LPL-274

Report

Jackson Creek Watershed Nonpoint Source Management Plan Delavan Lake, WI

Prepared for:

Town of Delavan

Wisconsin Department of Natural Resources

Quality through teamwork

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Rust Environment & Infrastructure

CHAPTER 6

NONPOINT SOURCE POLLUTION MANAGEMENT ALTERNATIVES AND RECOMMENDATIONS

INTRODUCTION

Based on the information and conclusions of Chapter 5 sediment and phosphorus control must come from both urban and rural sources. Thus, a variety of best management practices should be considered. A specific "target" pollution goal has not been set for the project. What can be achieved through the implementation of the practices discussed below will be a function of practicality, available funding, political desire, and voluntary cooperation of affected parties.

Each pollutant source and management measure is discussed, along with recommendations for specific units of government regarding each source. Although this study is being conducted for the Town of Delavan (with support from the DNR) several recommended pollution control measures are beyond the Town's authority to carry out. Other local units of government may have jurisdiction related to some of the recommendations. Each recommendation discussed below includes an identification of local units of government with authority to carry them out, and an estimate of the overall effectiveness for reducing pollution to Delavan Lake.

STREAM CORRIDOR/ WETLAND PROTECTION & ENHANCEMENT

Background

Creating and/or maintaining a natural, permanently vegetated corridor along a stream provides several benefits to the stream, and downstream water resources. Some of these benefits include:

1) stabilizing the streambank itself to minimize erosion from the bank;

2) providing a vegetative filter strip reduce overland flow velocities and promote adsorption, sedimentation, and filtration of pollutants from overland runoff;

3) improving stream corridor habitat for fish and wildlife; and

4) providing open space recreational lands (depending on land ownership, and/or easements)

The pollution reduction efficiency of vegetative filter strips is dependent on a number of factors including, width, type of vegetation, slope, soil type, and potential management uses. Pollution reduction efficiencies have been measured in the field in a number of scientific studies. The results vary considerably and range from 60% - 90% for phosphorus reduction, and 33% - 95 % for sediment reduction (Castelle, 1994).

Within the project area, nearly continuous wetlands are found along the main stem of Jackson Creek from Mound Road to Petrie Road. These wetlands are currently providing the "buffering" functions described above. It is important to note that the recommendations given below are based on the assumption that the mapped wetlands along the streams will not be developed in the future.

Table 6.1, and Figure 6.1 summarizes stream corridor locations that should be considered for preservation/creation of buffer strips by the Town. Criteria for these sites being identified are:

- sites adjacent to major drainage ways or stream channels
- west of Highway 12
- land currently in active cropland use (according to the 1995 aerial photographs.

It was assumed that lands mapped as wetlands along the drainage ways would be protected through existing state and federal regulations, thus wetlands were not identified for preservation through a land purchase program.

Table 6.1
Potential Stream Corridor Buffer Strip Areas

Channel/Creek	Township	Section(s)	Linear Ft.	Acres *
Jackson Cr. - Main stem	Tn. of Geneva	7, 17	1,600	7.35
Jackson Cr. - Main stem	Tn. of Geneva	17	8,160	37.47
Jackson Cr. - Main stem	Tn. of Geneva	8	900	4.13
Elkhorn Tributary NE	Tn. of Geneva	6	2,800	12.86
Inlet Tributary - Southeast	Tn. of Delavan	13	8,600	39.49
Elkhorn Tributary NE	Tn. of Delavan	11, 12	3,760	17.26
Elkhorn Tributary NW	Tn. of Delavan	2, 11	8,200	37.65
		Total:	34,020	156.21

* assumes buffer strips are 100 feet wide on each side of channel (200 feet total)

There are various mechanisms that could be used to obtain new streambank corridor buffer practices, including:

1) Cost Sharing/Rental: A governmental unit (federal, state, city, county, town,), or a nonprofit organization could provide money to a landowner to keep a defined piece of property under permanent vegetation. The agreement between the landowner and governmental unit would detail the payments, length of agreement, types of activities allows on the land, if the restriction were to be attached to the property deed, and other issues.

