
CHAPTER 6

WATERSHED ACTION PLAN

6.0 Introduction

This chapter of the Watershed Management Plan brings together the other sections of the Plan through potential solutions to the identified water quality issues. The following discussion describes Best Management Practices (BMPs) that could be implemented to address each goal and objective of the Plan.

6.1 Best Management Practices (BMPs)

Stormwater “Best Management Practices” or BMPs are structural, vegetative, or managerial practices used to minimize or eliminate stormwater runoff and pollutants from entering surface and ground waters. When we understand the sources (“where” pollutants come from) and causes (conditions that create the “source”) of a stormwater pollutant, we can determine which BMPs can be used to address these water quality problems.

BMPs cover a broad range of activities that vary in cost, effectiveness, and feasibility, depending on a set of complex factors. BMPs can be either engineered and constructed systems (structural practices) or institutional, educational, or managerial practices (vegetative or managerial practices). Structural BMPs directly improve the quality and/or control the quantity of runoff such as detention ponds and constructed wetlands. Vegetative or managerial practices are designed to limit the generation of stormwater runoff or reduce the amounts of pollutants contained in the runoff. No single BMP can address all stormwater problems. Each type has certain limitations based on drainage area served, available land space, cost, pollutant removal efficiency, as well as a variety of site specific factors such as soil types, slopes, depth to groundwater, etc. Careful consideration of these factors is necessary to select the appropriate BMPs for a particular location.

The Upper Clinton Subwatershed Core Group evaluated a broad list of possible BMPs based on their potential effectiveness, cost, and feasibility. At several Watershed meetings, the group considered which BMPs would (1) best address their priorities for the subwatershed in their locality, (2) be the most environmentally effective in their community, and (3) be the most likely to be implemented in the short term (initiated within five years), and the long term (initiated in more than five years) in their community. These discussions resulted in the following list of BMPs for the Upper Clinton Subwatershed.

Effectiveness and Location of BMPs

As mentioned above, different BMPs have different levels of pollutant-removal abilities. The following chart (compiled for the Mill Creek Subwatershed Management Plan, by the Huron River Watershed Council, 2003) shows the removal potential of several different types of stormwater BMPs:

**Table 6.1
BMP Pollutant Removal Efficiencies**

Management Practice	Pollutant Removal Efficiencies				
	Total Phosphorus	Total Nitrogen	TSS	Metals	Bacteria
High-powered street sweeping	30-90%		45-90%		
Riparian buffers	Forested: 23-42%; grass: 39-78%	Forested: 85%; grass 17-99%	Grass: 63-89%		
Vegetated roofs	70-100% runoff reduction, 40-50% of winter rainfall. 60% temperature reduction. Structural addition of plants over a traditional roof system.				
Vegetated filter strips (150ft strip)	40-80%	20-80%	40-90%		
Bioretention	65-98%	49%	81%	51-71%	
Wet extended detention pond	48-90%	31-90%	50-99%		
Constructed wetland	39-83%	56%	69%	(-80)-63%	76%
Infiltration trench	50-100%	42-100%	50-100%		
Infiltration basin	60-100%	50-100%	50-100%	85-90%	90%
Grassed swales	15-77%	15-45%	65-95%	14-71%	(-50)-(-25)%
Catch basin inlet devices		30-40% sand filter	30-90%		
Sand and organic filter	41-84%	22-54%	63-109%	26-100%	(-23)-98%
Stabilize soils on construction sites			80-90%		
Sediment basins or traps at construction sites			65%		

Sources: Claytor, R. and T.R. Schueler. 1996. Design of Stormwater Filtering Systems. Center for Watershed Protection, Ellicott City, MD
 Ferguson, T., R. Gignac, M. Stoffan, A. Ibrahim and J. Aldrich. 1997. Cost Estimating Guidelines, Best Management Practices and Engineered Controls. Rouge River National Wet Weather Demonstration Project.
 Brown, W. and T. Schueler. 1997. National Pollutant Removal Performance Database for Stormwater BMPs. Center for Watershed Protection, Ellicott City, MD.
 Schueler, T.R. and H.K. Holland. 2000. The Practice of Watershed Protection. Center for Watershed Protection, Ellicott City, MD.
 Tetra Tech MPS. 2002. Stormwater BMP Prioritization Analysis for the Kent and Brighton Lake Sub-Basins, Oakland and Livingston Counties, Michigan.
 Tilton and Associates, Inc. 2002. Stormwater Management Structural Best Management Practices – Potential Systems for Millers Creek Restoration, Ann Arbor, MI.
 U.S. EPA, 2002. National Menu for Best Management Practices for Stormwater Phase II.

