

2.1.3 POLLUTANT LOADING AND SOURCES

2.1.3.1 Overview

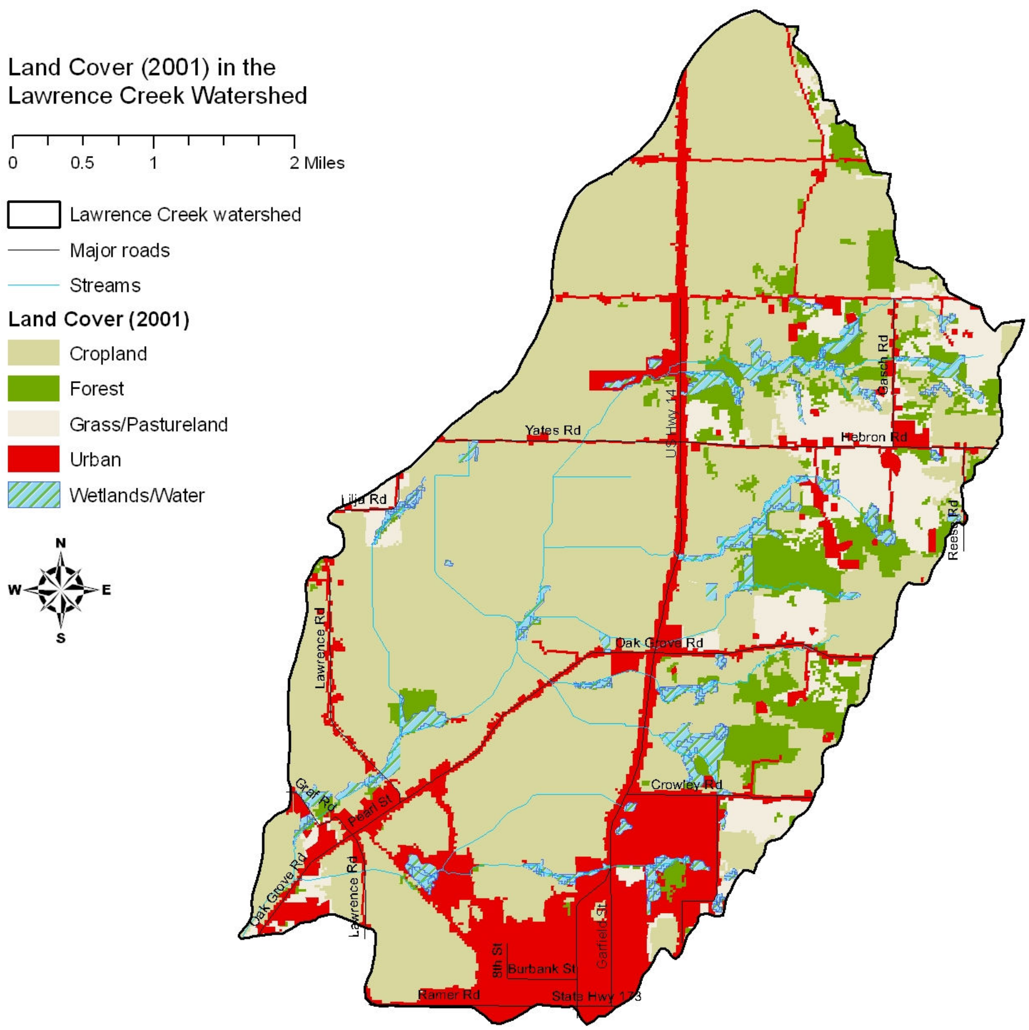
Illinois EPA also identifies potential sources of impairment, that is, the sources of pollutants or the historical origins of the causes of impairment. In the 2006 *Integrated Report*, there was no known source for the unknown impairment, but the report identified industrial point source discharges as the source for the total nitrogen and total phosphorus impairment. A sketch planning tool called STEPL

[11] John Aavang, Restoration Ecologist with McHenry County Conservation District; stakeholder comments August 14, 2008.

(Spreadsheet Tool to Estimate Pollutant Loads) was employed to estimate the existing load of nutrients and sediment from the watershed, compute total load reduction needed, break the load down by source area, and break it down by source type or contributor, e.g., crop production, urban runoff, etc.

A number of different watershed models were first evaluated to determine which best met the needs of the project. The universe of potential models was restricted to those discussed in detail in the U.S. EPA's draft *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*, Chapter 8.[12] The deciding factors in favor of STEPL were its moderate sophistication but usability in the absence of data for calibration and validation,[13] applicability to mixed urban and agricultural watersheds, its relative transparency and the ease of use of the model for stakeholders, and the inclusion of a load reduction model using BMP data. It is also available as a free download from U.S. EPA.[14] This section presents the results of the tool; further documentation of the data and assumptions employed is presented in the Appendix.

Figure 2-3.

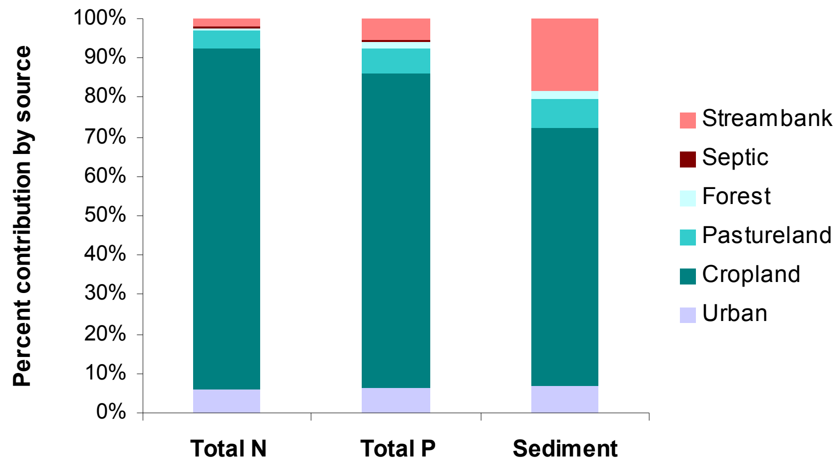


Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map
Source: 2001 National Land Cover Dataset

[12] http://epa.gov/nps/watershed_handbook/.
[13] There is no stream gage on Lawrence Creek or any of its tributaries, and water quality sampling has been nonexistent since 1993.
[14] http://it.tetratech-ffx.com/stepl/models$docs.htm.

The primary input to STEPL is land cover and land use information. Land cover categories are grouped into urban, cropland, forest, grass or pastureland, and a user-defined category that in our implementation was wetlands and water (Figure 2-3).[15] STEPL also allows the urban land cover classification to be broken down further, which was done by subcategorizing urban areas using the (draft, unreleased) CMAP land use inventory for 2005. This also allowed us to update the land cover information from 2001 with more recent information. The model output from STEPL is average annual pollutant loads from non-point sources and is shown by source in Figure 2-4. First, the gross pollutant load from the landscape is computed, and second, the mitigating effects of existing best management practices (BMPs) are incorporated. It is important to understand that STEPL is not a comprehensive physical model and cannot simulate water quality response. Finally, the Wisconsin portion of the watershed was explicitly included in the loading analysis. Land cover data were available on both sides of the state line, but land use information was not. However, the area within Wisconsin was small and land uses could be identified fairly readily by inspection of aerial photography.

Figure 2-4. Estimated contributions to current (2005) pollutant load by source.



2.1.3.2 Results

The results of the STEPL tool suggest that agriculture (cropland and pastureland) contributes the vast majority of total nitrogen, total phosphorus, and sediment load (Table 2-6). Agriculture is estimated to cause 86 percent of the nitrogen load, 79 percent of the phosphorus load, and 65 percent of the sediment load in the Lawrence Creek watershed. Septic systems appear to be a minor contributor. The estimated sediment contribution from urban sources is loosely equated to total suspended solids, which may contain a variety of solids other than sediment and may have different physical properties. The existing urban BMPs that help control total suspended solids include dry and wet ponds, which chiefly work by allowing solids to settle out of the water column.

Table 2-6. Estimated current (2005) annual pollutant load by source.

Sources	Total N (lb/y)	Total P (lb/y)	Sediment (t/y)
Urban	8,775	1,253	306
Cropland	124,150	14,947	2,802
Pastureland	6,865	1,207	322
Forest	847	312	82
Septic	252	99	0
Streambank	3,070	1,013	797
Total	**143,959**	**18,830**	4,309

[15] The land cover data for wetlands were supplemented with the 1999 McHenry County ADID study, which provides better accuracy.

There are a few other potential sources treated in STEPL for which no estimates have been made because of data limitations. It is believed that no feedlots exist in the Lawrence Creek watershed. Gully formation would require fieldwork to estimate, but this has not been done. Furthermore, shallow groundwater via baseflow can be a source of nutrient loading to streams, but no data have been identified that would allow an estimate to be made.

2.1.3.3 Load Reductions

As suggested in Section 2.1.1, available data suggest elevated levels of total phosphorus were due to an industrial discharger that has since ceased operation. Nitrogen may be elevated due to nonpoint sources, but the available data are not sufficient to separate the contribution from the defunct industrial discharger. It is not prudent in the case of nitrogen to compare concentrations to nutrient criteria and compute needed load reductions. The same problem applies to sediment. Because of these limitations, it is recommended that load reduction targets be established in practical terms of best management practice implementation rather than by comparing current loads to target loads. In other words, the sum of the potential load reductions from the identified BMP opportunities (100 percent implementation) in Section 5 would be the target.

2.2 Existing Protections

2.2.1 LOCAL ORDINANCES

2.2.1.1 Stormwater Management

The minimum standard to which local stormwater management ordinances should be compared in this region is the set of model ordinances prepared by the Northeastern Illinois Planning Commission (NIPC), as these were developed to codify the nonpoint source management policies of the Areawide Water Quality Management Plan. The City of Harvard has adapted by reference the language of the McHenry County Stormwater Management Ordinance as Chapter 8 of its Municipal Code Book, with some minor changes. But the City is not certified to enforce the countywide stormwater ordinance, so any any development within City limits regulated by the ordinance requires a stormwater management permit from the McHenry County Department of Planning and Development. Facility Planning Area Amendment application reviews by CMAP have shown that the countywide ordinance is generally consistent with the NIPC model ordinances, with the minor exceptions that it:

- Does not designate a minimum 75 foot setback zone from the edge of identified wetlands and water bodies in which development is limited to the following types of activities: minor improvements like walkways and signs, maintenance of highways and utilities and park and recreational area development.
- Does not prohibit watercourse relocation or modification except to remedy existing erosion problems, restore natural conditions, or to accommodate necessary utility crossings; and require mitigation of unavoidable adverse water quality and aquatic habitat impacts.
- Does not discourage culvert crossings of streams unless necessary for allowing access to a property.

In regard to the first bullet, the ordinance does specify that the minimum buffer width should be 100 feet where IBI is over 35. The available data, described above, suggest that this is the case in Lawrence Creek, at least at the two points sampled. In the absence of additional site-specific data, it is recommended that enforcement officers require buffers of 100 feet on both the main stem and the tributaries. The ordinance also requires wetland buffers whose width depends on the size and quality of the wetland.

Lastly, Harvard is not required to obtain coverage under the NPDES Phase II general permit, so the minimum control measure requirements under the program do not apply to the City.

2.2.1.2 Zoning and Subdivision Code

Local ordinances regulating land use and subdivision standards can have either a relatively negative or relatively positive effect on runoff control by, for example, stipulating certain street widths (more or less impervious surface) or by encouraging or not encouraging flexible development. Harvard's ordinances were compared to a checklist from the Center for Watershed Protection (CWP) for guidance. The results are shown in Table 2-7.

Table 2-7. Comparison of McHenry County and Harvard's ordinance requirements to CWP checklist

Code Element		McHenry County	Score	Harvard	Score	CWP	Max Score
1	Street width	31’	0	City Eng Standards	0	18-22’	4
	Queuing[16]	No language	0	No language	0	Yes	3
2	Try to minimize street length?	No language	0	No language	0	Yes	1
3	ROW width	60’	0	City Eng Standards	0	< 45’	3
	Placed utilities under paved ROW?	Yes	1	Yes	1	Yes	1
4	Cul-de-sac radii	70’	0	No language	0	<45’ <35’	3
	Allow landscaped island in cul-de-sac?	Yes	1	No language	0	Yes	1
	Allow alternative turn-arounds?	Yes	1	No language	0	Yes	1
5	Curb and gutter required?	No	2	Yes	0	No	1
	Established swale criteria?	Yes	2	Yes	2	Yes	2
6	Parking ratio, professional office	4	0	2-4	1	< 3	2
	Parking ratio, shopping center	5	0	3-5	1	≤ 4.5	1
	Parking ratio, single family detached	2	1	2	1	≤ 2	1
	Parking ratios are max rather than min?	No	0	No	0	Yes	1
7	Promote shared parking?	Yes	1	Yes	1	Yes	2
	Provide model shared parking agreements?	No	0	No	0	Yes	1
	Reduce parking ratios with shared parking?	No	0	Yes	1	Yes	1
	Parking ratio reduced near transit?	No	0	No	0	Yes	1
8	Parking stall width	9’-10’	1	9’	1	≤ 9’	1
	Stall length	18’-22’	1	19’	0	≤ 18’	1
	Smaller dimensions for compact cars?	No language	0	Yes	1	Yes	1
	Pervious area for spillover parking?	No language	0	No	0	Yes	2
9	Incentives for structured parking?	No language	0	No	0	Yes	1
10	Require minimum landscaping for parking lots?	No	0	Yes (12% if >50 vehicles)	2	Yes	2
	Bioretention islands allowed?	Yes	2	Unclear	0	Yes	2
11	CD or open space design allowed?	Yes	3	Yes	3	Yes	3
	Land conservation or impervious cover a major goal of open space design ordinance?	Yes	1	Yes	1	Yes	1
	Additional submittal or review requirements for CD?	Yes	0	Yes	0	No	1
	Is CD by-right form of development?	No	0	No	0	Yes	1
	Have flexible site design criteria?	Yes	2	Yes	2	Yes	2

[16] Queuing streets are two-way and have one lane for traffic and one for parking. When cars need to pass one another, one car pulls into a vacant parking stall to let the other pass.