   Walworth County Land Conservation Department (LCD) administers the USDA Conservation Reserve Program (RCP) which provides farms with an annual rental fee to keep land out of in

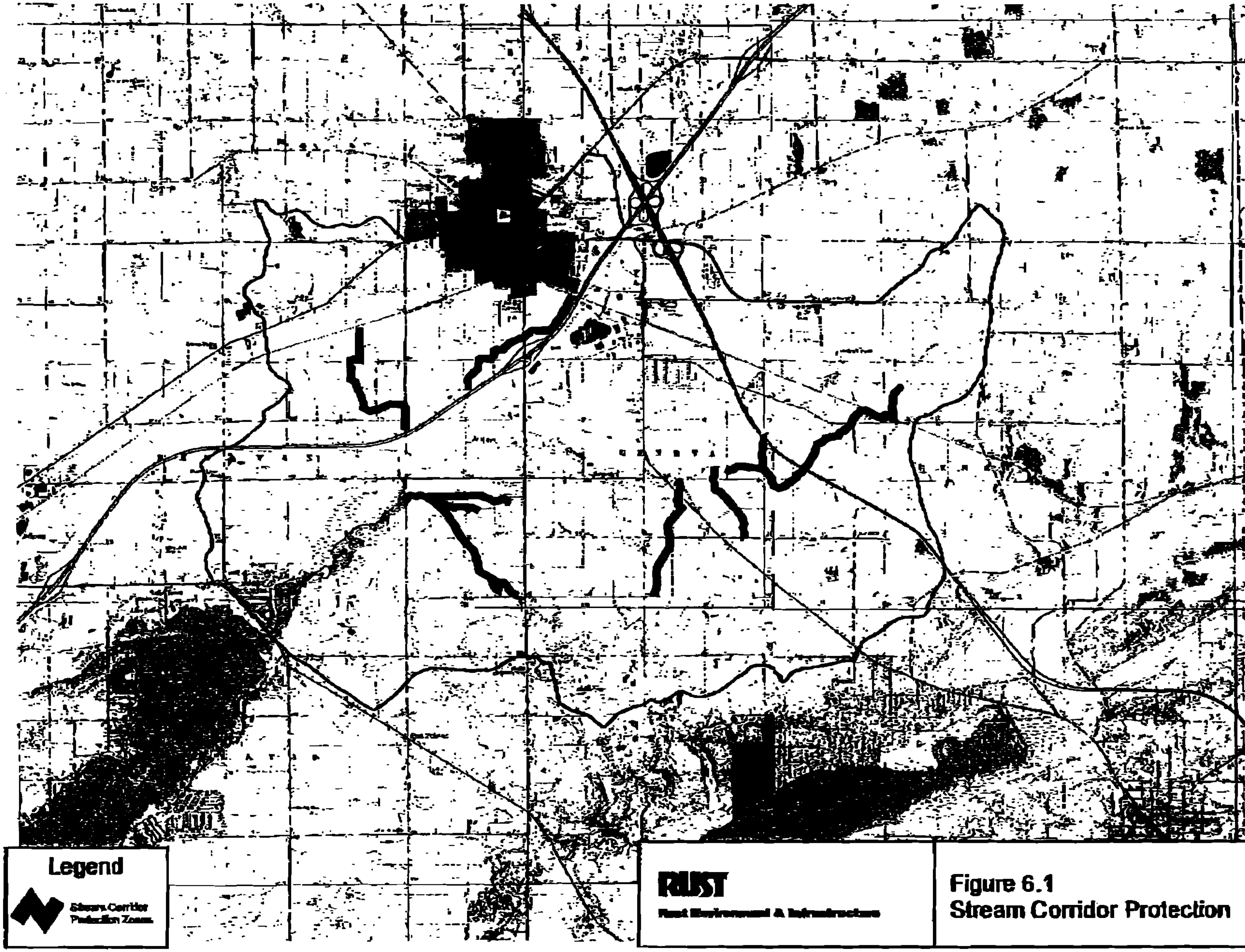

Figure 6.1
Stream Corridor Protection

production and in permanent vegetation. Within this program are provisions for filter strips to be included. The town could provide additional monetary incentive (in addition to the USDA rental amount) to encourage key properties to participate in the program.