It should be noted that information regarding the pollutant removal efficiency, costs, and design for structural stormwater BMPs is constantly evolving and improving. As a result, information contained in the above table is dynamic and subject to change.

Quantitatively evaluating the success of managerial BMPs is much more difficult. Research demonstrates that these BMPs have the largest impact on changing policy, enforcing protection standards, improving operating procedures, increasing public awareness, and changing behaviors to improve water quality and quantity over the long term. Because many of these BMPs are applied over a large land area, it is even more difficult to quantify their collective impact. However, intuitively, we know they work.

Generally, the location of structural BMPs is dependent on the particular site and site conditions. However, the following table provides general guidelines for common sense placement of BMPs. The following location guidelines are adapted from the rapid watershed assessment protocol of the Center for Watershed Protection and were obtained from the Mill Creek Subwatershed Management Plan. The “Amount of Development” heading generally describes today’s conditions. “Developing” areas implies areas that have some older and some newer approaches to stormwater management. “Developed” areas imply that these areas have been developed for several decades, and contain older approaches to stormwater management.

**Table 6.2
Location Parameters of Structural BMPs**

Amount of Development	Undeveloped	Developing	Developed
Philosophy	Preserve	Protect	Retrofit
Amount of impervious surface	<10%	11 – 26%	>26%
Water quality	Good	Fair	Fair-Poor
Stream biodiversity	Good-Excellent	Fair-Good	Poor
Channel stability	Stable	Unstable	Highly unstable
Stream protection objectives	Preserve biodiversity and channel stability	Maintain key elements of stream quality	Minimize pollutant loads delivered to downstream waters

Table 6.2
Location Parameters of Structural BMPs (Continued)

Amount of Development	Undeveloped	Developing	Developed
Water quality objectives	Sediment and temperature	Nutrients and metals	Bacteria
BMP selection and design criteria	Maintain pre-development hydrology	Maintain pre-development hydrology	Maximize pollutant removal and quantity control
	Minimize stream warming and sediment	Maximize pollutant removal, remove nutrients	Remove nutrients, metals and toxics
	Emphasize filtering systems	Emphasize filtering systems	

Sequencing of BMPs

A key consideration when planning to implement BMPs is how the various BMPs will be phased or sequenced in relation to one another over time. For example, it is not ideal to implement a stream bank restoration project before the cause of flashy flows is addressed if it can be avoided.

A phasing approach has been developed for BMPs that assists in clarifying the BMPs that should be considered at various stages in the watershed management process (Middle One Subwatershed Advisory Group, 2001). This approach has been slightly altered for this watershed plan, and is a recommendation only, as specific site conditions may warrant alternative sequencing.

Phase I: BMPs that can be initiated right away, require minimal cost or planning, and/or address the upstream sources / causes of a downstream problem. Usually non-structural BMPs such as source controls, education, good housekeeping activities, etc. However, some structural measures, such as swales or riparian buffer preservation, could also be included in this phase.

Phase II: BMPs that require significant planning and development or design specifications, require major costs, address sources / causes of a problem. Can be structural or non-structural BMPs, including ordinances, new projects / programs, studies, construction of detention ponds or manufactured wetlands, etc.

Phase III: BMPs for which success may depend on the success of a previously implemented BMP. Usually structural, such as in-stream habitat improvements after flow improvements have been made; pond or lake dredging after watershed-wide nutrient or sedimentation reduction efforts are in place, etc.

6.2 Action Items to Address the Upper Clinton Subwatershed Goals and Objectives

Long Term Goal 1: Restore and protect water quality in local waterways and lakes.

Objectives: 1-A: Identify and reduce sources of bacteria and illicit discharges.