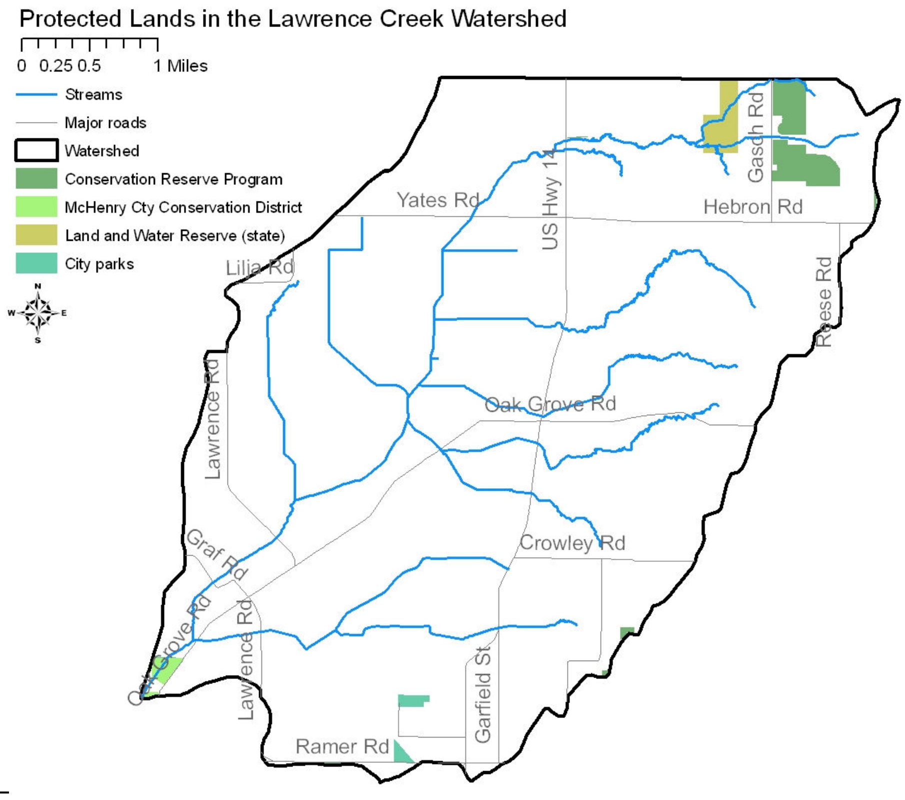
	Code Element	McHenry County	Score	Harvard	Score	CWP	Max Score
12	Irregular lot shapes allowed?	Yes	1	Yes	1	Yes	1
	Front setback for 0.5 ac residential lot	30’	0	25’	0	≤ 20’	1
	Rear setback for 0.5 ac residential lot	10’	1	30’	0	≤ 25’	1
	Min side setback for 0.5 ac residential lot	10’	0	6-12’	1	≤ 8’	1
	Frontage for 0.5 ac residential lot	100’	0	66-90’	0	< 80’	2
13	Min sidewalk width	4’	2	No language	0	≤ 4’	2
	Sidewalks required on both sides of street?	No	2	No language	0	No	2
	Sidewalk sloped to drain to yard, not street?	No language	0	No language	0	Yes	1
	Can alternate pedestrian networks be substituted?	No language	0	No language	0	Yes	1
14	Minimum driveway width?	No language	0	None	2	≤ 9’ ≤ 18’	2
	Can pervious materials be used on driveway?	No language	0	No language	0	Yes	2
	Use two-track design?	No language	0	No language	0	Yes	1
	Shared driveways permitted in residential developments?	No language	0	No language	0	Yes	1
15	Require association to manage open space?	No language	0	No language	0	Yes	2
	Require consolidation of open space?	Yes	2	No	0	Yes	1
	Keep percentage of open space in natural condition?	Yes	1	No	0	Yes	1
	Uses defined for open space?	Yes	1	Yes	1	Yes	1
	Can open space be managed by third party?	Yes	1	No language	0	Yes	1
16	Discharge roof runoff to yard?	No language	0	No language	0	Yes	2
	Allow temporary ponding on yard or roof?	No language	0	No language	0	Yes	2
17	Have stream buffer ordinance?	Yes	2	Yes	2	Yes	2
	Requires min buffer width?	100’ (if IBI > 35)	1	100’ (if IBI > 35)	1	≥ 75’	1
	Include wetlands, steep slope, and floodplain?	No	0	No	0	Yes	1
18	Require native vegetation in buffer?	Yes	2	Yes	2	Yes	2
	Does ordinance describe allowable uses in buffer?	Yes	1	Yes	1	Yes	1
	Buffer ordinance specifies education and enforcement?	Yes	1	Yes	1	Yes	1
19	Encourage preservation of natural vegetation on residential lots?	No language	0	No language	0	Yes	2
	Require clearing trees from septic field?	No language	0	No language	0	No	1
20	Require tree conservation?	No language	0	No language	0	Yes	2
	Limits of disturbance on construction plans adequate to prevent clearing?	No language	0	No language	0	Yes	1
21	Incentives for conserving non-regulated land?	Yes	2	No language	0	Yes	2
	Flexibility to meet regulatory requirements?	Yes	2	Yes	2	Yes	2
22	Require water quality treatment for stormwater?	Yes	2	Yes	2	Yes	2
	Effective design criteria for BMPs?	Yes	1	Yes	1	Yes	1
	Discharge stormwater directly into wetland without pretreatment?	Yes	0	No	1	No	1
	Restrict or prohibit development in 100 yr floodplain?	Yes	2	Yes	2	Yes	2
Total Score			**46**		**38**		**100**

The purpose of the CWP's checklist was to scan municipal ordinances to determine whether it would be worth holding a "site planning roundtable," in which officials from municipal engineering, planning, etc. departments go through ordinances in more detail. Using a facilitated process they would determine which ordinances the group would be willing to change and which they were not, and recommendations would be forwarded for action by elected officials. The major areas where Harvard seems to be out of keeping with the CWP checklist are in (1) street and cul-de-sac requirements, (2) sidewalk and driveway requirements, and (3) tree conservation and vegetation on residential land, which all affect imperviousness. While the CWP's exact guidelines may not be ideal for Harvard, it would seem that there is opportunity to discuss establishing more protective zoning and subdivision standards.

2.2.2 PROTECTED LANDS

There is little protected land within the watershed. The area where land preservation has been practiced with the most vigor is in the headwaters in the far northeast part of the watershed. A 55-acre Land and Water Reserve[17] property called the Maunk-Sook Sedge Meadow and Savanna is located there as well as two large areas enrolled in the Conservation Reserve Program. A small part of the Beck's Woods Conservation Area near the mouth of Lawrence Creek is the only holding by the McHenry County Conservation District within the watershed. There are no state-owned lands. Easement information is difficult to assemble and keep current, but the catalogue prepared for the Kishwaukee basin by KREP shows no easements in the Lawrence Creek watershed. Finally, there are two parks owned by the City of Harvard within the watershed. Together this amounts to approximately 290 acres, or about 2 percent of the watershed. This is approximately the same percentage as in the entire Kishwaukee basin, which had about 1.9 percent of its land in some form of protected status as of 2004.[18]

Figure 2-5.



Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map
Source: CMAP

[17] The Land and Water Reserve program is operated by the Illinois Nature Preserves Commission to protect areas that support significant natural heritage or archaeological resources. The agreement to register an area as a Land and Water Reserve determines allowable uses and stipulates management objectives. The agreement may be for a term of years or permanent, and the property can be sold or passed on to heirs subject to the agreement. Land and waters permanently registered may qualify for reduced tax benefits in the form of a local property tax reduction and possibly a charitable contribution deduction on federal income taxes.

[18] Kishwaukee River Ecosystem Partnership. April 2004. *Report on the Natural Resources and Habitat in the Kishwaukee River Watershed*, p. 25. http://krep.bios.niu.edu/KREP_PUBS/Report_Kishwaukee_river_Watershed.pdf

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3. ESTIMATION OF FUTURE NEEDS AND CONCERNS

3.1 Future Land Use Projection

3.1.1 CURRENT LAND USE

The starting point for the land use analysis was the (draft, unreleased) CMAP 2005 land use inventory, which for this project was taken as existing conditions (Table 3-1). Although a portion of the Lawrence Creek watershed stretches into Wisconsin, land use data were only available for the Illinois portion. The housing market slowdown of the last year or two probably means that the 2005 inventory describes current conditions fairly accurately.

Table 3-1. Land use (2005) in the Lawrence Creek watershed (IL portion).

Current Land Use	Acres	Percent of Watershed
Agriculture	8,556	73%
Commercial	89	1%
Industrial	101	1%
Institutional	78	1%
Multi-family	39	0%
Open Space	48	0%
Residential	876	7%
Transportation	12	0%
Vacant and Wetland	1,939	16%
Water	64	1%
Total	11,801	100%

Source: Draft, unreleased CMAP 2005 land use inventory

3.1.2 EXPECTED LAND USE CHANGES

Although fairly dramatic landscape changes may occur in the lower half of the Lawrence Creek watershed, it was concluded after review of various sources of information that while future land use conditions could be projected quantitatively, watershed stakeholders had little confidence in such projections. This section takes the approach of reviewing land use planning exercises that have been conducted for jurisdictions in the watershed and discusses the probable extent of industrial development.

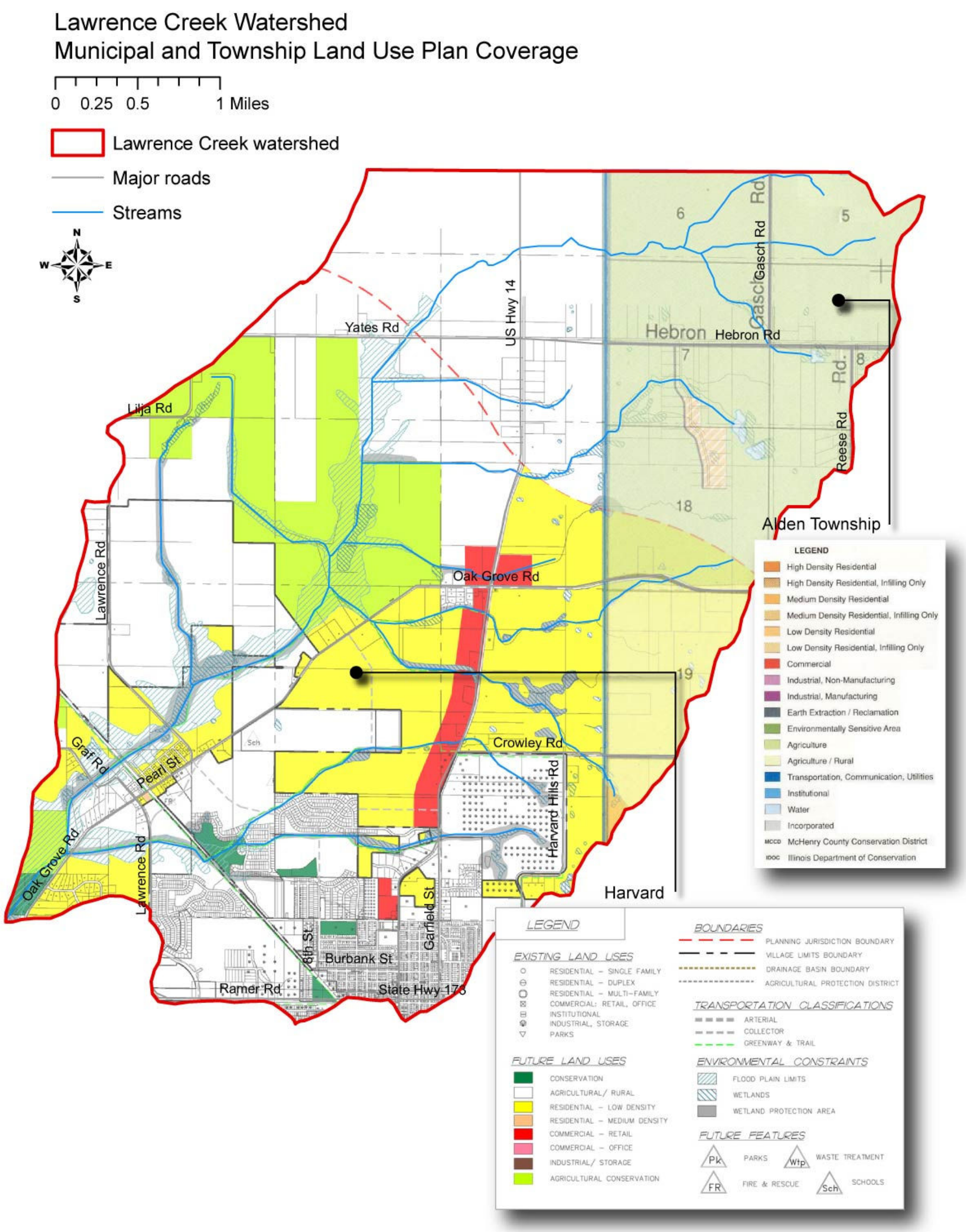
The City of Harvard's Comprehensive Plan[19] was adopted in 1995, with a horizon year of 2015 (Figure 3-1). At the time, the Plan was anticipating a surge in population growth, driven by the growing housing market and a new Motorola plant. The Motorola plant is now vacant, however, and the housing market has lost steam, so some of the Plan's more aggressive recommendations have not been realized. The plan does make some general policy statements that are still relevant to future development patterns in the watershed, which is discussed again in Section 4.2 The Plan asserts that single-family residential is the preferred type of development, and it outlines portions of the watershed, largely north of the City, both east and west of US Hwy 14, which would accommodate the growth. It establishes where future commercial and industrial uses should be located as well, i.e., along the US 14 corridor, and northwest of the city, and also estimates a jurisdictional boundary.

Alden Township also adopted a land use plan[20] in 1997 (updated 2005). Townships with land use plans can make a formal objection to the county board over a development proposal requiring a zoning change if the township board feels it is incompatible with the township plan, which then forces a supermajority

[19] http://www.cityofharvard.org/plan/CompPlan.pdf
[20] http://www.aldenplan.org/pdfs/2005AldenTwnsipLandUsePlan.pdf

vote of the county board to approve the request. Most of the land use recommendations in the Alden Township plan are drawn from the *McHenry County Land Use Plan: Year 2010 Update.*

Figure 3-1.

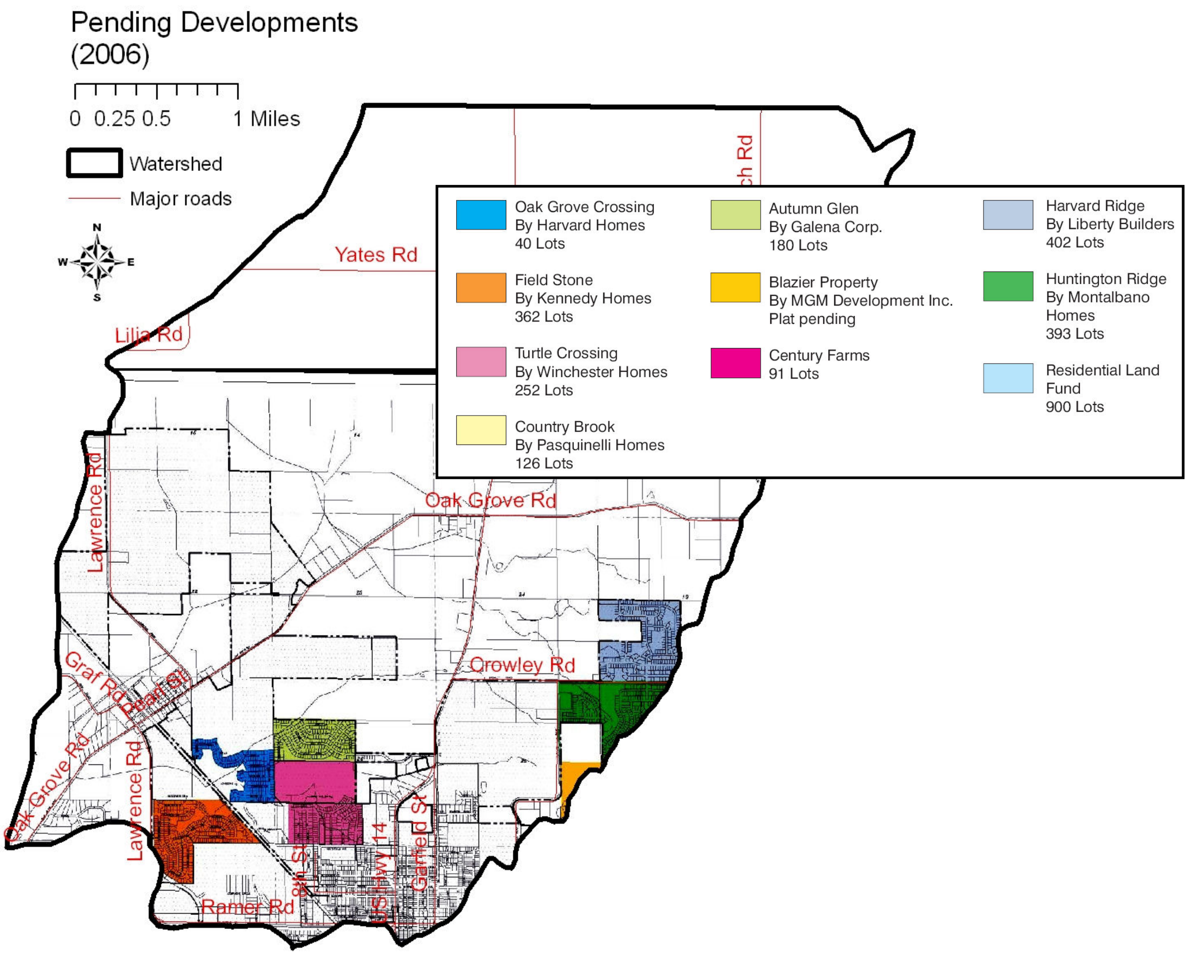


Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map
Source: Comprehensive plans for Harvard and Alden Township.