2) Easement Purchase: A governmental unit (federal, state, city, county, town,), or a nonprofit organization could purchase an easement on the property, restricting the use and management of the land. In this case the easement would become a deed restriction.

3) Land Purchase: A governmental unit (federal, state, city, county, town,), or a nonprofit organization could purchase the property outright. Under this approach, the purchaser has complete control over the management of the property, and also would be responsible for the long term maintenance, taxes, etc.

BMP Effectiveness

Using the assumptions listed below, obtaining permanent vegetative cover on the entire 156 acres of potential corridor area may result in:

1) annual phosphorus reduction to Delavan Lake of approximately 300 pounds per year - or about a 3.0% reduction in the annual phosphorus load from the entire project area, and

2) annual sediment reduction of about 35 tons/year - or about a 2.8% reduction in the annual load from the entire project area.

Assumptions:

- average annual unit area phosphorus load from rural lands = 0.56 lbs/acre/year; sediment load of .06 tons/acre/year
- lands contributing runoff to buffer zone does not exceed 400 feet of overland flow; thus contributing area = 34,020 linear ft. x 400 ft. x 2 (each side of channel) = 625 acres of land contribute runoff to the buffer areas.
- buffer (corridor) zone lands change from phosphorus loading rate of 0.56 lbs /acre/yr, and sediment load of 0.06 tons/acre/year (existing condition) to zero (permanent vegetative condition)
- phosphorus loads from the 625 acres of contributing area is reduced by 60% and sediment loads reduced by 70% (lowest values reported by Castelle, 1994)

In addition to the buffer strips proposed for protection above, existing wetlands provide an important pollution reduction function. The existing wetlands along 20,700 feet of channels (west of Highway 12) are buffering the runoff from approximately 380 acres. These wetlands are reducing the project area's annual pollutant load by 16 tons per year for sediment and 128 pounds per year for phosphorus.

Costs

Cost estimates for two approaches to establishing stream corridor buffers are summarized in Table 6.2. The two approaches are: 1) purchase of the corridor property, and 2) increasing the cost sharing available for the existing USDA/County program. Rural land values vary greatly depending upon soil conditions, productivity of the land, and the development potential. Inquiries about recent rural land values with local real estate agents revealed per acre sale costs ranging from $2,000 to $2,500. Under the USDA CRP set aside program, the county expects that per acre rental rates for the types of land along the drainage ways will be about $105 per acre per year.

Table 6.2
Cost Estimates for Stream Corridor Establishment
(assumes 156 acres of corridor)

Approach	Unit Costs	Total Costs	Other Considerations
Land Purchase	$2,500/ac	$390,000	costs of land management, maintenance, legal fees, insurance, administration, etc. must be factored in
Additional Rental Money to CRP	$50/ac/yr*	$7,800/yr	administration costs and long term protection and costs must be factored in.

* This value, plus the length of the rental agreement, must be determined by the Town; County LCD rental agreements generally run 10 - 15 years. The $50 would be in addition to the USDA rental of $105/acre to attract more participation in the program. The level of additional funding would be set by the Town

Recommendation

It is recommended that the Town of Delavan investigate working with the County LCD in providing additional rental money for filter strip establishment through CRP for eligible properties identified in Table 6.1 and Figure 6.1.

CONSTRUCTION SITE EROSION

Background

Construction site erosion can be a significant source of nonpoint source pollution in a watershed undergoing urban development. Erosion rates from construction sites can be much higher than erosion from agricultural fields. Construction site erosion can be controlled with measures such as sedimentation basins, sediment traps, rock tracking pads, silt fence, straw bales, mulch, temporary seeding, and timely final landscaping of the site. These practices are described in the Wisconsin Construction Site Best Management Practice Handbook (WDNR, 1989).