Action 1: Implement waterfowl and pet waste management programs. Effective nuisance waterfowl and pet waste management programs can reduce bacteria and nutrient sources within the subwatershed. Programs to reduce waterfowl waste may include installation of native plantings to replace turf grass along ponds and lakes, or detention basin retrofits that incorporate taller native vegetation to help curtail nuisance waterfowl. Pet waste receptacles and educational signage can be placed in community parks or other pedestrian areas where residents walk their dogs.

Action 2: Support County inspections and/or enforcement of Health Department regulations regarding on-site sewage disposal systems. Proper on-site sewage disposal maintenance can significantly reduce nutrient loading, especially near lakes and impoundments. Many areas around existing lakes and impoundments do not have access to sanitary sewer systems, so maintenance programs that include regular pumping of septic tanks and evaluation of the septic fields may not only improve the quality of the adjacent water resources, but may also educate home owners about the potential impacts OSDS, if not functioning properly, have on their water resources. Oakland County, which contains all the communities within the Upper Clinton subwatershed, is currently evaluating a time-of-sale inspection and maintenance ordinance for on-site sewage disposal systems (OSDS) that will provide these benefits. While inspection and enforcement of the Health Department's OSDS rules are within the County's jurisdiction, local municipalities can support these efforts by reporting problematic systems to the County, and then follow up on these sites if the County fails to do so in a timely manner. The community can also, under the Building Code, write citations for failure to comply with the Health Department's standards, and begin legal action if necessary. Communities can also adopt rules that allow it to fix a problem system, and then assess the property owner for the costs.

Action 3: Promote and participate in existing annual watershed education and outreach events, such as River Day and the Clinton Clean-Up.

Action 4: Promote and/or participate in the watershed education and outreach activities of local organizations as outlined in community Public Education Plans. These organizations include the Clinton River Watershed Council, MSU Extension, MDEQ, North Oakland Headwaters Land Conservancy, Oakland Land Conservancy, SEMCOG, etc.

Action 5: Promote and participate in the Clinton River Watershed Council's stormwater education program, as outlined in community Public Education Plans. This program is designed to educate the public about the following six topics, as required by the Phase II stormwater permit:

- The public's responsibility for stewardship of their watershed.
- The location, function, and potential pollution impacts of separate stormwater drainage systems.
- How to identify and report illicit discharges or improper disposal of materials into stormwater drainage systems.
- The need to minimize wastes from residential activities washed into stormwater drainage systems (including car washing, pesticide and fertilizer use, and lawn and pest waste disposal).
- How to dispose of household hazardous wastes, travel trailer sanitary wastes, yard wastes, and motor vehicle fluids.
- Management of riparian lands to protect water quality.

Action 6: Promote, encourage, and/or participate in educational opportunities for land use decision-makers offered by the organizations listed in Action 4. Educating land use decision-makers is a critical component to the successful implementation of the subwatershed plan. These individuals are responsible for implementing many of the actions identified for protecting and restoring the Upper Clinton Subwatershed. Thus, they must stay on top of the most current stormwater and watershed management tools and techniques.

Action 7: Develop comprehensive sanitary sewer infrastructure plans and/or maintenance plans. Some of the municipalities in the Upper Clinton Subwatershed should develop comprehensive sewer plans that are consistent with their zoning and master plans. Local sewer plans identify areas where

sanitary sewer service is or will be available, areas where on-site disposal systems will be used for wastewater treatment, and areas where sewers and on-site systems are not appropriate (i.e. environmentally sensitive areas, floodplains, etc.). These service areas should be developed based on the sewer system's capacity to collect, transport, and treat wastewater flows at the density levels allowed in the zoning map and master plans and/or the ability of soils to accommodate on-site disposal systems. A related plan that should also be considered is a sanitary sewer maintenance plan. This plan would lay out actions to monitor the existing system, and provide schedules for inspections, maintenance/repair, and possibly replacement of system components. It could also address staffing and funding of these tasks.

Action 8: Establish maintenance programs for stormwater management facilities. Short-term maintenance of detention basins, catch basins, swirl concentrators, and other stormwater facilities during construction as well as long-term maintenance by the property owner after construction is as important as implementing BMPs in the first place. Without regular inspections and maintenance, these systems will not provide effective pollutant reduction. These systems, if properly maintained, reduce sediment loading as well as nutrient loading because nutrients bind to soil particles. Catch basins also fill with debris, and if fitted with special inserts, organic compounds. All these materials must be removed for the facility to function properly.