Further research was done in order to understand more fully the extent of the industrial, commercial, and residential development planned in the near term. Meyer Material owns a large portion of the land within this area and has a long-range plan for gravel mining. According to Meyer officials, mining operations will not impact the stream for another 20 years, as the company's plans are to start well away from the creek and slowly move towards it.[21] The operation could ultimately affect a large area between US 14 and Lawrence, Yates, and Oak Grove Roads.

In 2006, approximately seven residential subdivisions were in early planning stages in Harvard within the watershed, primarily along the north side of the city (Figure 3-2). For instance, plans were underway for mixed multi-family residential and commercial development within the triangle formed by Diggins Street, Lawrence Road, and the Union Pacific Railway Company line. Kennedy Homes had planned a subdivision (Field Stone) between Lawrence Road and the Union Pacific line, but this has been put on hold. With the downturn in the housing market, it is difficult to say which of these developments will go forward and how many units they might ultimately contain. Finally, the City and the Harvard Economic Development Corporation are also promoting development of the Arrowhead Industrial Park north of Diggins/Ramer Rd and west of the Union Pacific line, which ultimately might make up ~225 acres although build-out does not seem near.

Figure 3-2.



Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map
Source: Harvard Economic Development Corporation. http://www.harvardedc.com/hrdm-map.pdf

Broadly speaking, the Meyer Material gravel operation, the Arrowhead Industrial Park, and perhaps one or two subdivisions are the most significant future land use changes expected in the Lawrence Creek

[21] Watershed stakeholder meeting, April 17, 2008

watershed over the medium term. Discussions with the McHenry County Conservation District suggest that significant land acquisition is not expected in the watershed for fifteen years or so. Thus, the gravel mine is expected to affect by far the largest amount of land in the watershed, ultimately resulting in the removal of one of the tributaries to the creek and creation of a large lake, according to the reclamation plan.

3.1.3 IMPERVIOUS COVER

Impervious cover was estimated based on imperviousness in 2001 from the National Land Cover Dataset as the base layer. It is calculated that 3.4 percent of the land within the watershed was impervious in 2001. Land use data for 2005 suggest little change from 2001 – 2005. A rule of thumb for water quality protection is that imperviousness should not exceed 10 percent. Even with buildout according to the aggressive 1995 comprehensive plan, imperviousness would still be only about 7.5 percent on a watershed wide basis, as projected based on average levels of imperviousness for each land use category. While industrial development is expected to take place, it is not expected to cause a major increase in imperviousness.

3.2 Change in Sources of Water Quality Degradation

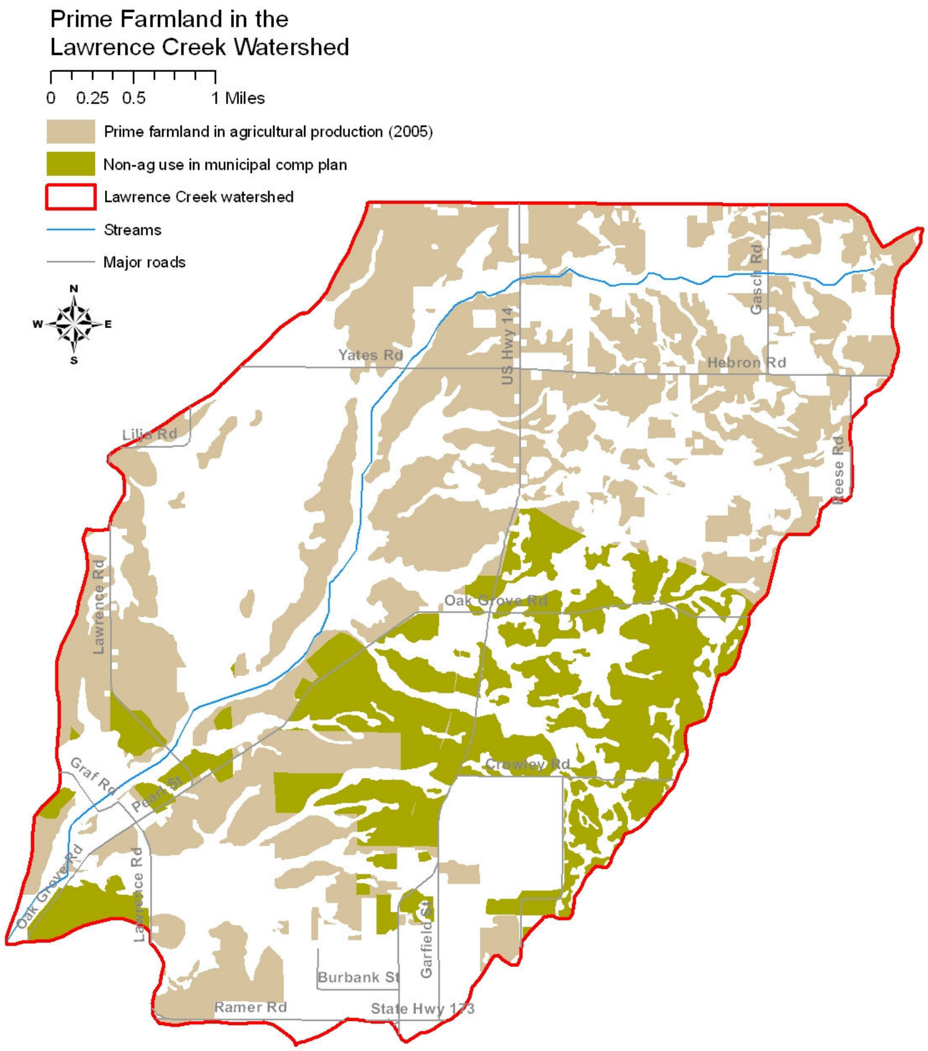
As described in Section 2, best professional judgment suggests that nutrients and habitat alteration are the most likely sources of water quality degradation in the Lawrence Creek watershed. Without sufficient data to estimate future land use, it is difficult to make specific estimates of future degradation. However, it is anticipated that nutrient loading would decrease on a long-term average basis as a result of development. Aquatic habitat, on the other hand, could be improved if a 100-foot buffer planted with native vegetation were required in developments along the main stem and tributaries. The McHenry County Watershed Development Ordinance requires 100 feet when IBI is over 35, as data from MCCD suggest it is on Lawrence Creek. Smaller scale, relatively inexpensive stream restoration practices, such as some of those developed in Section 5, could also be negotiated during development approval.[22] Stakeholders also identified chloride, irrigation withdrawals, and pesticide use as potential causes of impairment as well. Road salt application could grow somewhat more heavy as a result of adding new streets, but this would not be dramatic given the limited development expected in the watershed. It might also be counteracted by the increasing cost of deicing agents. Changes in irrigation use are unclear. Increasing drought frequency may lead to additional withdrawal, but the conversion of agricultural land to mining may either increase or decrease withdrawals.

3.3 Prime Farmland

The B-MAG *Framework for a Basinwide Planning and Protection Pilot* makes repeated mention of a need to investigate ways to protect prime farmland as part of the watershed planning process. The olive and tan colors in Figure 3-3 together show all prime farmland identified in the McHenry County Soil Survey that was in an agricultural use in 2005. The olive color represents prime farmland that would be converted to an urban use if the comprehensive plan in the watershed were implemented.

[22] The water quality review for the 2006 FPA amendment request noted that the City had been working with a potential developer to include improvements to Mokeler Creek that would return the stream to a more natural state (including relocating the stream to a more natural meander).

Figure 3-3.



Note: does not include areas considered prime if drained; the portion of the watershed in Wisconsin is not shown in this map
Source: McHenry County SSURGO, CMAP 2005 land use inventory, and Harvard Comprehensive Plan

Although the Harvard Comprehensive Plan does not contain a section on agricultural protection policies or objectives, in its land use map it does recognize Agricultural Protection and Conservation Areas.[23] These have been enlarged since the 1995 Comprehensive Plan and occupy several large areas of land, generally west of Lawrence Creek (Figure 3-4).[24] Agricultural districts are also included as a zoning classification in Harvard. The minimum lot size in agriculturally zoned areas is 40,000 square feet (~1 DU/acre); this is much too dense to actually function as agricultural zoning and is even too dense to be considered a rural residential classification. Other than this, Harvard has no policies in place to protect prime farmland. However, county government adopted an agricultural protection policy in 2007 and appointed a committee to review potential applicants for federal agricultural protection match funding.[25] Because limited development pressure will lower the farmer's opportunity cost of preservation, this may

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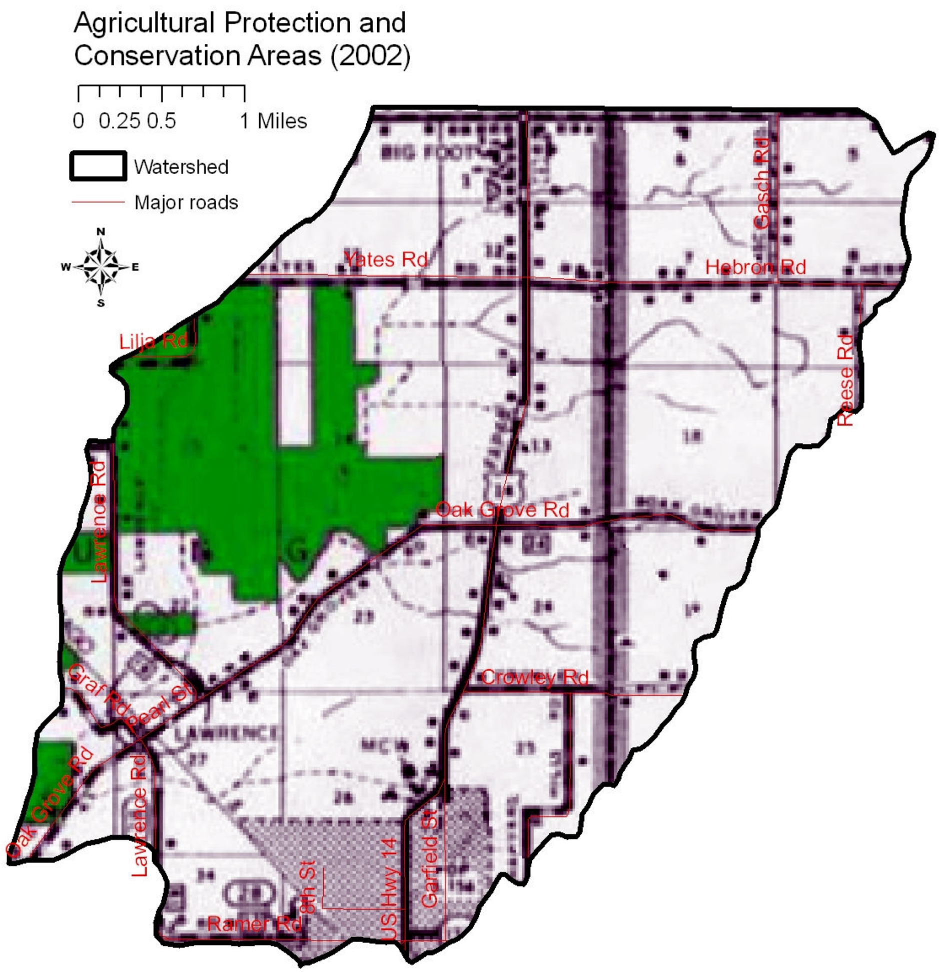
[23] Formed under the Agricultural Areas Conservation and Protection Act (505 ILCS 5/1 et seq.)
[24] Stakeholders raised concerns that the identified Agricultural Protection and Conservation Areas were not currently in existence, but the data was verified by the McHenry County Soil and Water Conservation District, to which the Illinois Department of Agriculture deferred.
[25] NRCS Farm and Ranch Lands Protection Program http://www.nrcs.usda.gov/programs/frpp/

be a good time to apply available farmland protection techniques in the watershed. It is recommended that the agricultural conservation coordinator (Section 5) work with landowners to establish agricultural conservation easements or to utilize other protection tools.

Figure 3-4.



Source: Illinois Department of Agriculture, *Agricultural Areas: 2002 Annual Report*, current status verified through personal communication
Note: does not include Wisconsin portion of watershed

4. A VISION FOR THE WATERSHED

This section presents the general policy framework of the *Lawrence Creek Watershed Plan*. The first subsection presents findings from meetings with local officials and identifies relevant policy statements in Harvard's Comprehensive Plan. The second subsection proposes a vision of land use based on the comprehensive plan and other sources of information. The third describes the overall reductions in pollutant loading from current conditions expected from implementing the plan.

4.1 Issues and Opportunities

4.1.1 CITY OF HARVARD

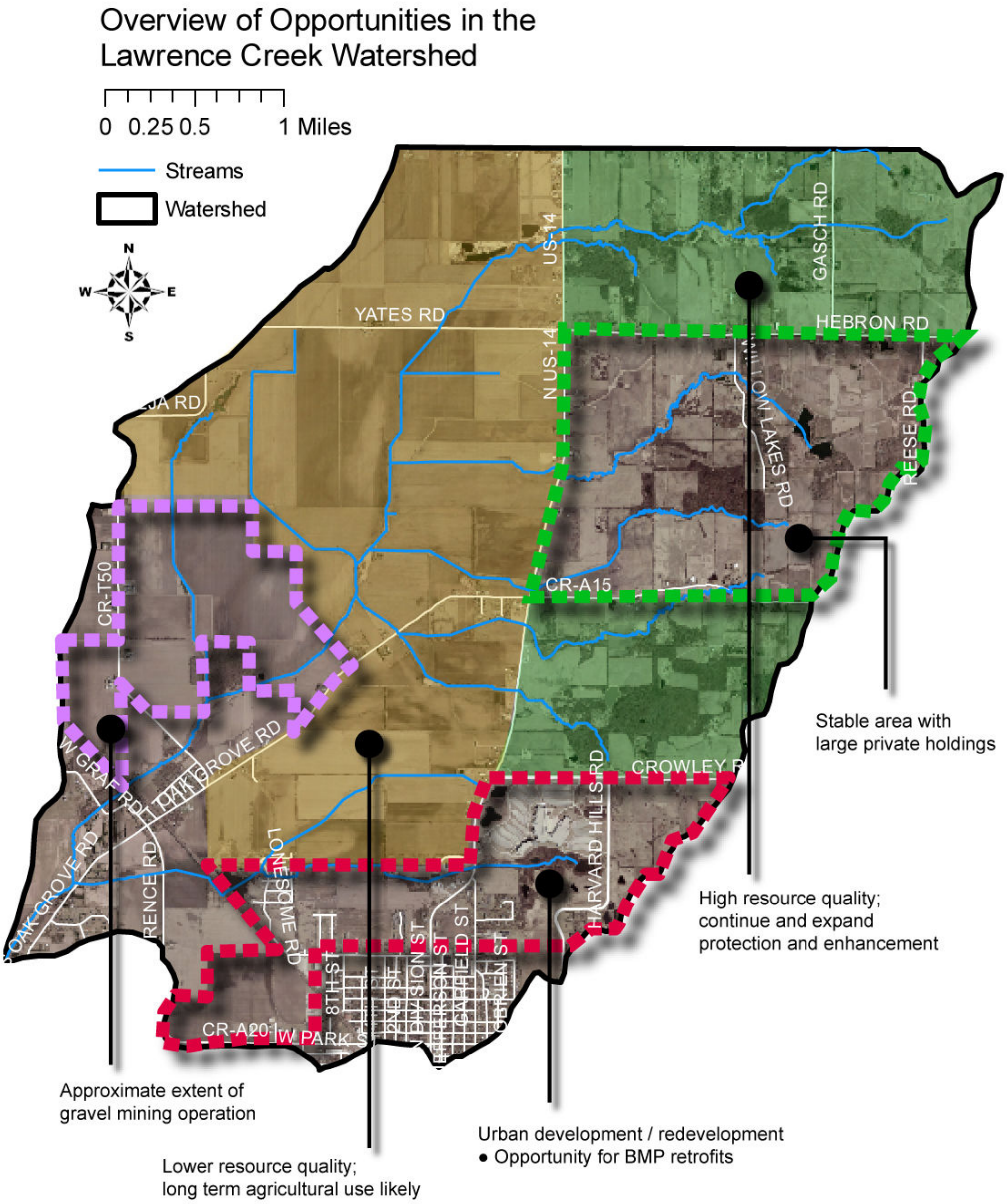
Approximately 2,700 acres in the watershed were within the corporate limits of the City of Harvard as of 2005. Land use in this area comprises mainly pre-war housing on a grid pattern with small format commercial uses along US 14. There are a handful of new subdivisions on the outskirts of the city, as well as a large (now vacant) Motorola plant. The farthest stretches of incorporated land include some agriculture. There is a separate storm sewer system, although the older areas of the city lack detention facilities. Several concepts for projects to retrofit these already developed areas to improve water quality are described in Section 5.2. However, the potential from urban retrofit projects appears lower than for other opportunities, and more expensive as well.