As discussed in Chapter 5, the Town of Delavan and the City of Elkhorn have their own construction site erosion control ordinances requiring implementation of such practices. In addition, the Walworth County Land Conservation Department is responsible for permitting and inspection of construction site erosion control measures in the Shoreland Zone which is defined as being within 1000 feet of a lake or 300 feet of a navigable stream.

Effective construction site erosion control requires adequate enforcement of existing local erosion control ordinances. The keys to this are: requiring submittal of a detailed erosion control plan with the erosion control permit application which complies with the ordinance; frequent inspection of the site to check for compliance with the erosion control plan; and, implementing quick and adequate responses to non-compliance such as shutting down the site, fines, or the withholding of a deposit.

BMP Effectiveness

Dane County (Wisconsin) has developed a construction site erosion control ordinance which uses a soil loss calculation to set acceptable levels of management on a construction site. The calculations used indicate that with an extremely high level of control, construction sites may be expected to achieve approximately a 60% - 70% level of reduction compared to an un-managed site. This represents an improvement of 10% to 20% from the construction site sources estimated in Chapter 5. If construction site erosion could be further reduced from present conditions by an additional 20%, this would translate to a reduction of:

1) phosphorus by about 175 pounds per year - or 1.8% of the project area load and
2) sediment reduction of 112 tons per year - or about 7.7% of the project area load.

It is important to note that this reduction assumes that all local units of government where development is taking place (City, Towns, and County) increase their construction site erosion control efforts.

Costs

For purposes of estimating the costs of reducing pollution loading to Delavan Lake from construction sites it was assumed that the inspection/enforcement efforts would need to double from the present levels. Since various units of government carry out construction erosion inspection efforts the costs would vary by each unit of government, depending on workload represented by the construction activities within the Jackson Creek watershed compared with the rest each municipality. A permit fee system can be established to offset the costs of the additional inspections.

Recommendation

It is recommended that the Town of Delavan and the City of Elkhorn, and the Town of Geneva increase the construction erosion/enforcement efforts within the project area. In regards to the Town of Delavan, this increased effort should also apply to the entire town, since much of the town drains to Delavan Lake outside of the Jackson Creek watershed.

URBAN STORMWATER MANAGEMENT PRACTICES

Background

This category of nonpoint source control practices includes a variety of measures that can be applied to both established urban lands, and developing lands. Each practice is briefly described below.

Street Sweeping and Catch Basin cleaning can be an effective means of removing sediment and nutrients from streets and the storm sewer system. A catch basin is a sump in a manhole below the elevation of the storm sewer. Pollution reduction is dependent upon the frequency of sweeping and/or catch basin cleaning and the type of land use.

Currently, the City of Elkhorn street sweeps two or three times a year, once in the spring, summer and fall, except for the central downtown area and the main streets which are swept weekly. The City's catch basins are cleaned once a year. The major urban area in the Town of Delavan, the Inlet Oaks area on the north west side of the lake inlet does not have curb and gutter and is drained by a ditch and swale system (this system is a good pollution control practice - see discussion below). Effective street sweeping requires a curb for the sweeper to brush up against. The Town street sweeps in this area on the occasion when construction work is being done.

Grass Swales and Wet Detention Ponds generally are most easily installed during the site development phase. Both practices can be combined to maximize the pollution reduction potential from developed areas. The location and sizing of the ponds and/or grass swales can be integrated into the site to fit the development.

Grass swales are channels or ditches lined with dense grass. Grass swales are effective at removing pollutants from stormwater runoff by filtration in the grass and by infiltration of water into the soil. Grass swales can take the place of curb and gutter type drainage, which provides no filtration or infiltration benefits. Outside of the Elkhorn area much of the residential areas in the watershed are served by grass swales or ditch systems.