Maintenance of stormwater management facilities should be handled by the agency with jurisdiction over the facility, such as the municipality or road commission. Maintenance of private systems should be required of the property owner or, if appropriate, the homeowners association. Requirements for minimum maintenance measures could be included in the Master Deed and Bylaws, including a provision for the community to do the work and assess the association if not conducted on a regular basis. These requirements could also be contained in the community's Engineering Standards as a condition of site plan approval.

Action 9: Establish detention basin retrofit and enhancement programs in re-development projects. In areas planned for re-development where stormwater facilities were originally designed only for flood control, opportunities exist for various enhancements or retrofits to incorporate sediment and

nutrient removal capabilities. Outlet structures may be reconfigured to handle the small storm events provided adequate volume still exists in the basin for the design storm event. These improvements, combined with native plantings and buffer strips along the basin will reduce nutrient, sediment, and bacteria loadings, discourage geese from congregating, encourage populations of other types of wildlife such as birds, fish, and insects, and ultimately create a more aesthetic environment for the property owner. Such enhancements may also provide passive recreation opportunities.

Action 10: Identify and eliminate illicit discharges. As part of their Phase II stormwater permits, municipalities and counties in the Upper Clinton Subwatershed must develop and implement Illicit Discharge Elimination plans (IDEP). These plans include conducting a thorough inventory and mapping of outfalls into surface waters, water quality monitoring of outfall discharges, and follow-up when problems are identified. IDEP programs typically identify nutrient and bacteria sources such as cross-connections between sanitary and storm sewers or failing on-site sewage disposal systems, but can also identify hazardous waste discharges, or connections from a property's sump or footing drain.

Action 11: Develop and implement a long-term monitoring strategy. Continued monitoring of chemical, biological, and physical parameters is critical to evaluating the long-term success of this subwatershed plan. Monitoring is especially critical to identify and respond to illicit discharges such as hazardous waste and sewage discharges. The historical monitoring data and stream inventory results provide a baseline for future assessment. The Oakland County Drain Commissioner's Office and the Clinton River Watershed Council currently engage in various monitoring activities in the Clinton River watershed, including the Upper Clinton Subwatershed. The subwatershed group should continue to track monitoring activities by these agencies and entities and pursue additional funding opportunities for monitoring as they arise.

1-B: Reduce nutrient loading contributing to excessive aquatic plant growth.

Action 12: Implement lawn care education programs for residents and businesses. Programs that address specific practices on individual properties can have a major impact on nutrient reduction. Lawn care education programs, particularly

for riparian land owners, should include information about fertilizer, watering, and mowing practices. In addition, assistance can be provided on reducing turf grass through the establishment of native plant alternatives. Organizations such as the Clinton River Watershed Council, land conservancies, MSU Extension, and Wild Ones currently offer some materials and programs. Lawn care programs should focus on residential and commercial lawns as well as maintenance of common areas and landscaped areas around detention basins. These areas often require different types of maintenance to keep them functioning properly.

Action 13: Encourage golf course management programs that protect water quality. Encouraging golf courses to develop and implement plans to minimize nutrient loading will help preserve the high quality of the Upper Clinton Subwatershed. These efforts may include educating golf course staff about the importance of protecting the water resources located on the golf course. Education may also include training appropriate staff on proper fertilizer, watering, and mowing techniques to protect water resources. In addition, identifying areas for suitable native plant establishment will also help slow and filter stormwater runoff prior to it entering local tributaries. The MSU Extension Turf grass Stewardship Program is a good source of information for this purpose and offers a certification program for golf courses.

Action 14: Research and evaluate the effectiveness of a fertilizer ordinance. Fertilizer ordinances, standards, guidelines, and/or resolutions in community regulations or as part of a subdivision's Master Deed and Bylaws that regulate application of nutrients by both private landowners and/or commercial applicators can minimize nutrient loading, specifically of phosphorus, to waterways. These guidelines can supplement existing public education and involvement programs. Several communities within the Rouge River watershed have adopted or are currently drafting fertilizer ordinances that require licensing and/or permits from the local community prior to any fertilizer application.