The City's Comprehensive Plan includes a number of natural resource protection and land development policies which can help shape this watershed plan's recommendations. The Plan's policy on conservation is to preserve high quality natural environments including surface and subsurface water resources, recharge areas, scenic vistas, and woodlands and wildlife habitat. It also discusses connecting natural features and existing parks along stream and drainage courses, and calls for a linear park along Lawrence Creek. Greenways for the Lawrence Creek area are specified to be 40 feet wide, improved with crushed limestone, and to contain 6 foot wide pedestrian paths. The City noted its intention to participate with other agencies in implementing the *Northeastern Illinois Regional Greenways Plan*. Harvard's plan also states that the City seeks to preserve the quality and recognition of its Class A streams.[26] In identifying areas in which it will encourage development, the Plan notes the City will seek to avoid areas that could pose significant adverse impacts on stream quality.

The Plan also states that the City will oppose any rezoning or development proposal, other than allowed under the County's development related ordinances as they currently exist, within the area designated as open space on the City's future land use map. However, the Plan map places relatively little emphasis on open space and natural areas (Section 3.1.2) within the Lawrence Creek watershed. The Plan also sets standards for park acreage: neighborhood and district parks standards are 2.5 acres per 1,000 people, and urban parks standards are 5 acres per 1,000 people. The City will require that new developments within their planning jurisdiction be connected to city water and sewer and will attempt to direct and influence growth patterns consistent with this Plan by extending water and wastewater lines into areas targeted for development. The Plan discourages growth and development outside of its planning jurisdiction and states the intention to "work with the County to limit certain rezoning in the County to those consistent with the County's Comprehensive Plan, and which are necessary to support agriculture, forestry or mining." The Plan seeks to increase the percentage of single family detached housing in the community to at least 75 percent of the total housing stock, converting some of the demand for multi-family housing to single family detached housing or duplex development with densities of about 3 dwelling units per acre.

[26] The Piscasaw, which Lawrence Creek is tributary to, is a Class A stream.

Figure 4-1.



4.1.2 UNINCORPORATED AREA

The majority of the land within the Illinois portion of the watershed, approximately 9,000 acres, is unincorporated. There are a few small pockets of rural residential development within the unincorporated land, primarily in the southwest corner of the watershed and nestled in the hilly area east of US 14 in Alden Township. This area is shown in light green in Figure 4-1. There are many land protection and restoration opportunities in this area. West of US 14, however, agricultural best management practices on the flat, drained farmland will be appropriate to help decrease nutrient and sediment loading and to some extent to improve habitat.

4.2 Vision of Land Use

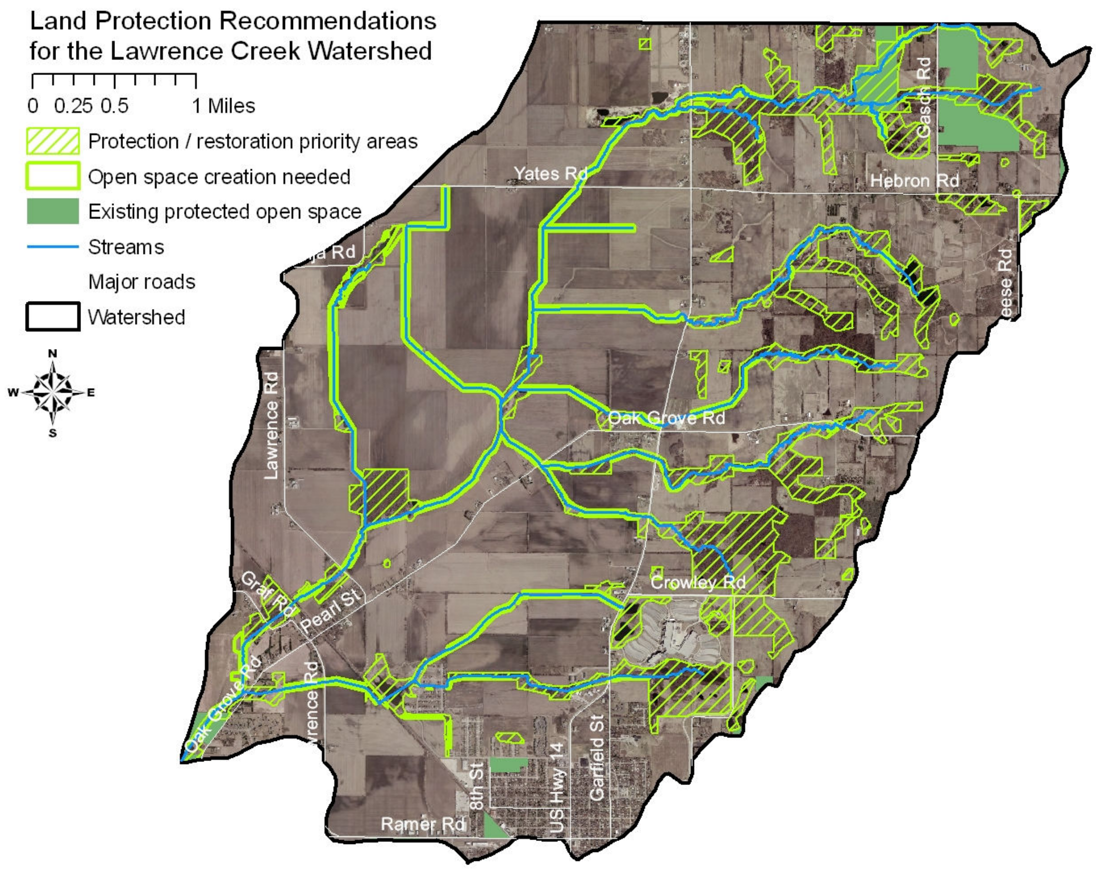
The vision for land use in the Lawrence Creek watershed is described in this section. It consists of a vision for enhancing the natural environment, a vision for the future development pattern in the watershed, and a vision for reclamation of the gravel mine.

4.2.1 NATURAL AREA PRESERVATION AND RESTORATION

4.2.1.1 Overview

One of the most important strategies for protecting the quality of Lawrence Creek is to protect and restore more of the land in the watershed. Very little of it is protected now. Many studies have shown a positive relationship between natural land cover in a watershed and the health of aquatic communities as measured by indicators like the fish Index of Biotic Integrity.[27] The Kishwaukee River Ecosystem Partnership has identified priorities for the protection and restoration of natural areas, for the *Lawrence Creek Watershed Plan*, as shown in Figure 4-2. These priorities are based on the presence of wetlands, good quality stands of native trees (especially oak stands of ≥ 25 acres), the presence of threatened or endangered species nearby, the McHenry County Natural Area Inventory,[28] and other factors. Almost all of these priority areas are east of US 14 and most of them are outside the probable area of municipal development/redevelopment.

Figure 4-2.



Source: KREP and CMAP

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[27] Brabec, E., S. Schulte, and P.L. Richards. 2002. Impervious Surfaces and Water Quality: A Review of Current Literature and Its Implications for Watershed Planning. *Journal of Planning Literature* 16: 499–514.

[28] This is a list of areas compiled by the McHenry County Conservation District that have significant ecological value, whether or not they occur on protected or public land.

Since little of the watershed is held by land management agencies or enrolled in conservation programs, it can be assumed that almost all of the priority areas identified require ecological restoration. Protection could utilize a number of strategies, from acquisition to easements (i.e., acquiring a partial interest in land) to contract enrollment programs like the Wetland Reserve Program,[29] whereas restoration involves returning a landscape to a condition closer to pre-settlement conditions and could involve work ranging from periodic burning and reseeding to major reconstruction projects involving extensive engineering and earthwork. This plan's vision for the preservation and restoration of natural areas includes the elements in the following subsections.

4.2.1.2 Legal protection and restoration of terrestrial natural areas

It is not expected that McHenry County Conservation District or Illinois Nature Preserve Commission priorities will lead them to be major players in the watershed within the next decade. The initiative for protection and restoration will lie, then, with (1) private landowners taking out easements on their properties in conjunction with land trusts and (2) private landowners enrolling in various conservation programs, such as the Wildlife Habitat Incentives Program,[30] etc. This plan identifies 1,650 acres of priority areas (Figure 4-2), or approximately 12 percent of the watershed, almost none of which is in public hands or in any form of conservation program. There are approximately 200 owners of the parcels containing these priority areas. The current percentage of protected land in the Lawrence Creek watershed is about the same as in the Kishwaukee basin as a whole. In contrast, about 8.5 percent of McHenry County is held in public hands, with an unknown additional amount of land in the county in private conservation easements.

It is important to emphasize that although the identified areas are a priority and represent the core areas for protection and restoration, they are not the only areas that are in need of restoration within the Lawrence Creek watershed. There are opportunities throughout the entire watershed for restoration and management of highly-erodible agricultural land and extant forests, wetlands, grasslands, and other natural areas. Property-owners may be interested in these types of projects, for a variety of ecosystem benefits, not just water quality.

The Land Conservancy of McHenry County is taking advantage of some of these land restoration and conservation opportunities, and a relevant example is their ongoing efforts with the "Alden Headwaters Conservation Area." The Land Conservancy has done some land acquisition, but the primary effort is facilitating private land restoration and protection work through organizing and information sharing. The effort identified two potential restoration areas within the Lawrence Creek watershed, near Stateline Road. One is along the creek itself, recommending brush clearing and invasive reed canary grass management. Another site is at the corner of Gasch Road and Stateline Road, where recommendations include installing conservation practices on the farmland, and restoration in the stream corridor.

4.2.1.3 Creation of vegetated stream buffers of at least 100 feet

To provide the "skeleton" of an open space network along the streams, the vision of this plan is that the stream should be buffered by at least 100 feet with native vegetation. In agricultural areas, this should be accomplished by planting filter strips on cropland, as shown in more detail in Section 5.1.2, utilizing the vegetation recommendations of the resource agents at the McHenry County SWCD and NRCS. In developing areas, the vision should be accomplished by buffer establishment during development. The

[29] This program provides an opportunity for landowners to receive financial incentives to restore, protect, and enhance wetlands in exchange for retiring marginal land from agriculture. It can involve a ten-year contract or an easement.
[30] Wildlife Habitat Incentives Program: www.nrcs.usda.gov/programs/whip/

areas in need of buffer establishment are shown in Figure 4-2 as "open space creation needed." This plan interprets the McHenry County Stormwater Management Ordinance (SMO) as requiring 100 foot buffers along both the main stem and tributaries because available Index of Biotic Integrity scores are higher than 35 (see Section 2.1.1). When processing stormwater permits at the time of development under the countywide stormwater ordinance, the County should therefore require at least 100 foot buffers in the watershed.

Buffer composition should be determined based on inferred pre-settlement vegetation conditions. As a flexible alternative, buffers established in a conservation design development could also be based on the parent soil type, which should be left ungraded to maintain viable soil profiles for restoration, and could be more or less than 100 feet depending on site conditions. Benefits generally increase when buffers extend beyond 100 feet, for example through floodplain and wetland set-asides or conservation design, which protects entire hydric soil assemblages and upland buffers along river and creek corridors. A financing mechanism for ongoing management should be applied to all such buffers because of the great potential for invasive species to degrade their value over time.

4.2.1.4 Wetland restoration

Many wetlands have been drained by the agricultural practices of channelizing streams and laying drain tile. In agricultural areas, it is recommended that wetland reconstruction be undertaken with the goal of treating agricultural runoff to remove nutrients, as discussed in Section 5.1.4. Additionally, a number of the priority areas in Figure 4-2 include wetlands that should be managed and restored.

4.2.1.5 Stream restoration and instream habitat improvement

In contrast to the other elements of this vision which are more terrestrially focused, stream restoration and instream habitat improvement hold the potential to directly improve conditions for aquatic life, increasing scores on the main indicators for this plan, the Index of Biotic Integrity for fish and the Macroinvertebrate Biotic Index for aquatic "bugs." As noted previously, much of the stream network has been channelized, drastically reducing its habitat value, and agricultural land in the watershed has been subject to extensive draining. Thus, any section of the stream that has been channelized (Figure 2-2), that flows past drained wetlands, or that lacks a natural stream corridor is a potential candidate for restoration. Section 5.3 describes the results of a strategic survey of the stream intended to identify a list of potential projects that would make up a medium-term program for implementing the vision, but fully restoring the stream system in the watershed will involve a long-term effort.

4.2.2 DEVELOPMENT PATTERN

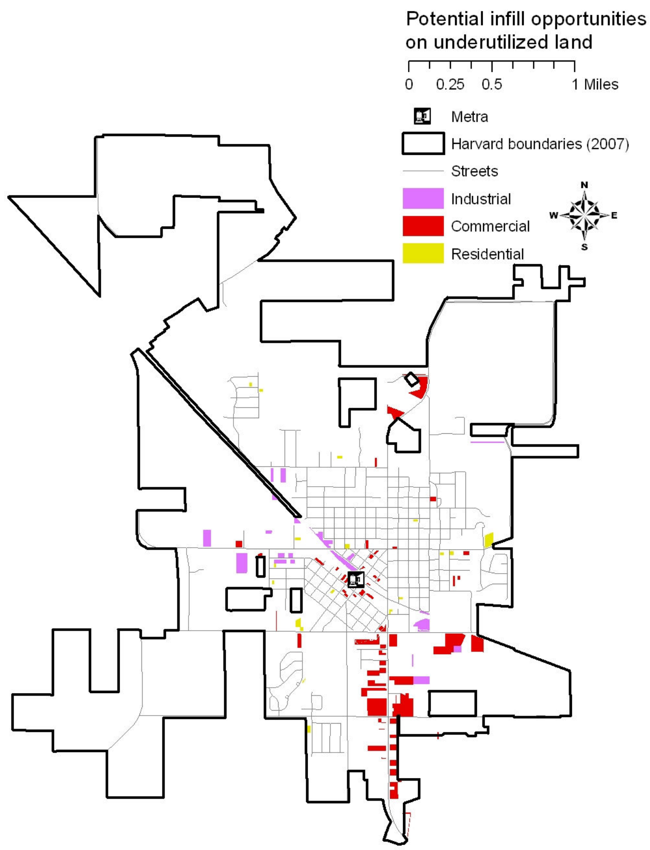
Broadly speaking, there are two ways to limit negative impacts of growth on natural resources. One is to utilize sensitive design techniques or development regulations that preserve natural resources while developing on greenfield sites and require protective BMPs. The other is to pursue a strategy of directing growth into already urbanized areas by building on vacant or underutilized lots. An example of underutilized land would be a large surface parking lot downtown. Pursuing infill development may also support other community goals. For example, it could tend to increase demand for downtown commercial services, while reinvestment in real estate nearby also encourages other property owners to do the same, ultimately enhancing vitality. It could also decrease traffic by putting Metra within walking distance while preserving farmland. Infill development can also increase tax revenues while minimizing the need for public investment in new road, water, and sewer infrastructure.[31] The 1995 Comprehensive Plan expressed a goal of increasing the proportion of single family detached housing in the city, generally

[31] For more information, see CMAP. 2008. *Regional Snapshot on Infill.* http://www.cmap.illinois.gov/snapshot.aspx

at a density of around 3 dwelling units per acre, by annexation and development of greenfield sites. Density in established older single family neighborhoods is generally 2 ~ 3 units per gross acre. In fact, the Comprehensive Plan expresses the policy that "the City will not use higher densities in established areas to encourage infill of those areas" (p. VI-11). This plan encourages the City to revisit that policy.