Wet detention basins have a permanent pool of water which is very effective for settling out pollutants. These types of basins can also be designed to reduce peak flows as well.

BMP Effectiveness

Table 6.3 summarizes the estimated effectiveness for the urban BMPs.

Table 6.3
Effectiveness of Pollution Reduction for Urban BMPs

Practice/ Location	BMP Effectiveness *		Project Pollution Load Reduction			
	Sediment	Phosphorus	Sediment		Phosphorus	
	(%)	(%)	tns/yr	(%)	lbs/yr	(%)
Street Sweeping Commercial/Industrial land use Residential land use	35 - 40% <5%	15 - 20% <5%	88 0	6%	196 0	2%
Catch Basin Cleaning Commercial/Industrial land use Residential land use	8% 5%	5% 5%	Already being done by City of Elkhorn			
Grass Swales (all developing urban lands)	50 - 60%	40 - 50%	192	13%	788	8%
Wet Detention Basins (all developing urban lands)	80%	60%	306	21%	1,182	13%

* BMP Effectiveness based on SLAMM results.

Costs

Table 6.4
Cost Estimates for Urban BMPs

Practice	Unit Costs *	Units	Costs
Street Sweeping	$2.50/acre/sweeping pass	484 acres (existing commercial & industrial	$16,940 (1)
Catch Basin Cleaning	City of Elkhorn existing activity		
Grass Swales	Costs to be incorporated as part of development (2)		
Wet Detention Basins	Costs to be incorporated as part of development (2)		

* Costs based on SEWRPC Tech. Rpt. 31 (1991)

(1) assumes 14 sweepings per year in addition to the two already conducted by the City of Elkhorn

(2) Local units of government can establish regulations that require new developments to incorporate best management practices to minimize nonpoint pollution and reduce stormwater flows from an area. The costs of these practices are a part of the development costs, and thus are reflected in the lot values. In this manner, the public, does not bear the costs of stormwater management from new developments.

Recommendations

It is recommended that the Town of Delavan, the City of Elkhorn, and the Town of Geneva adopt stormwater management ordinances that require nonpoint source pollution control, and runoff management practices. Specific issues that are recommended to be contained in a stormwater ordinance are:

- The peak runoff flows for selected storms from the propose development should not exceed the peak flows that would come from the same area if it were under a "naturally vegetated condition". This condition should be defined by specifying the Curve Number (CN) to be used by the developer. It is recommended that a curve number no higher than 58 be required for use in all pre-development calculations.

- Describe the accepted methodology and parameters for hydrologic modeling. (For example: use the SCS Type II 24 Hour Storm, maximum overland flow lengths, etc.).

- Where storm sewer pipes are used, the sizing must carry the 10 year 24 hour storm for existing and future land use conditions.

- All new developments must implement one or more stormwater management practices that will reduce the average annual suspended sediment load from the post-developed site by a minimum of 80% when compared to the same developed condition with no best management practices. Further information on approaches to achieving this level of treatment should be provided in a referenced guidance document or handbook maintained and updated by the town (or other unit of government).

- Although runoff from residential lake front properties along the inlet was not quantified, it is recommended that proper lawn and housekeeping practices be adhered to. Actions such as: minimal lawn fertilization; shoreline buffer strips, proper disposal of household and automotive products, and proper leaf disposal should be described in detail in a fact sheet or booklet and provided to the property owners. This recommendation applies to residential lands around the entire lake (not just in the project area).

It is also recommended that the Town of Delavan develop a comprehensive stormwater management plan. The Town is likely to undergo significant changes in land use over the next several years and a stormwater management plan will point out actions that can be taken to reduce flooding and nonpoint source pollution from future developments.

AGRICULTURAL PRACTICES

Background

For purposes of this section the agricultural practices will focus on soil loss from cropping practices and phosphorus loading from drain tiles.