Action 15: Review land use planning and management practices to promote Low Impact Development (LID). Because many areas within the Upper Clinton Subwatershed are still undeveloped, opportunities exist for reviewing the effectiveness of existing land use planning and management practices. Land use planning involves a comprehensive planning

process and can promote LID techniques that control or prevent runoff from certain developed land uses into areas with sensitive water and wetland resources.

Action 16: Minimize directly connected impervious surfaces from new development through the implementation of Low Impact Development Plans. Utilizing LID techniques for new developments can minimize directly connected impervious surfaces. LID techniques combine a hydrologically functional site design with pollution prevention measures to compensate for land that is now being used for buildings, parking lots and other human uses. The result will minimize or eliminate impacts of peak discharge, runoff volume, and stormwater pollutants as compared to typical development impacts. LID can apply to new residential, commercial, and industrial developments. In urban communities, especially older areas, opportunities exist to disconnect impervious areas through downspout and sump pump disconnection, and installation of rain gardens and other bioretention areas.

Action 17: Develop and implement native vegetation guidelines. The use of native vegetation in landscaping and in conjunction with other stormwater best management practices can improve stormwater absorption and filtration. Communities should develop guidelines to preserve and restore native plant communities in open space, buffer zones, and parklands, encourage the use of native landscaping on both municipally-owned and private lands, and utilize native plants in constructed wetlands and stormwater management systems such as detention and retention ponds. It may also be necessary to revise weed ordinances to accommodate native plantings. Establishing native plants, including prairie and wildflower meadows, within new developments as opposed to grass seed or sod can also greatly enhance stormwater infiltration and nutrient uptake.

Action 18: Establish and/or support street sweeping programs. Street sweeping not only reduces sediment loads, but is also effective at reducing nutrient loading because many nutrients bind to soil particles. Because many communities within the Upper Clinton Subwatershed do not have jurisdiction over paved roads, or have many unpaved road segments, street sweeping may not be suitable on all roadways; however, encouraging property owners of large parking lots to regularly maintain their paved surfaces without washing debris into the storm sewers will also reduce nutrient and sediment loading.

Street maintenance programs may be implemented by the appropriate jurisdictional agency or even by property owners. Homeowners' associations should be encouraged to contract with a company to regularly maintain their streets and catch basins if these areas are not under the jurisdiction of the local community or county.

Action 19: Educate municipal staff and/or contractors on “good housekeeping” practices, including proper fleet and service yard maintenance and landscaping activities. These activities are a requirement of the Phase II stormwater permit. Not only do good housekeeping practices reduce stormwater impacts from municipal properties, they also set an excellent example for residents and can be used as a public education tool.

Other actions that will address nutrient loading include Actions 3, 4, 5, 6, 7, 10, 11.

1-C: Reduce siltation from construction sites and road crossings.

Action 20: Implement soil erosion and sedimentation control (SESC) ordinances or standards. Within the Upper Clinton Subwatershed, statewide soil erosion and sedimentation control (SESC) regulations are managed primarily by county agencies. All SESC plans must meet state requirements. Communities may also consider adopting and overseeing a local SESC ordinance or standards, which must be approved by the Michigan Department of Environmental Quality Water Division. In addition, requiring SESC permits prior to allowing any construction work on a site will help to minimize soil erosion and sedimentation. Soil erosion and sedimentation control plans should also include stabilization measures for construction activities. These plans should show preservation of trees and vegetation along wetlands and streams. Clearing and grading schedules should be identified early in the review and permitting process should be staged to minimize the amount of exposed earth at any time.

Once mass grading of a site is complete, stabilization of areas should occur as soon as practicable. For example, detention basins should be stabilized once the outlet pipes are installed to minimize sediment from escaping the basins. Road right-of-ways within residential areas can also be stabilized as soon as the roads are complete. Areas where rear yard drainage systems are present should also be stabilized. These measures will minimize

the amount of sediment runoff from individual lots before the building process begins.

Action 21: Implement soil erosion and sedimentation control education programs. Although many communities do not currently have jurisdiction over soil erosion and sedimentation control, improving municipal staff's understanding of soil erosion impacts will have a positive impact on the overall site plan review process. Staff from local planning and engineering departments, or their consultants, will be able to identify opportunities for minimizing soil erosion and sedimentation impacts during site plan review. Many videos and other education materials are available about SESC.