Figure 4-3 shows the initial results[32] of a regional study to identify infill development potential by examining the ratio of the value of land improvements to the value of the land itself. A low ratio suggests that land is underutilized. These initial results suggest that there is a fair amount of underutilized commercial land — often times in overflow parking lots — in Harvard. Underutilized residential uses are less common, but there are a number of commercial uses around the Metra station downtown that could be appropriate for housing redevelopment if market conditions and stakeholders favored it. Industrial properties could also present opportunities; standard procedures can be used to determine the extent of contamination, if any, and the remediation needed.

Figure 4-3.



Source: CMAP

The vision of this plan is, *first*, for part of future municipal growth to occur via infill and redevelopment and for part of it to occur on greenfield sites utilizing naturalized stormwater management. The latter could rise to conservation design should municipal officials seek it when they process planned unit developments. *Conservation design* can be described as "a design system that takes into account the natural landscape and ecology of a development site and facilitates development while maintaining the

[32] Meaning that it has not yet been fully validated by stakeholders familiar with their communities, and that the analysis reflects broad-scale regional assumptions that may not necessarily identify the best opportunities in a particular place.

most valuable natural features and functions of the site. Conservation design includes a collection of site design principles and practices that can be combined to create environmentally sound development. The main principles for conservation design are: (1) flexibility in site design and lot size, (2) thoughtful protection and management of natural areas, (3) reduction of impervious surface areas, and (4) sustainable stormwater management."[33]

Second, the priority protection and restoration areas should not be damaged by future development. This is partly an extension of the policy in the Comprehensive Plan that the City will oppose any rezoning or development proposal within the area designated as open space on the City's future land use map; only it is recommended that the priority areas in Figure 4-2 be considered areas the City would act to protect in the same fashion. The exception would be developments that would proceed under the McHenry County Conservation Design Standards and Procedures.[34] However, Harvard is also urged to make sure that any new development in its corporate boundaries would not harm these priority areas, either by direct destruction during development or by such indirect means as diverting drainage into them. Likewise, the proper use of conservation design could assure that development could proceed

4.2.3 GRAVEL MINE RECLAMATION

As noted in Section 3.1.2, the Meyer Material Gravel Mine is expected to affect the largest amount of land in the watershed, ultimately resulting in the removal of one of Lawrence Creek's tributaries and the creation of a lake. But modern mining practices involve plans to reclaim the surface during and after mining, and this land disturbance may prove to be an opportunity to return the land to a natural state with ecological benefits.

The Mineral Information Institute[35] has several reclamation project case-studies, undertaken at mineral resource mines across the country. There is no reason to believe that some of the successes that have been achieved elsewhere cannot be replicated at the Meyer Material Gravel Mine in Harvard. The reclamation plan can emphasize habitat and water quality as top priorities in the lands it creates. Examples of mine reclamation projects include creating wetlands, improving riparian corridors, planting native species and removing invasive ones, creating microhabitats for special species, building nesting boxes, and re-vegetating grasslands and prairies. Careful design of reclamation in the Lawrence Creek watershed can create an attractive, diverse natural area, with some of these quality habitat features. This is in contrast to a uniformly deep and unvaried waterbody, as is currently planned for the area following the completion of mining.

There are numerous species identified in the Illinois State Wildlife Action Plan that could benefit from enhanced wetland resources in the Lawrence Creek area. Bird species such as the Least bittern and American bittern, amphibians such as salamanders and frogs, and reptiles such as the Blanding's turtle are all in need of additional quality habitat in the watershed. Thoughtful reclamation can also contribute to the relatively small amount of protected land (as a percentage) of the watershed. A small park and public access area is planned to be donated to the City of Harvard at the south end of the gravel mine following reclamation. There is potential for a large (400+ acre) wetland complex to be created in the mined area through the addition of islands, nesting features, hemi-marsh areas with emergent vegetation,

[33] Northeastern Illinois Planning Commission and Chicago Wilderness. 2003. *Conservation Design Resource Manual.* http://www.chicagowilderness.org/pubprod/miscpdf/CD_Resource_Manual.pdf. This is a straightforward, accessible, and useful reference on conservation design.
[34] The McHenry County Conservation Design Standards and Procedures is an amendment to the County's Subdivision Ordinance.
[35] Mineral Information Institute: http://www.mii.org

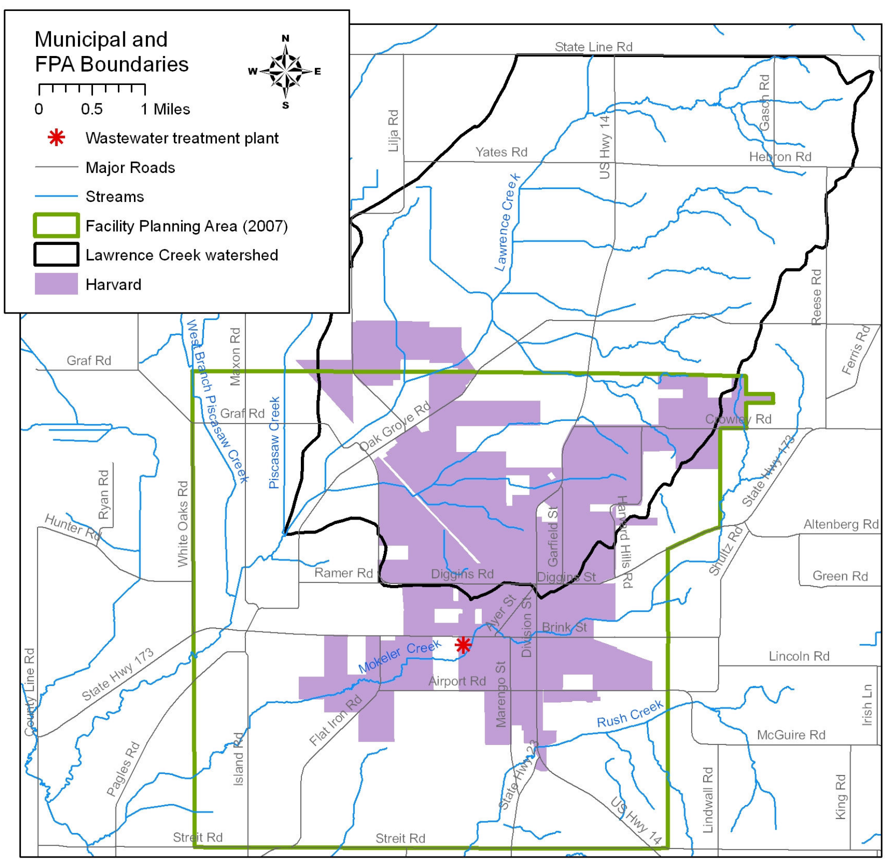
as well as open water areas. Finally, many reclamation projects have served as a tool to educate students and the general public about geology, hydrology, and ecosystem restoration.

4.3 Vision for Wastewater

4.3.1 OVERVIEW

The City of Harvard has one treatment plant on Mokeler Creek, which also is on the 303(d) list of impaired waterways, with potential sources of impairment listed as municipal point sources, agriculture, construction, land development, urban runoff/storm sewers, hydrologic/habitat modifications and channelization (Figure 4-4). The plant was originally constructed in 1940 and has been upgraded a number of times since then. Its permitted design average flow is 1.8 million gallons per day. Current inflow, however, is approximately 1.07 mgd. In 2006 the City requested an expansion of the plant to 2.4 mgd, to be completed sometime between the application date and 2030, which the Northeastern Illinois Planning Commission supported;[36] the Illinois EPA deferred action on the City's request. The City also requested approval to construct a second 1.0 mgd plant on Mokeler Creek which could eventually be expanded to 2.0 mgd. This request was not supported by the Commission. The NIPC water quality review noted that the Harvard WWTP has consistently achieved its NPDES effluent limits for biological oxygen demand, total suspended solids, and ammonia. The plant is also now required to meet the 1 mg/L phosphorus limit.

Figure 4-4.



Source: CMAP
Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map

[36] Northeastern Illinois Planning Commission Water Quality Review #06-WQ-148. September 20, 2006.

Should Harvard realistically require additional capacity, it appears that the City's first choice would be another centralized plant near the first. The NIPC review of Harvard's application noted that the only long-term wastewater alternatives actually analyzed in reaching this conclusion were centralized and satellite conventional treatment systems, with land application dismissed as too expensive. Neither did Harvard consider partial reuse applications. The vision of this plan is to minimize the amount of wastewater produced in the Lawrence Creek watershed that discharges into Mokeler Creek. Stakeholders expressed interest in aquifer recharge potential through direct injection or fast infiltration for effluent. But the primary means of doing this would be to institute indoor water use conservation measures or to employ land application or partial reuse.

4.3.2 WATER CONSERVATION

One approach to reduce wastewater volume is for Harvard to adopt indoor water use conservation measures. If household appliances, bathroom fixtures, and other indoor uses are or become more efficient, less water becomes wastewater. Several indoor water-use conservation measures are available for adoption. Not all measures require changes in behavior, but all are designed to effect long-term reductions in per capita water demand. While the California Urban Water Conservation Council is a prime resource on conservation and efficiency, the measures listed below have been implemented in many places throughout the country as part of a comprehensive program to increase efficiency, reduce waste, and lower water and wastewater utility operating costs:

- Water-survey programs for residential customers
- Residential plumbing retrofit
- Metering with commodity rates for all new connections and retrofit of unmetered connections
- High-efficiency clothes washing machine financial incentive programs
- Conservation programs for commercial, industrial, and institutional accounts
- Conservation pricing
- Residential ultra-low-flush toilet replacement programs

Adoption of these measures will soon find strong support at both county and regional levels of planning. For example, a new Groundwater Protection Program in McHenry County is emphasizing water conservation among other measures that aim to enhance stewardship of countywide water resources that show signs of stress. Furthermore, the Northeastern Illinois Regional Water Supply Planning Group, an outcome of Governor Blagojevich's Executive Order 2006-1, has adopted the seven conservation measures listed above along with seven additional measures for the regional water supply plan currently under development. It is expected that the regional plan recommendations, due in mid-2009, will be implemented by municipal and county governments along with water utilities and individuals where appropriate. Thus, the City of Harvard is encouraged to show support for both county and regional planning initiatives and undertake municipally led conservation programs to implement these measures.

4.3.3 LAND APPLICATION

As mentioned previously, an alternatives analysis that considers land application is required as part of a request for a new or expanded treatment plant. For various reasons it is rare for municipalities to give this option serious consideration, usually citing land costs, but it remains the lowest impact disposal option from the water resources standpoint. The McHenry County Conservation District has now set up a Land Application Task Force to determine the context in which the use of reclaimed water on District properties could be acceptable. This plan encourages MCCD to consider the possibility of applying effluent to portions of its land not already committed to restoration or to make new acquisitions partly for the purpose of land-applying effluent. If MCCD were to purchase or help purchase land to use as a buffer for a natural area, and that buffer area were also used to land-apply effluent, then the cost of treatment would be reduced significantly while providing the quality of life benefits of preserving additional open space.

There would be additional opportunities to do this with decentralized treatment. In particular, effluent from a treatment system could be used to irrigate common open space in a development if the system were designed in from the outset, as in the Sheaffer wastewater treatment system. For instance, planned unit development zone districts in Harvard already include a mandatory 20% open space set aside standard, and this could be used for application of treated wastewater. The McHenry County Conservation Design Ordinance, for example, allows for the use of land application in common open space areas.

4.3.4 SEPTIC SYSTEMS

A potential pollutant source in the watershed is septic systems. There are no systematic records for locations of septic systems or failure rates, however.[37] In order to estimate the number of septic systems in the watershed, 1990 Census data were utilized, but these data were not specific to the watershed. Estimates of the number of septic systems within the watershed were then calculated at the subwatershed scale. Examination of the data suggests that septic systems are evenly spread through the subwatersheds, with each subwatershed estimated to have 0.02 ~ 0.03 septic systems per acre. Thus no hotpots are evident based on the density of septic systems, although failure rates could vary across the watershed. As discussed in Section 2.1.3.2, existing septic systems do not appear to contribute substantially to nutrient enrichment, although conservative assumptions were made about failure rates. It is assumed that few new septic systems will be installed in the watershed, generally only for very low density rural residential development. Harvard requires hookup to the sewer system, and it is expected that the City will extend sewers to serve all or most new development unless land application is utilized.

[37] No systematic information is available regarding the rate of failure of septic systems in the county according to personal communication from Mike Eisele, McHenry County Health Department, December 13, 2007

5. A PLAN FOR IMPLEMENTING THE VISION

This section describes the opportunities for water quality (nonpoint-related) and habitat improvement that have been identified as part of the planning process, providing background information, locations, cost estimates, and expected pollutant load reductions. It should be taken in conjunction with the vision presented in Section 4.

5.1 Agricultural Best Management Practices

Agricultural best management practices (BMPs) are generally meant to limit soil loss from cropland and to reduce nutrient concentrations in runoff. Resource agents in McHenry, Boone, and Winnebago Counties identified a short list of the most effective BMPs, resulting in the recommendations in this chapter. Each BMP and its preferred location is discussed in the first section. The second section provides information on the programs recommended to fund BMP implementation as well as expected pollution reduction benefits.

5.1.1 CONSERVATION TILLAGE

As a means of protecting water quality, conservation tillage — any tillage practice that leaves at least 30 percent of the soil covered with crop residue between growing seasons — is most applicable to lands with higher erosion potential. It is recommended that conservation tillage be targeted to areas with erosion index values between 1.5 and 8.[38] Because erosion index values over 8 (as well as other conditions) bring the Highly Erodible Lands compliance provisions into effect for farmers participating in various federal programs (most farmers),[39] it is thought that conservation measures are adequate in those areas. In McHenry County, various forms of conservation tillage accounted for about 39 percent of farm acres planted with corn in 2004.[40] Which tillage practice is actually used on a given field varies from year to year, but if the proportion of fields *not* already in a form of conservation tillage in the watershed is the same as in the entire county (61 percent), then an additional 2,417 acres could be targeted for this practice.