The Walworth County Land Conservation Department coordinates the various federal and state agricultural conservation programs. Cropping practices such as contour farming, minimum tillage, and strip cropping can reduce soil erosion and the associated sediment and nutrient runoff. Over 60% of the croplands in the project area are under a farm plan developed by the County. This means that fields are generally managed to prevent excessive soil erosion. Of the lands not under a farm plan, the data collected indicates that these land are also not eroding at excessive levels.

Discharge from agricultural field drains may be contributing up to 9% of the annual phosphorus load to the lake, but negligible contributions of the sediment load. Agricultural drain tile discharge generally is not regulated by local, state or federal agencies.

BMP Effectiveness

On fields with high erosion rates, cropping practices can reduce erosion rates by 50 - 75%. Based on reviews of the County's farm plans, discussions with County staff, and limited field investigations, there are very few fields with high soil loss rates. This means that although the total contribution of cropped fields to the sediment and phosphorus load to the lake is significant, the opportunities to reduce the loads through additional management practices is limited. If an additional 10% reduction of overall cropland soil loss could be achieved in the project area, it would result in a reduction of 4%-5% of sediment and phosphorus to the lake.

There are two basic approaches to reducing the phosphorus loading from tile drainage discharge: 1) reduce the amount of phosphorus fertilizer applied to the croplands, or 2) remove the phosphorus from the tile discharge water. Removal of phosphorus through treatment of the water has been previously investigated (WDNR, 1989). It was concluded that this approach is costly and presents additional environmental issues to be resolved. Fertilizer application rates are unknown in the project area so it is not possible to determine the reduction that could be achieved through reduced application rates.

Costs

Cost estimates were not made for the agricultural management practices. Walworth County LCD has cost share rates used for various cropland erosion control practices; however the practices applied to the specific sites are unknown at this time. Below is a discussion on further identifying erosion sites. At the time of the site identification, additional information may be presented on costs of recommended BMPs.

Recommendations

In December of 1996 staff from the Walworth County LCD and Rust toured then Jackson Creek watershed to identify cropland or gully erosion control needs. Although widespread cropland erosion problems were not apparent in the Jackson Creek watershed, specific sites were identified that could benefit from additional management practices. A total of 12 fields were located for a total of 520 acres.

It is recommended that the Town work with the County LCD to determine how best to provide assistance in:

1) improving management of erosion sites identified in the field inventory, and
2) encouraging a soil testing program of croplands to minimize the application rates and timing of phosphorus fertilizers.

SUMMARY OF RECOMMENDATIONS

Table 6.5
Recommendations, Costs, and Estimated Pollution Reduction

Source	Recommendation	Cost	Project Area Pollutant Load Reduction	
			Sediment (%)	Phosphorus (%)
Cropland Erosion	Stream corridor protection Land purchase: CRP rental enhancement: Existing Wetlands:	 $390,000 $ 7,800/yr. $0	 2.8% 1%	 3.0% 1%
Construction Site Erosion	Increase inspections & enforcement	$0	7.7%	1.8%
Urban Stormwater Management	Increase street sweeping: Manage new development:	$16,940/yr $0	6% 21%	2% 13%
Cropland Erosion	BMPs for identified sites:	unknown	<5%	<5%
Drain Tile Discharge	Soil testing & fertilizer management	unknown	0%	<2%

CONCLUSIONS

- Based on the analysis conducted, and the summary above, it appears that future urban developments present the greatest increase in nonpoint pollution contribution to the lake, and also has the greatest potential for control. Ordinances for controlling nonpoint source pollution from developed lands should be developed by both the Town of Delavan and the City of Elkhorn.

- Other sources although not as significant (such as construction erosion), are still important and improved management can be accomplished with little or no costs to the current residents, if a fee system is established to cover the increased staffing requirements.

- The purchase of stream corridor buffer strips does not appear warranted given the high initial costs and relatively low return. Cooperating with the County LCD programs to augment the existing rental rates for selected lands (shown of Figure 6.1) would be a more cost effective approach.