Action 22: Improve soil erosion inspection and enforcement practices. County agencies, in most cases, are the jurisdiction responsible for SESC inspection and enforcement in the Upper Clinton Subwatershed. These agencies are often understaffed for this purpose, especially given the rate of construction and development in many communities. Municipalities concerned about the need for more frequent and reliable inspection and enforcement should work with the counties to stress the importance of inspection and enforcement and explore opportunities to improve these services.

Action 23: Improve maintenance of unpaved roads, particularly at road-stream crossings. Many roads within the Upper Clinton Subwatershed are under the jurisdiction of the county road commission. Because many roads in the subwatershed are unpaved, it is important that the local communities and county work cooperatively to implement road maintenance techniques that reduce soil erosion and sedimentation impacts on the water resources. Opportunities that may be evaluated include quickly vegetating roadside ditches to slow and filter stormwater runoff, removing accumulated sediment from roadside ditches, and only re-grading ditches during dry weather.

Action 24: Develop or modify private road ordinances or standards to incorporate impervious surface minimization techniques. Roads are a significant contributor to sediment loading. A private road ordinance can allow small developments to construct narrower roadways with less clearing, grading, and impervious surface than public roads. The layout of the development can also often be altered during site plan review to reduce the amount of impervious surface.

Action 25: Cooperate with the County, other Clinton watershed groups, or agencies on stream bank stabilization projects. In some cases, stream bank erosion can be a direct source of sedimentation within streams. However, stream bank erosion is often related to peak storm flows. Therefore, it is important to address stream flows upstream of any site to be stabilized if the projects are to succeed over the long term. Conducting a geomorphology study in advance of stabilization work will assist in understanding the stream's flow dynamics and identifying the highest priority sites.

Natural channels exist in two or more stages. Restoration to existing channels should explore the opportunity to return the channel to a two-stage cross section. This will help reduce the shear flows at bank-full conditions that lead to high shear stresses and erosion. Stream bank stabilization measures work by either reducing the force of flowing water and/or by increasing the resistance of the bank to erosion. Vegetating stream banks also provides important ecological benefits such as shading water and providing crucial habitat for both terrestrial and aquatic wildlife species.

Three basic types of stream bank stabilization methods exist: engineered structures, bioengineering methods, and biotechnical methods. Engineered structures include riprap, gabions, deflectors and other "hard" revetments. Bioengineering refers to the use of live plant materials that are embedded in the ground, where they serve as soil reinforcement, hydraulic drains, and barriers to earth movement. Examples of bioengineering techniques include live stakes, live fascines, brush mattresses, live cribwall, and branch packing. Biotechnical measures include the integrated use of plants and inert structural components to stabilize channel slopes, prevent erosion and provide a natural appearance. Examples of biotechnical techniques include joint plantings, vegetated gabion mattresses, vegetated cellular grids, and reinforced grass systems. Whenever possible, bioengineered or biotechnical methods should be implemented in lieu of engineered methods to increase habitat, nutrient uptake, and aesthetic values.

The Upper Clinton subwatershed communities may cooperate with the County, other Clinton River watershed groups, or other agencies that are interested in working together to identify or address stream bank problems. Level of participation will

depend on each community's financial and staffing resources available at the time.

Other actions that will address soil erosion and sedimentation control include Actions 3, 4, 5, 6, 9, 11, 18

1-D: Promote and implement pollution prevention programs.

Action 4: Promote and participate in the watershed education and outreach activities of local organizations as outlined in community Public Education Plans. (Described above.)

Long Term Goal 2: Reduce flow variability.

Objectives: 2-A: Minimize the increase in impervious surfaces and mitigate the amount of existing impervious surface.

Action 26: Create and adopt local Impervious Surface Minimization/Mitigation provisions. Because the Upper Clinton subwatershed is still developing, some of the communities have an opportunity to minimize the amount of impervious surface in new developments. These standards can also be applied to re-development in more urbanized areas as well. Reducing impervious surfaces can be accomplished through site plan review standards, ordinances, or Engineering standards and guidelines. Some examples include flexibility in parking regulations, requiring landscaped/infiltration islands in parking areas, private road standards that allow narrower pavement and right-of-way widths than County road standards, and cluster or open space development provisions that minimize setbacks and increase open space for stormwater infiltration.