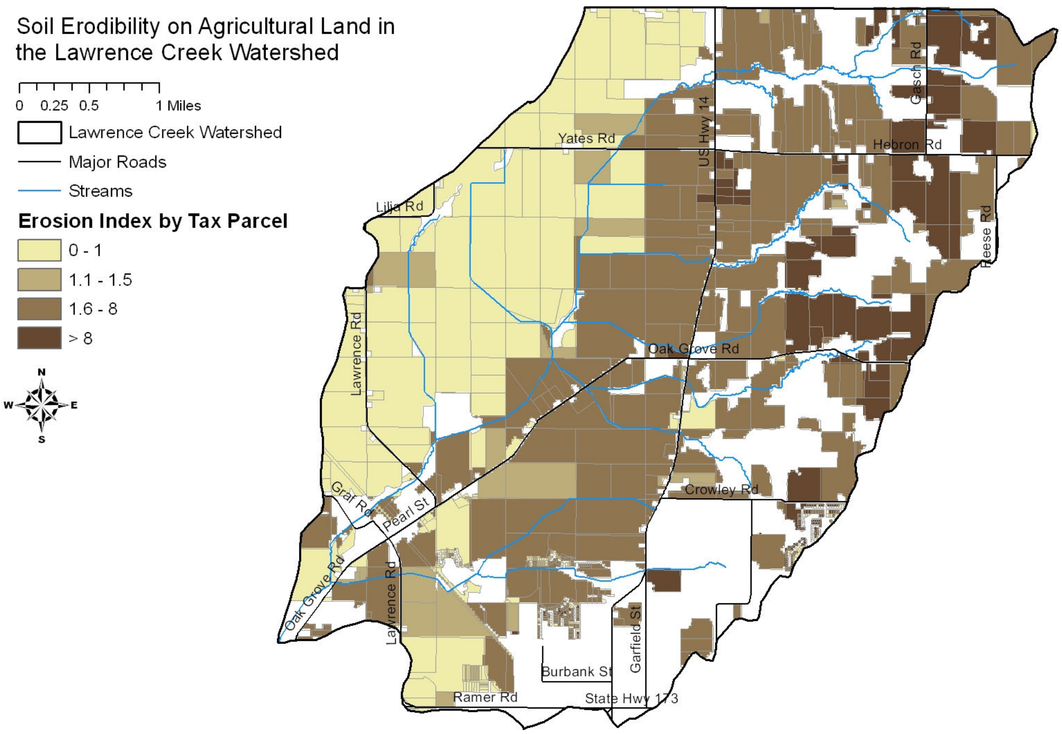
The main lever for increasing the use of conservation tillage in the watershed is targeted outreach to farmers by the NRCS and the McHenry County SWCD along with technical assistance. Also, the direct costs of implementing conservation tillage may be offset through the state Conservation Practices Program and through the federal Environmental Quality Incentives Program, either of which pay $20 per acre for nutrient management planning, capped at an $800 total payment. Agents at the NRCS office in McHenry County tend to promote the strip till form of conservation tillage — tilling strips where seeds will be planted and leaving area between rows untilled. No-till tends to keep the soil colder and wetter for longer into spring, which delays planting and may potentially decrease yields. In contrast strip till improves drainage and promotes warming. In general, strip till should leave about two-thirds of a field unplowed.

[38] The erosion index = $R \times K \times LS \div T$, where T is tolerable soil loss and the other factors are those in the RUSLE equation (R = erosivity of rainfall, K = erodibility of soil, and LS is a combination of slope and the length of the slope). The erosion index gives the potential for soil loss without regard to land cover, the type of crop planted, or management measures. An erosion index value < 1 indicates that soil loss is less than the tolerable rate. Resource agency staff more commonly use slope rather than the erosion index. The results are generally similar, as both methods highlight the same areas. Any slope over 7 percent is considered highly susceptible to erosion. Agency personnel with the NRCS also target conservation tillage to farmland with slopes of 4 – 7 percent that are moderately susceptible to erosion.

[39] http://www.nrcs.usda.gov/Programs/compliance/index.html

[40] Illinois Department of Agriculture. 2004. *Illinois Soil Conservation Transect Survey*.

Figure 5-1.



Source: McHenry SSURGO, USGS 30 meter digital elevation model, McHenry County, CMAP 2005 land use inventory
Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map

There is an additional incentive for conservation tillage available through the Illinois Climate Change Initiative (ICCI) and the Chicago Climate Exchange (CCX). CCX is group of businesses and other organizations that voluntarily agree to reduce their greenhouse gas emissions (GHG) by 6 percent and do so by either changing their operations to emit less GHG or by purchasing credits equivalent to a reduction in GHG. Some of these credits (called "Exchange Soil Offsets" or XSOs) come from farmers who practice conservation tillage or who install filter strips. Conservation tillage is eligible as a credit because it decreases the rate of carbon loss from farm fields, and the monetary value of a credit is determined by its availability and the demand for it on the CCX, much like any other traded commodity. Because each of the XSOs is generally small, they are purchased by the Delta Institute (under contract with the producer) and aggregated into larger credits for resale on the CCX. As of mid-May the value of the credit itself was about $2.70 per acre after program costs. The producer contracts directly with the Delta Institute,[41] but the SWCD can assist by helping farmers understand the program and fill out the forms. As of February 2008, no contracts had been signed in McHenry County. The value of the XSO is not very high at present, but can be expected to increase as the market begins to recognize the importance of mitigating climate change. It is recommended that SWCD staff market the ICCI program in addition to the more familiar federal programs. A question and answer document for Illinois SWCDs has also been provided by the Illinois Climate Change Initiative.[42]

5.1.2 FILTER STRIPS

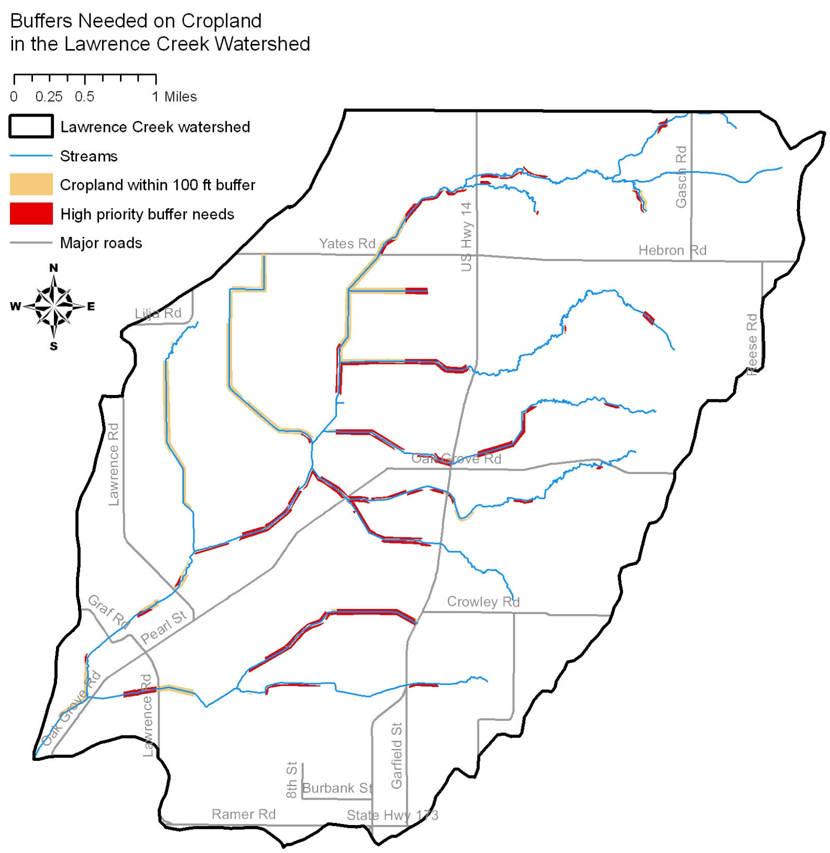
Grass or forest buffers are installed along streams in order to intercept and filter sheet flow from cropped areas. This practice was targeted to agricultural lands where the vegetation within the 100 foot stream

[41] http://illinoisclimate.org/contracts.php
[42] http://illinoisclimate.org/documents/SWCDFAQ.pdf

corridor is inadequate, which totals about 208 acres (Figure 5-2). The priority areas for implementing filter strips are highlighted, totaling about 115 acres, where erosion potential is higher because of soils and topography (Figure 5-1). No distinction was made between forest and grass buffers, as we expect a decision between the two to be made based on the preferences of the individual landowner and the advice of the natural resource agent.

There is a practical problem with filter strips: installing them takes land out of agricultural production, reducing yield; high commodity prices, especially corn, make this unattractive to some farmers. However it can be shown (Section 5.1.6 below) that farmers would pay nothing or make a modest bonus for enrolling in conservation programs to install filter strips. This is because the federal programs provide a number of incentive payments and a signing bonus for filter strips in addition to cost-share payments and soil rental. Also, the Illinois Climate Exchange Initiative accepts filter strips as carbon credits, with a value in mid-May of $4.51 per acre after program costs.

Figure 5-2.



Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map.
Source: Kishwaukee River Ecosystem Partnership

There is an additional incentive for filter strips that is available through the state. Land on which vegetative filter strips are installed is assessed at one-sixth of its assessed value as cropland.[43] The program is run through McHenry County Soil and Water Conservation District. One of the biggest problems with agricultural BMPs in McHenry County is the prevalence of cash rent farmers and absentee

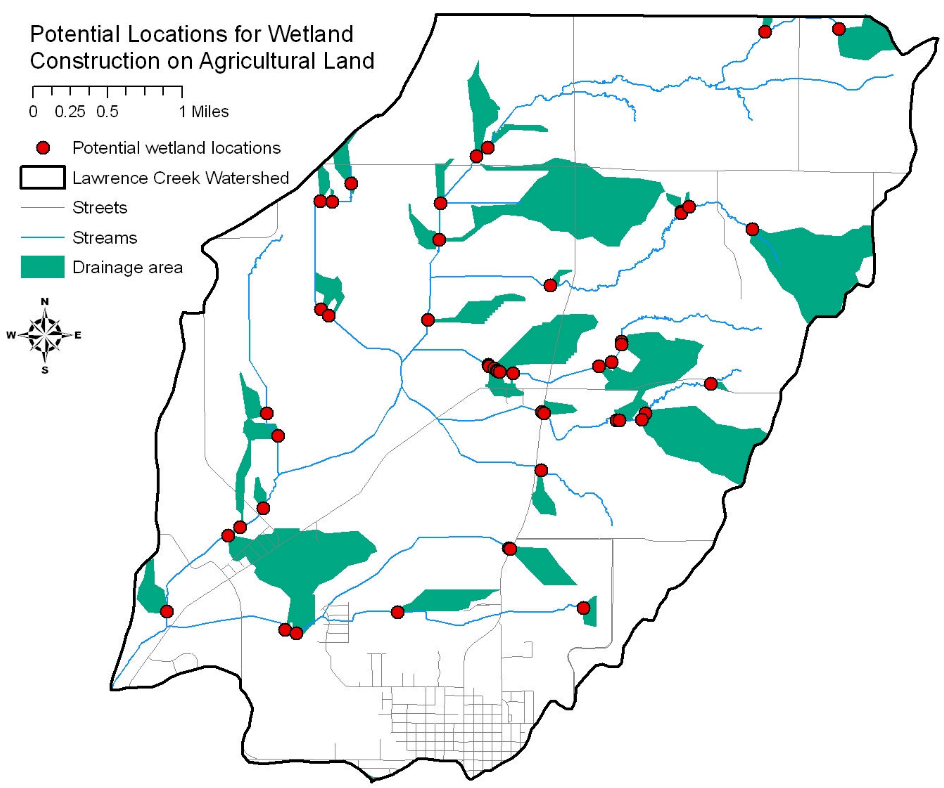
[43] http://dnr.state.il.us/OREP/C2000/Incentives.htm#VFSA

owners. The operators in this case see limited value in installing BMPs since their leases are typically only for one year; they have little reason to plan for the long-term productivity of the land since they do not own it. Owners are not very involved in the management of their land, and taking land out of production with filter strip contracts may make the land less marketable to cash renters. The tax incentive may help somewhat in this situation because it can only go to the taxpayer and may be a tool to help convince owners, if they can be identified and reached, that conservation programs are important and worthy.

5.1.3 NUTRIENT MANAGEMENT

All cropland could potentially benefit from improved nutrient management, but to be strategic in controlling nutrient runoff in this watershed, the practice could be targeted to areas where other BMPs are not. This would be to the flatter, less erodible areas of the watershed, i.e., where predicted erosion is less than the tolerable rate (erosion index < 1). There are 2,519 acres of land under the tolerable rate of erosion (averaged by tax parcel) in the watershed. The main selling point for nutrient management planning is the savings in fertilizer inputs. However, there is an upfront cost of paying for soil tests, which are ideally carried out by taking samples in a grid pattern with each cell 2.5 acres (but not more than 5 acres). This is offset through the state Conservation Practices Program and through the federal Environmental Quality Incentives Program, either of which pay $20 per acre for nutrient management planning, capped at an $800 total payment.

Figure 5-3.



Source: CMAP
Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map

5.1.4 WETLAND CONSTRUCTION

Wetland construction using U.S. Department of Agriculture programs would occur only on farmed hydric soils, defined for our purpose as any hydric soil in an agricultural area without an existing delineated wetland. It is important to note that wetland construction in this instance is being targeted to lands in agricultural production to take advantage of Farm Bill programs. The draft, unreleased CMAP land use inventory for 2005 was used to define agricultural areas, while the 1999 McHenry ADID study provided wetland locations. Actual locations for wetland reconstruction were determined strictly based on potential for water quality benefits. The predicted locations of accumulated flow, which approximate drain tile alignments and first order streams, were followed to the point where they intersect delineated streams. A subset of these tile outlets and first order stream confluences are within farmed wetlands, and for these points the contributing drainage area was determined (Figure 5-3). Using the rule of thumb that a 1:100 ratio of wetland area to drainage area[44] is required for effective treatment, the resulting potential acreage of wetland construction is estimated at 15 acres, treating 1,563 acres of cropland. Potential wetland locations will require additional ground-truthing for project planning.

5.1.5 AGRICULTURAL BMP COORDINATOR

This plan is not proposing new conservation programs or new funding sources per se; it is describing the BMPs needed and recommending funding sources to use to implement them. All of these funding sources are available to farmers now but have not been employed to the extent they could be. This is because implementation depends ultimately on the willingness of the farmer to implement conservation practices and because the SWCD and NRCS offices lack the resources to conduct targeted marketing to potential implementers. The resource agencies respond to requests by producers for federal and state assistance but do not campaign for the use of the programs. Therefore an agricultural BMP or conservation coordinator position is proposed. The purpose of the position is to market Farm Bill and other programs directly to farmers in the watershed. Ideally the person selected would be a retired or semi-retired farmer who is able to speak from experience on the implementation of BMPs and who is familiar with potential objections to their use. The position would probably pay in the neighborhood of $40,000 per year with fringe. To maximize the value of the position, the coordinator should work in all three watersheds of the Kishwaukee for which CMAP and KREP have developed plans, plus other areas in the basin as opportunities arise. The SWCD offices in McHenry and Boone Counties could provide an office and potentially a vehicle for the coordinator as part of match for grant funding. The recommended grant sources are Section 319 and C2000 funds. The most appropriate applicant for the funding would be the Kishwaukee River Ecosystem Partnership.

5.1.6 COSTS AND LOAD REDUCTIONS

Table 5-1. Estimated annual load reductions from agricultural BMPs

	Wetland construction	Nutrient Management	Strip-till	Filter strips	Total
Acres installed	15	2,519	2417	122	
Acres treated	1563	2,519	2417	732	
Nitrogen (lb/y)	5,304	5,343	18,797	7,245	36,690
Phosphorus (lb/y)	1,277	1,501	1,852	935	5,564

Source: removal efficiencies for strip-till and filter strips from STEPL; wetland construction from National Pollutant Removal Performance Database, v3; nutrient management from USEPA 's *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*

[44] This 1% value is chosen for planning purposes. For example, the Iowa Conservation Reserve Enhancement Program allows ratios between 0.5% and 2% (http://www.agriculture.state.ia.us/waterResources/pdf/LandownerGuide.pdf). The actual wetland size will be determined by site conditions.