Other actions that will address impervious surfaces include Actions 15 and 16.

2-B: Restore and protect riparian vegetation.

Action 27: Create and adopt local regulations requiring a buffer along riparian corridors. Development and re-development sites that are adjacent to streams, lakes, or wetlands can preserve or improve the water quality of these natural resources by either maintaining the natural buffer that currently exists, or re-creating a buffer for areas that had been previously cleared. This can be done through provisions in the Zoning

Ordinance or in existing Engineering Standards. Existing riparian land owners can also be educated about the benefits of riparian vegetation for water quality, wildlife habitat, and soil erosion control, and encouraged to re-vegetate their properties to receive these benefits.

Other actions that will address protection of riparian vegetation include Actions 3, 4, 5, 6, 12, 13, 15, 17, 23, 25.

2-C: Reduce the amount of stormwater runoff to predevelopment patterns and levels to stabilize stream flow.

Action 28: Develop and implement stormwater management document(s), including stormwater management ordinances or standards, and/or maintenance programs. Comprehensive stormwater management documents address development, implementation, and enforcement of controls to protect designated uses in all receiving waters. They include the development of ordinances or other regulatory measures to address post-construction stormwater runoff from new development and re-development projects.

Stormwater management ordinances or standards outline specific requirements for constructing structural BMPs to minimize the flow and water quality impacts associated with new development. An example of a specific requirement is to modify parking ordinance standards to minimize impervious surfaces. Parking lots contribute a significant amount of impervious surface in commercial areas. As the Upper Clinton Subwatershed continues to develop, it will become important to analyze parking standards and identify opportunities to reduce parking lot size and allow for “banked” parking to reserve space for future parking if needed.

Implementation of stormwater standards is often complicated by overlapping jurisdictions and conflicting goals and priorities. Where there are overlapping jurisdictions within individual communities, especially between townships, it is imperative that municipalities work cooperatively to understand the unique issues specific to each. This will ensure successful implementation of stormwater management ordinances and standards.

Other actions that will address predevelopment stormwater runoff patterns and levels to stabilize stream flow include Actions 8, 9, 15, 16, 17.

Long Term Goal 3: Improve local regulations regarding protection of natural areas and water resources.

Objectives: 3-A: Develop natural feature inventories and/or assessments to create plans for preservation and/or restoration of natural features.

Action 29: Inventory natural features (e.g. wetlands, floodplains, steep slopes, woodlands, unique ecosystems, etc.) and develop Natural Areas Resource Protection Plans. The first step in protecting a community's natural resources is identifying what resources a community has, where they are located, what benefits they provide the community, and which resources should be protected. After an inventory, it is often helpful to design an assessment of these natural features so that they can be prioritized in terms of their importance to the community and their relative need for preservation.

Communities should also consider developing a Natural Area Resource Protection Plan that identifies natural feature areas, including wetlands, woodlands and riparian corridors, within their jurisdictional boundaries and also describes each features' unique functions and opportunities for preservation, enhancement, and restoration. This type of plan will identify areas unique for high-quality stormwater management, habitat enhancement, water quality enhancement, aesthetics, and recreational opportunities. It is often not feasible to protect all of the natural features in a community; however, an inventory and assessment can provide scientific rationale to support a location protection ordinance and/or the basis for avoiding the feature during site design and development. Community-wide inventories and assessments can also provide future opportunities to preserve greenways for wildlife as well as recreation. This plan can easily complement land use, water resource, and stormwater management ordinances.

3-B: Develop goals and policies in the Master Plan regarding natural feature protection and management.

Action 30: Update community Master Plans to enhance natural feature preservation and create a basis for environmental protection ordinances.

3-C: Develop ordinances for managing natural features to benefit stormwater quality and quantity.

Action 31: Develop water resource and natural feature protection standards, ordinances and/or programs.

Protecting existing natural features such as wetlands, woodlands and riparian corridors in the subwatershed is a key goal, especially in less developed communities. These guidance documents can create opportunities to minimize impacts associated with new developments as well as identify opportunities for preservation and enhancement. These documents can also help guide re-development of an area with existing natural features.

Action 32: Cooperate with the County, other Clinton River watershed groups, or agencies to identify, prioritize, and implement projects to construct, restore, and enhance wetlands. In addition to preserving existing wetlands through the practices outlined above, there could be opportunities to restore and enhance wetlands in the Upper Clinton Subwatershed. Constructed wetlands, as an alternative to detention basins, could also serve as excellent stormwater treatment facilities and improve wetland functions within the subwatershed.

Working with the County, other watershed groups, or other agencies, the Upper Clinton subwatershed group may cooperate on projects that would enhance the wetland resources within the subwatershed. Level of participation will depend on each community's financial and staffing resources available at the time.

Long Term Goal 4: Increase public understanding of their role in protecting water quality.

Objectives: 4-A: Develop and/or promote existing public involvement programs (workshops, events, etc.) to improve the public's understanding of their role in protecting water quality.

Actions to promote existing public involvement programs include Actions 3, 4, 5, 6.

4-B: Develop and/or continue information and education programs (brochures, newsletter articles, etc.) to disseminate water quality messages to the public.

Actions to develop/continue public education and information programs to the public include Actions 3, 4, 5, 6.

Long Term Goal 5: Protect and restore quality aquatic and riparian habitats.

Objectives: 5-A: Develop a habitat protection and/or restoration plan.

Action 33: Cooperate with the County, other Clinton River watershed groups, and agencies to identify, prioritize, and implement projects to restore and enhance instream habitat. Habitat restoration techniques include instream structures that may be used to correct and/or improve fish and wildlife habitat deficiencies over a broad range of conditions. Examples of these techniques include channel blocks, boulder clusters, covered logs, tree cover, bank cribs, log and bank shelters, channel constrictors, cross logs, and revetment, wedge and “K” dams. The majority of these structures can be installed with hand labor and tools. After construction, a maintenance program should be implemented to ensure long-term success of the habitat structure.

The Upper Clinton Subwatershed communities may cooperate with the County, other Clinton River watershed groups, or agencies on projects that will improve instream habitat within the Upper Clinton subwatershed. Level of participation will depend on each community’s financial and staffing resources available at the time.

5-B: Reduce siltation from construction sites and road crossings.

Actions that will reduce siltation from construction sites and road crossings include 3, 4, 5, 6, 8, 10, 11, 18, 20 - 25.

5-C: Restore and protect riparian vegetation.

Actions that will address protection of riparian vegetation include Actions 3, 4, 5, 6, 12, 15 - 17, 23, 25, 27. (Note that “restoration” activities include land-owner education activities.)

5-D: Develop natural feature inventories and/or assessments to create plans for preservation and/or restoration of natural features.

Action 29: Inventory natural features (e.g. wetlands, floodplains, steep slopes, woodlands, unique ecosystems, etc.) and develop Natural Areas Resource Protection Plans.
(Described above.)

5-E: Develop goals and policies in the Master Plan regarding natural feature protection and management.

Action 30: Update community Master Plans to enhance natural feature preservation and basis for environmental protection ordinances. (Described above.)

5-F: Develop ordinances for managing natural features to benefit stormwater quality and quantity.

Actions that create ordinances to manage natural features to benefit stormwater quality and quantity include Action 31 and 32.

Long Term Goal 6: Increase opportunities for passive and active recreational uses while at the same time protect water resources.

Objectives: 6-A: Identify key areas to protect and restore, and plan for recreational and interpretive opportunities adjacent to lake shores and riparian corridors.

Action 34: Develop water resource recreational plans or update current recreation plans with emphasis on appropriate water-based recreational opportunities. To help residents appreciate and value water resources, it is important to allow them to enjoy lakes and streams through recreational activities. However, these activities can be harmful to the resource unless proper care is taken to develop recreational programs with stewardship in mind. Therefore, recreation plans should be developed to provide access points for water-based recreational activities at lakes and streams that can tolerate such activities without being degraded. Particularly sensitive or rare water resources should be preserved for passive activities, such as viewing from a trail or wildlife/bird watching. Also, development of facilities for these activities should also be constructed to minimize impact on the resource.

6-B: Develop recreation plans for key natural areas that are consistent with this Watershed Management Plan.

Action 35: Update current Recreation Master Plans to include individual park plans that outline goals and strategies for protecting and managing key natural areas.

Other actions that will assist in creating recreation plans for key environmental areas include Action 29.