Table 5-2. Estimated costs for agricultural BMPs

Conservation Practice	Ac	Program	Avg cost / ac [45]	Capital cost	Cost share	Soil rental /ac[46]	XSO /ac[47]	Total payments to farmers	Total cost to farmers or (savings)
Filter strips[48]	122	CRP	$260	$31,720	90%	$89	$4.51	$25,780	($22,608)
Wetland constr.[49]	15	CRP	$4,100	$61,500	90%	$89		$3,102	$3,048
Strip till	2,417	CPP	$20	$48,340			$2.70	$54,866	($6,526)
Nutrient mgt	2,519	CPP*	$20	$50,380				$50,380	$0
Total	5,073		$4,400	$211,500				$134,128	($26,086)

Notes: CPP - Conservation Practices Program - State Department of Agriculture; EQIP - Environmental Quality Incentives Program – USDA; CRP - Conservation Reserve Program – USDA.
* EQIP will also fund this practice

5.2 Urban Nonpoint Best Management Practices

The Lawrence Creek watershed was evaluated for potential implementation of urban best management practices (BMPs). The City of Harvard is the only significant urban area in the Lawrence Creek watershed. Within the watershed land use in Harvard is mostly pre-war housing arranged on a grid pattern that was developed prior to detention requirements. The most challenging aspect of identifying potential BMP retrofit projects in established neighborhoods is to find the physical space to implement the facilities. Unless a drainage corridor has been preserved, or a significant site such an institution or industry has been vacated or has excess land, there are few water quality improvements that are economically justifiable when alternative sites exist nearby (as they do in this case). Severe drainage issues may warrant the implementation of storage facilities that could incorporate water quality BMPs, but only when there are available storage sites or the drainage issues are so severe that buyouts to create storage space can also be justified. In most cases, conveyance improvements offset by offsite storage is the preferred option for solving poor drainage in established neighborhoods. In this watershed, large unimproved spaces (agriculture or existing wetlands and riparian corridor) are located a short distance away from Harvard. These areas represent the best potential for implementing a water quality project that treats the majority of stormwater runoff from the portion of Harvard tributary to Lawrence Creek. More recent development has occurred north of Northfield Avenue. Runoff from this area flows through an online pond located north of Apple Valley Road.

The following projects were identified through meetings with municipal representatives, review of available mapping, and in-field observations. The estimated costs do not include the purchase of land or drainage easements. Site locations are provided in Figure 5-14.

[45] Average cost for no-till and nutrient management planning is considered to be equal to the payment of $20 /ac, capped at $800. This appears to cover costs and perhaps yield a slight incentive according to statistics in USEPA. 1993. *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters.* EPA 840-B-92-002. http://www.epa.gov/nps/MMGI/Chapter2/ch2-2c.html
[46] Average soil rental rate for soils in Upper Kishwaukee
[47] XSO = Exchange Soil Offset from Illinois Climate Change Initiative/Chicago Climate Exchange. Payment based on market value of $6.34 per metric ton (May 15, 2008) using http://illinoisclimate.org/conservationcalculator.php
[48] Notes: the following incentives apply to filter strips and wetland construction: SIP -Stewardship Incentive Payment - 20% bonus on average Soil rental rate; PIP - Practice Incentive Payment - 90% cost share to establish practice; SP - Signing Bonus - One time Payment of $100 × the number of acres enrolled.
[49] Shallow water wetland estimated 5 acre area with 1 ft soil removed at $2.35/yard and 100 per acre seeding.

5.2.1 STRUCTURAL RETROFITS

Expand and Enhance Existing Wetlands West of Railroad (1). This potential project is located southwest on the opposite side of the railroad from the lake that is bounded by the railroad, Willow Lane and Lonesome Road. The lake discharges under a pedestrian bridge where it joins a tributary carrying urban stormwater runoff from prior to passing under the railroad. On the west side of the railroad a wooded and wetland area exists. This area could be expanded and enhanced to become a regional water quality treatment wetland. The treatment wetland would be sized to cover approximately 20 acres, which would provide measurable water quality improvements for the 3-square-mile watershed. At this time, only 10 percent of the tributary watershed is urbanized, however, that number could increase as new development occurs north and west of Harvard. The estimated cost for implementing the wetland project is $800,000.

Figure 5-4: Facing west toward wetlands and riparian corridor from bridge at outlet of lake between railroad, Willow Land and Lonesome Road.

Vegetated Swales North of Northfield Avenue (2). A series of vegetated swales conveys flow west and north from the intersection of Northfield Avenue and Route 14, to the new detention basin north of Apple Valley Road. These vegetated swales have all been constructed with turf grass cover and are typically mowed. One section is rip-rap lined while a few other segments are displaying signs that they will typically be wet (missing grass, standing water). The northernmost reach of swale (north of Apple Valley Road) is still getting established. The condition of these swales should be monitored to ensure that the turf grass remains stable and fills in the recently completed segments. If turf grass shows signs that flow velocities are too high, or conditions are too wet, then some segments may be planted with a native plant mix that would be more tolerant of these conditions. The primary water quality benefit of this project would be the prevention of any additional erosion if the condition of the swales deteriorates at some point in the future. The cost for this project is not estimated as the only recommendation for now is to monitor the condition of the swales.

Figure 5-5: Facing west from north of Apple Valley Rd., large man-made pond.

Figure 5-6: Facing north from Apple Valley Rd., large swale leading to man-made pond.

Figure 5-7: Facing west from end of 6th Street, newly constructed swale running west.

Figure 5-8: Facing west from intersection of Northfield Ave. and Northfield Court.

Figure 5-9: Facing east from end of 6th Street, newly constructed swale.

Figure 5-10: Facing west from parking lot at Northfield Court.

Figure 5-11: Facing parking lot (east) from Northfield Ave.

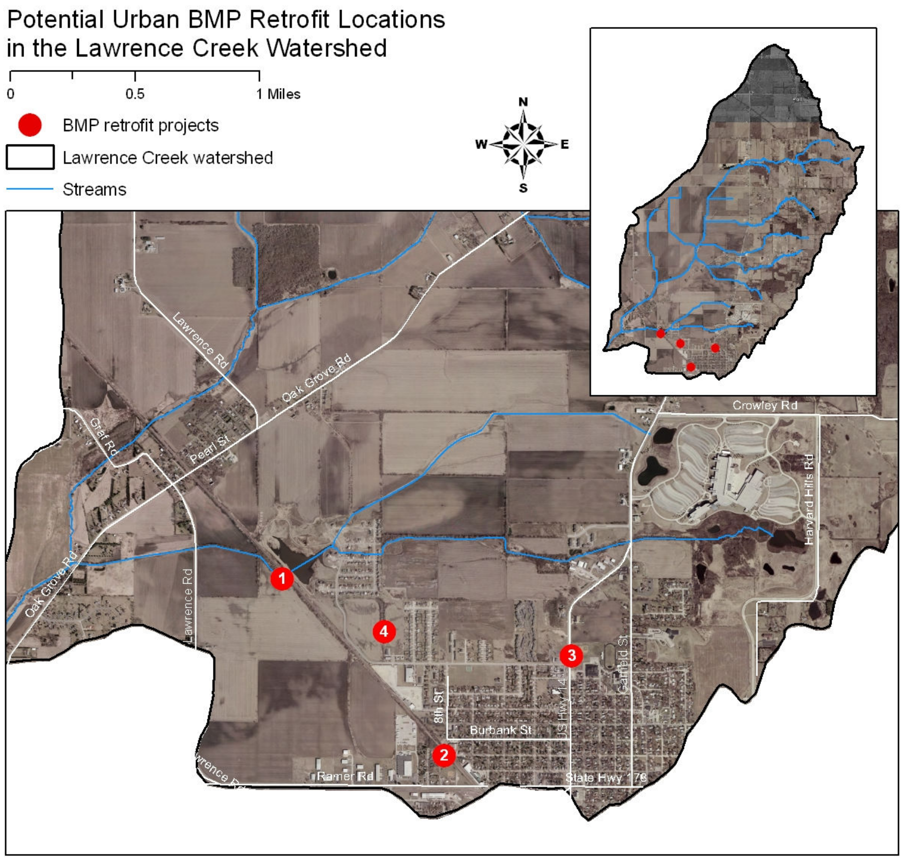
Bioswale East of Route 14 (3). This project involves the creation of a bioswale along the eastern side of Route 14 adjacent to the Northfield Avenue intersection. There are several sewers that daylight at this location prior to flowing west under Route 14. Treating 0.5 inches of runoff from the 75-acre tributary area would require three acre-feet of storage. If this was provided in three-foot deep naturalized detention basin, the basin would occupy the entire small field south of the ball field. The estimated cost for a naturalized detention basin that would detain 0.5 inches of runoff is $95,000. It is unlikely that this project would be acceptable to the school district as it appears that the field is actively used for recreation activities. Alternatively, a more feasibly sized bioswale (50 feet by 300 feet) would treat only 0.05 inches of runoff from the tributary area. While the water quality benefits may be marginal, it may help to reduce the frequency of ponding that has been reported at this location. The estimated cost for implementing the bioswale would be $30,000.

Figure 5-12: Facing east from Route 14, convergence of four drainage pipes next to high school.

Lonesome Road/Northfield Avenue Wetland Basin (4). This project involves the creation of a 2.5-acres wetland basin north of Northfield Avenue, east of Lonesome Road, and west of 10th Street. The existing channel in this area drains 80 acres of urban watershed. The wetland basin would be placed onstream and would require some overbank excavation to create a new wetland in this area. This project is in essence a smaller version of the Railroad Wetland (Project 1), but is much more efficient at treating the urban runoff, since its much smaller watershed is exclusively urban area. The estimated cost for implementing this project is $110,000.

Figure 5-13: Facing south from next to Route 14.

Figure 5-14.



Source: CMAP

Table 5-3. Costs and load reductions expected for urban retrofit projects.

Project ID	Proposed Project	Cost	Acres treated	Pollutant Removal TSS (t/yr)	TN (lb/yr)	TP (lb/yr)
1	Wetland detention	$800,000	1,920	150.3	1,017.6	325.2
2	Vegetated swale	—	—	—	—	—
3	Bioswale	$30,000	75	0.9	8.8	2.2
4	Wetland detention	$110,000	80	10.1	99.2	27.2
		$940,000		**161.3**	**1,125.6**	**354.6**

Note: In the case of retrofits to existing BMPs, pollutant removal is given as incremental reduction over current removal.

5.3 Habitat and Ecosystem Restoration

A windshield survey of the stream, concentrating on the main stem, was undertaken in an effort to identify potential habitat restoration projects. The proposed projects are intended primarily to improve habitat for fish and macroinvertebrates and in some cases to improve stream buffering or hydrology. These projects comprise a medium-term plan (five years) to help implement the vision described in Section 4.

Mainstem of Lawrence Creek Upstream of Lawrence Road (1) There is a large wetland just upstream of the road crossing at Lawrence Road that is down-gradient from an extensive area of hydric soils in agricultural land use. The mainstem of Lawrence Creek borders the wetland to the south while an unnamed tributary borders it to the north. Both channels are ditched and entrenched. The existing wetland could be expanded to include the area directly downstream which intersects with Lawrence Road. There appears to be overland flow from the creek channel that likely contributes sediment during larger storms. The expanded wetland complex and buffer would limit non-point source pollution and improve riparian wildlife habitat. Assuming limited grading to prevent channelized flow and native plantings, this 10 acre project could be accomplished for $75,000. This does not include cost estimates for periodic dredging which may be required to remove the build-up of sediments over the long term.

Northernmost Stream Crossing at Hwy 14 (2) The main stem stream crossing at Highway 14 is low gradient, lacking instream habitat, channelized, experiencing bank erosion, and lacking a riparian buffer. Riparian restoration could include creating a buffer of native vegetation a minimum of 100 foot wide on either side of the stream channel to provide protection from runoff and improve wildlife habitat. Instream habitat improvements could be installed such as stream barbs or anchored large woody debris to create scour pools and backwater areas. Large woody debris could also be placed perpendicular to the stream channel as a habitat feature. Log, brush, or rock structures could be installed in the lower portion of the streambank adjacent to pools to provide additional habitat and shading until riparian vegetation matures and provides natural shading. Habitat heterogeneity encourages a wider variety of aquatic biota to locally utilize the stream channel. Bank reinforcement such as riprap[50] or native plantings should be incorporated where appropriate to reduce erosion. Ten (10) acres of new buffer would be desirable in this location, at $30,000. Installation of three (3) stream barbs would cost approximately $22,500.

Figure 5-15. Mainstem Stream Crossing at Highway 14.

Mainstem Stream Crossing at Yates Road (3) The mainstem stream sections upstream and downstream of the Yates Road crossing are channelized, lacking instream habitat, and do not have adequate riparian buffers. Many of the soils in this area may be classified as hydric indicating a high likelihood of historic wetlands. Riparian restoration should include creation of a buffer of native vegetation of at least 100 feet wide around the stream channel to provide protection from runoff and create wildlife habitat. Instream habitat should be installed such as stream barbs or anchored large woody debris to create scour pools

[50] Concerns have been raised about the effectiveness of riprap for bank reinforcement; stakeholder comments August 14, 2008. Other options are described by the Federal Interagency Stream Corridor Restoration Working Group (FISRWG), in *Stream Corridor Restoration: Principles, Processes, and Practices*. 1998. http://www.nrcs.usda.gov/Technical/stream_restoration/.

(parallel installation) or backwater areas (alternating installation). Large woody debris could also be placed perpendicular to the stream channel as a habitat feature. Habitat heterogeneity encourages a wider variety of aquatic biota to locally utilize the stream channel. Bank reinforcement such as riprap or native plantings should be incorporated where appropriate to reduce erosion.[51] A series of shallow wetland scrapes could be created in proximity to the stream channel to benefit local and migratory wildlife in the reach from Yates road to just north of the crossing at Lawrence Road. The scrapes should be included with wider (>200 foot) riparian buffer areas to provide non-liear habitat contiguous to the stream channel. Adding 23 acres of buffer would cost around $69,000 and 5 installed stream barbs would be $37,500. The wetland scrapes, at about ½ acre in size and 1 to 2 feet deep, could be created at $20,000 each (3 proposed at $60,000 total). Combined recommendations #1 and #3 would create a series of wetlands linked via naturalized buffers.

Figure 5-16. Mainstem Stream Crossing at Yates Road.

Figure 5-17. Mainstem Stream Crossing at Yates Road.

Stormwater Ponds at Former Motorola Factory Site (4) Several large stormwater ponds are located on the former Motorola facility in Harvard. Options exist to improve the water quality enhancement and wildlife values of the stormwater ponds by creating more shallow marsh areas. Also the woody species should be controlled in the existing native buffer. Enhancing the diversity of native emergent plant community also would a beneficial activity to provide terrestrial and aquatic wildlife and enhanced water quality discharges to downstream areas. Assuming only minor regrading, simple permitting and new plantings, this 9 acres pond complex could be restored for approximately $56,000.

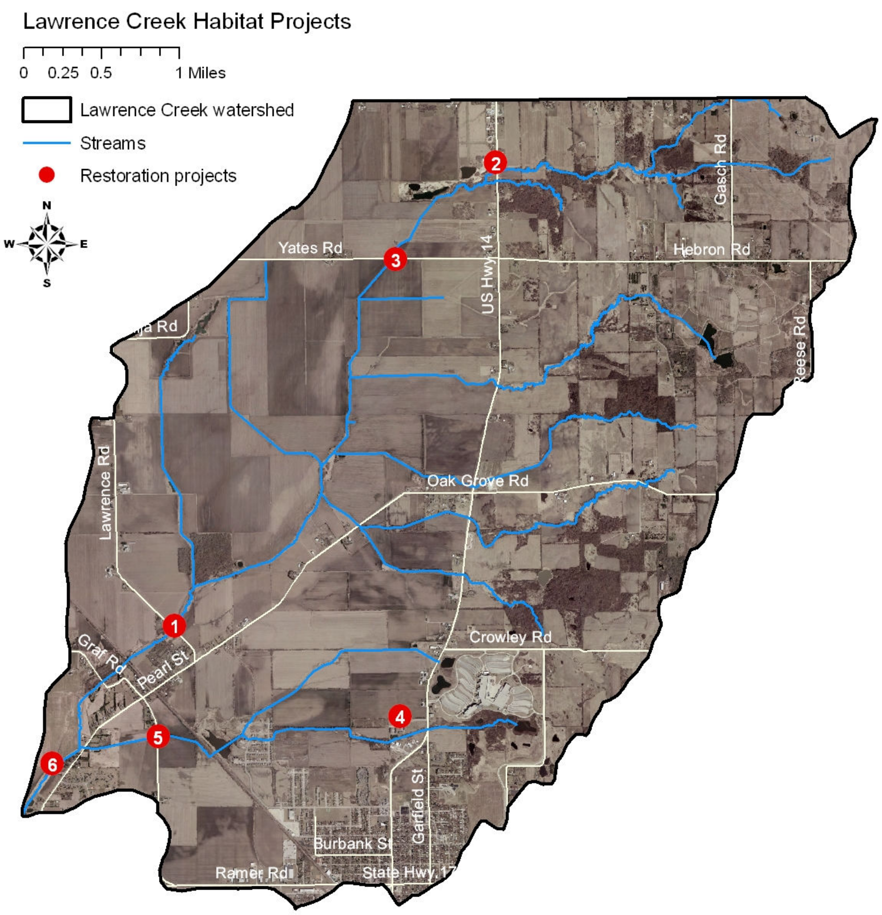
Table 5-4. Estimated costs and potential funding sources for habitat restoration projects

Site	Project Description	Quantity	Unit	Total cost
1	Open water wetland pond creation	10	acres	$75,000
2a	Stream buffer creation	10	acres	$30,000
2b	Stream barb installation	3	each	$22,500
3a	Stream buffer creation	23	acres	$69,000
3b	Stream barb installation	5	unit	$37,500
3c	Wetland scrape creation	3	each	$60,000
4	Enhance existing wetland ponds	9	acres	$56,000
5a	Stream buffer creation	18	acres	$54,000
5b	Wetland scrape creation	3	each	$60,000
6a	Stream barb installation	5	units	$37,500
6b	Stream buffer expansion	13	acres	$39,000
6c	Bank protection	1200	lineal feet	$90,000

[51] Ibid.

Unnamed Tributary (Ditch) Crossing at Graf Road (5) There is a crossing at Graf Road of a small unnamed tributary to Lawrence Creek. Downstream of the road crossing the stream is nearly devoid of riparian buffer. A 100 foot stream buffer should be created to provide water quality benefits and an expanded riparian corridor. The soils in this section are possibly hydric indicating a high probability of historic wetlands. A series of small wetland scrapes could be created from Graf Road to the crossing at Oak Grove Road to improve local and migratory wildlife habitat. The scrapes should be located within an expanded riparian buffer to provide larger sections of habitat contiguous to the stream channel. For budgetary purposes, it is assumed that the scrapes would be approximately ½ acre in size, a few feet deep at maximum depth and that excavated materials can be deposited in the adjacent fields. These scrapes can be created for approximately $20,000 each (3 proposed at $60,000 total). About 18 acres of buffers would complement the scrapes for riparian habitat enhancements ($54,000).

Figure 5-18.



Source: CMAP
Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map

Mainstem From Subwatershed Origin to Lawrence Road (6) This stream section is relatively high quality characterized by a narrow but well vegetated riparian zone, a meandering channel, and a mixture of coarse and fine substrates. Potential improvements of the stream channel include creating deeper pools and reducing bank erosion. Stream barbs, boulder clusters, sills or weirs, or large woody debris could be installed to encourage scouring and creation of deeper areas in the channel. The streambanks should be reshaped to a natural, stable slope and planted with native species to limit bank erosion. Alternately, stabilization structures such as logs could be embedded into the bank to prevent erosion and provide habitat for fish and invertebrates. The riparian buffer is well vegetated, but should be allowed to expand beyond its current width to a minimum of 100 feet at its narrowest point to provide greater value to wildlife. Thirteen acres of new buffer could be added for $39,000, and there are opportunities for approximately 5 stream barbs at $37,500. Stream reshaping should be budgeted at an average of $75 per lineal foot of work. About 3600 lineal foot of streambank occurs in this section of the creek, although only approximately 1200 feet of streambank would benefit from major reshaping. About $90,000 would be needed to complete this work.

Figure 5-19. Mainstem from Subwatershed Origin to Lawrence Road.

Figure 5-20. Mainstem from mouth to Lawrence Road.

5.4 Schedule for Implementation

The following is a generalized schedule for implementing the *Lawrence Creek Watershed Plan*. It is based on the expectation that the plan will be updated starting five years after adoption.

Table 5-5. Schedule for implementing recommended actions

Year	Action	Party
2009	Submit applications for funding for agricultural BMP coordinator	KREP/SWCDs
	Begin physical-chemical monitoring program	IEPA/ISWS
	Hold site planning roundtable to review ordinances for water quality effects and recommend amendments	Harvard/county
	Begin biological monitoring program	MCCD
	Begin implementing a stream restoration practice	Landowner/KREP
2010	Agricultural conservation coordinator hired and begins work	KREP/SWCDs
	Begin implementing a stream restoration practice	Landowner/KREP
2011	Begin implementing a stream restoration practice	Landowner/KREP
2012	Begin water quality model calibration and validation	ISWS
	Begin implementing a stream restoration practice	Landowner/KREP
2013	Begin plan update	IEPA/CMAP

CMAP = Chicago Metropolitan Agency for Planning, IEPA = Illinois Environmental Protection Agency, ISWS = Illinois State Water Survey, MCCD = McHenry County Conservation District, SWCD = Soil and Water Conservation District

5.5 Information and Education

The watershed planning process, commencing in April 2007 and ending in September 2008, was instrumental in accomplishing the information/education component of a watershed-based plan. Stakeholders including landowners, nongovernmental-organization staff, and municipal staff were consistent participants during meetings throughout the 18-month planning process that culminated with the Lawrence Creek Watershed Plan.

Additionally, an agricultural BMP coordinator is proposed in Section 5.1.5. This individual will make personal contact with landowners throughout the watershed and promote the benefits of land-conservation practices to landowners, water quality, and the overall environmental health of the watershed alike. These discussions will naturally entail dissemination of information and lead to an increase in awareness of watershed-plan objectives among the many landowners contacted.

Furthermore, it is reasonable to expect that the Kishwaukee River Ecosystem Partnership (KREP) will play an important role in encouraging and facilitating the flow of information and educational activities. KREP has for many years been involved in such activities regarding watershed resources and stewardship. KREP will maintain the database of natural resources that it uses to promote awareness among watershed residents and will hold training sessions for local government officials on the use of the database. KREP will also continue to lead tours throughout the Kishwaukee River Basin to share information with local decision-makers about best management practices to maintain or improve water resources. KREP will prepare a plan for outreach and education specific to the recommendations and needs identified in the watershed plan. Regular reviews of plan implementation status, a recommendation found in Section 6.2, will serve as an additional forum for information and education.

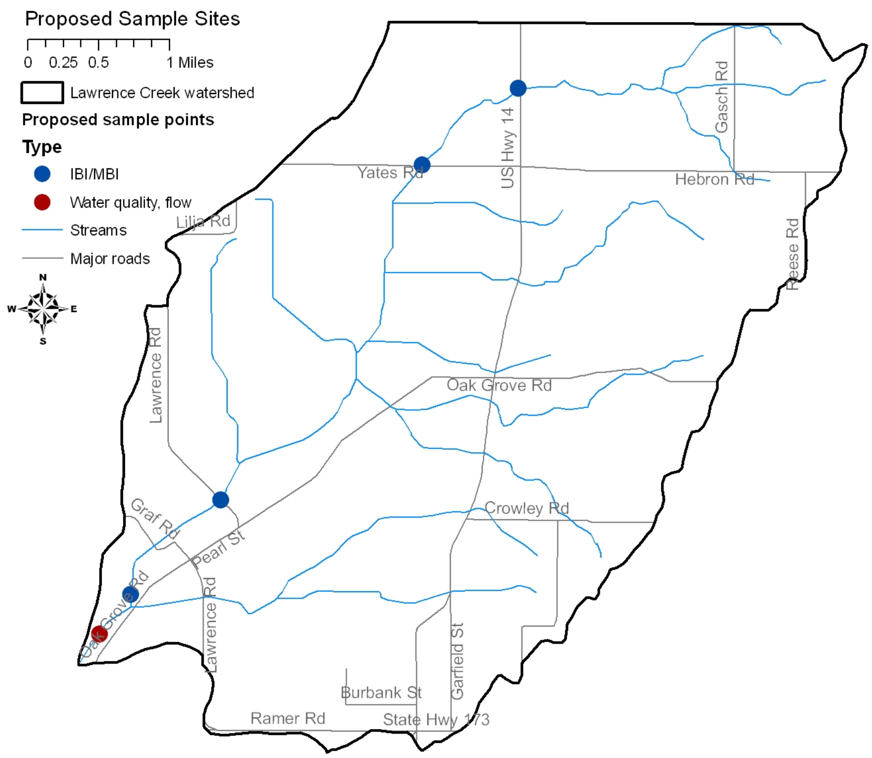
6. METRICS FOR EVALUATION

6.1 Monitoring Program

6.1.1 PHYSICAL-CHEMICAL DATA COLLECTION AND MODELING

The data available for Lawrence Creek are inadequate to calculate watershed loading with acceptable accuracy or to simulate water quality response at all. It is recommended that Illinois EPA and potentially other parties commit funds to collect additional data and develop such a water quality model. The study objectives are as follows. First, additional samples of total nitrogen, total phosphorus, and total suspended solids should be collected. Second, a water quality model (e.g., HSPF, QUAL2K, etc.) should be calibrated and validated using the data, so the frequency of sampling, additional constituents monitored, and length of the sample program should be adequate to do so. It may be necessary to provide a weather station as well. Third, the study should determine monthly and annual loads of total nitrogen, total phosphorus, and total suspended solids as well as the frequency and amount by which concentrations exceed criteria and determine more precisely the reduction in loading necessary to meet the criteria.[52]

Figure 6-1.



Source: CMAP
Note: The portion of the Lawrence Creek watershed in Wisconsin is not shown in this map

Approximately 18 ~ 24 samples per year for about four years are recommended for nutrients and sediment just upstream from the confluence with Piscasaw Creek. In situ measurements of temperature, pH, and dissolved oxygen should also be taken for use in modeling. The sample design should include sampling during both high and low flows to get an adequate representation of the distribution of flow

[52] By this time the Illinois Pollution Control Board may have adopted nutrient standards.

and concentration. Flow measurements are also needed from a stage-discharge stream gaging station.[53] Because sedimentation is also a potential cause of impairment, cross sections of the channel, about 1 ~ 2 per year over four years, should be taken to determine the rate at which sediment is accumulating. Sedimentation can then be related back to watershed loading with a level of accuracy that is at least an improvement over the present state of information. Planning-level cost information has been provided by the Illinois State Water Survey for such a sampling program (Table 6-1) based on the three watersheds in the Kishwaukee basin for which plans are being developed b y CMAP and KREP. The cost for Lawrence Creek would be roughly $165,000 assuming no economy of scale.

Table 6-1. Estimated cost of monitoring for three watersheds in the Kishwaukee basin

	Year 1	Year 2	Year 3	Year 4	Project	**Total**
Personnel						$234,497
Field Staff	$35,000	$36,050	$37,132	$38,245	$146,427	
Data Managemnt	$10,833	$11,158	$11,493	$11,838	$45,321	
Project Manager	$6,941	$4,766	$4,909	$5,056	$21,672	
cross-section survey (1/yr)	$9,270	$3,820	$3,935	$4,053	$21,077	
Totals	$62,044	$55,794	$57,468	$59,192	$234,497	
Fringe	$22,094	$19,868	$20,464	$21,078	$83,504	$83,504
Equipment	$28,500	$500	$525	$551		$30,076
Gage incls pump sampler ($7600)						
CSI Weather Station ($5700)						
Supplies	$2,000	$500	$525	$551		$3,576
Travel	$1,000	$200	$200	$200		$12,364
cross-section survey (1/yr + setup)	$5,200	$1,800	$1,854	$1,910		
Op Auto	$4,348	$2,274	$2,388	$2,507		$11,517
Contractual	$7,700	$8,085	$8,489	$8,914		$33,188
LabAnalyses (24/yr:100/samp)						
Telecomm	$600	$600	$600	$600		$2,400
Subtotal						$411,122
F&A						$82,224
Grand Total	$160,183	$107,545	$111,015	$114,603		**$493,347**

Source: Illinois State Water Survey

6.1.2 BIOLOGICAL MONITORING

Since the ultimate measures of the plan's success are the Index of Biotic Integrity and Macroinvertebrate Biotic Index, it must be determined whether IBI and MBI scores are improving or not. It is recommended that a reliable program of regular future biological monitoring be instituted. Because the McHenry County Conservation District has the equipment to conduct such studies and is located nearby, it is recommended that Illinois EPA provide funding for MCCD staff to undertake IBI and MBI measurements once every 2–3 years, potentially at the sites recommended in Figure 6-1.[54] There is also a place for volunteer efforts in biological monitoring, although it will not be possible for them to generate IBI scores because of the special equipment needed. It would be desirable to expand the amount of monitoring performed by volunteers, both for the resulting data and for the sense of stewardship it helps sustain. The

[53] A stage-discharge stream gaging station is able to show the relationship between the vertical height of the gage and stream flow (i.e., stream discharge) at a particular time. Flow can then be inferred from gage height readings.

[54] Previously MCCD had sampled at sites within protected areas. Unless there are access issues, samples should be taken up and down the stream to represent average conditions as well. Sample points are shown at road crossings as access points, but IBI measurements would be taken well away from the bridges to avoid anthropogenic effects. In the higher reaches of the stream (<10 feet wide), it may not be possible to compute an IBI score; in this case a species list can be made.

most important information for a volunteer monitoring effort to generate is Macroinvertebrate Biotic Index (MBI) scores.

6.2 Milestones for Plan Implementation

The interim measurable milestones for determining whether plan recommendations are being implemented are described in Section 5.4, Table 5.5: Schedule for implementing recommended actions. It is further recommended that KREP track progress with implementation via an annual review (or more frequent if preferred) where all parties that are listed as having a lead role with implementation provide a report on the status of their activities. CMAP staff will participate in these annual reviews and lend assistance where appropriate.

6.3 Ensuring Load Reductions Are Being Achieved

Three criteria will be used to determine whether loading reductions are being achieved over time and whether progress is being made towards attaining water quality objectives. First, the water chemistry monitoring scheme proposed as a watershed plan recommendation will generate data at a much improved resolution across both space and time. This data collection effort will enable an analysis of the efficacy of plan recommendations as they manifest in changes or trends in ambient water quality. Secondly, should IEPA choose to accept the plan recommendation made above to require the municipal wastewater treatments plants to monitor and report total nitrogen concentrations in effluent, these data will significantly improve our ability to determine the effectiveness of planned nitrogen-removal technologies and loads over time from these point source dischargers. Thirdly, biological sampling as recommended above is a critical component for judging the efficacy of watershed plan recommendations. It is expected that the expertise present at the McHenry County Conservation District can be taken advantage of to measure IBI scores every 2-3 years in order to track progress towards improving water quality.

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