A.8 RECOMMENDATIONS

Once a watershed's condition has been studied and any impairments identified, it is useful to examine ways to correct the problems. In this chapter, some general recommendations for the Big Darby Creek watershed are discussed. More specific, quantified recommendations may result from the Total Maximum Daily Load project, scheduled to be completed in late 2004.

Recommendations are not limited to this chapter. Recommendations for changes at specific locations that would benefit stream resource quality (for example, riparian and streamside buffer practices or landuse changes) are dispersed throughout this document. Another type of recommendation, pertaining specifically to altering stream use designations, are contained in Section A.5.2.

A.8.1 Protect Ground Water Sources

Water resource quality of the upper Big Darby Creek and the upper half of the Little Darby Creek benefits considerably from the positive effects of ground water inflow, a relic of the glacial geology of the upper watershed. More stable stream base flows and lower water temperatures are direct advantages that the ground water provides. The ground water inflows have reduced the stresses associated with modest nutrient enrichment and habitat simplification. Ultimately, the ground water flows increase the potential for recovery of the impaired streams when other stressors are eliminated.

Every effort should be taken to protect the integrity of the ground water source. Excessive withdrawals would be harmful; protective efforts should include restrictions on wells that would lower the water table to the point that they would reduce the expression of ground water in these streams. Recharge of the resource should be promoted. Hardening of the watershed and other activities that limit infiltration and reduce recharge should be discouraged. Providing riparian canopy (e.g., trees on stream banks) extends benefits such as lower stream temperatures further downstream. Other practices to protect this groundwater source should be investigated and implemented.

A.8.2 Manage Storm Water

Some of the impairments of water resource quality in portions of the Big Darby Creek watershed are directly related to the quantity and quality of water draining from the land, especially during and after rain storms. Storm water effects including sedimentation, habitat changes and changes in hydrology. The headwaters of Big Darby Creek, Flat Branch and Big Darby Creek immediately downstream, the Hellbranch Run subwatershed, and the lower reaches of Big Darby Creek are already being affected. Other areas are under threat, such as Little Darby Creek near West Jefferson where commercial development is occurring.

Excessive storm water decreases stream stability. Increased flow destabilizes stream banks resulting in collapse, increased erosion and reduced habitat diversity. Increased delivery of eroded sediments results in embeddedness (i.e., smothering of the stream bed), loss of instream habitat, filling of the pools and less in-channel storage of water, which results in more frequent out-of-channel flooding. Excessive storm water runoff reduces groundwater infiltration, which reduces groundwater contribution to stream base flows, which in turn results in stream desiccation and more frequent intermittency. All of these factors result in reduced biological diversity and productivity, generally yielding less diverse, more tolerant aquatic biological communities.

The potentially dramatic changes that occur as a watershed is hardened must be planned for and adequately dealt with through proper storm water best management practices (BMPs) for both water quantity and water quality. Timely compliance inspections and rigorous enforcement when plans are not followed are useful deterrents.

Many of these issues for suburbanizing subwatersheds are currently being dealt with in the portion of the Big Darby Creek watershed labeled the Environmentally Sensitive Development Area of the State's Water Quality Management Plan for the Scioto River Basin (208 plan). An advisory group is developing plans to prevent further degradation of this subwatershed, which drains to one of the highest quality, most diverse segments on the mainstem of Big Darby Creek. Key elements of their plan include riparian buffer restrictions, comprehensive storm water management, conservation development (cluster development which promotes the preservation of tracts of open land including farmland), and adequate public facilities to support any proposed development.

A.8.3 Reduce Nutrient Enrichment

Nutrients contribute to water resource degradation throughout the watershed. Concentrations of phosphorus and nitrogen well above background reference conditions are common. Areas with depressed dissolved oxygen concentrations have been identified, and some areas have shown declines in mean concentrations over time. Algal blooms, once a rare occurrence, are now common and cover long stream distances.

Generally, reducing the contributions from common sources will improve the condition of the watershed with respect to nutrient enrichment. Nutrient enrichment is widespread and not confined to one particular subwatershed, although there are indications that some areas are adding more than "their share." A variety of sources contribute to the problem: leachate from septic systems, land application of manure, inadequately treated domestic sewage, over application of fertilizer, spills of manure, and inadequate riparian buffers. The sources in each subwatershed are different, and the solutions to the problem in each subwatershed will need to reflect those differences. Accurate identification of and reliable information about activities that contribute nutrients will be critical to taking effective action.

A.8.4 Improve Habitat Quality

Many of the small headwater streams and the very headwaters of many of the larger streams in the Big Darby Creek watershed have been physically altered. Some small water courses have been legally petitioned under the provisions of the County Ditch Law to facilitate drainage. They will be maintained in this condition in perpetuity or until their petitions are revoked. Other streams were altered by individual landowners or under provisions of older ditch laws. Regardless, channelization has lowered habitat quality in large portions of the Big Darby Creek watershed.

This study has discovered that conditions would be much poorer if not for the positive influence of cool, abundant ground water. In many altered streams, both groundwater influenced and the more typical channelized streams, the absence of riparian vegetation and the presence of nutrient intensive activities on adjacent lands leads to the export of excess nutrients. Little filtering takes place, yielding swift and direct delivery of nutrient-rich storm water to these hydraulically simplified channels. This in turn results in swift delivery of this nutrient enriched water downstream with little instream processing. The enrichment problems that are increasing on the mainstem of Big Darby Creek and other significant tributaries are a direct result of these habitat problems.

To remedy these problems throughout the watershed an effort should be made to take advantage of the natural assimilative capacity of stream channels. Streams allowed to develop naturally provide a variety of beneficial services: flushing of fine sediments into adjacent floodplains, processing of nutrients into productive biomass instead of nuisance algae, improvement of water quality, creation of diverse instream habitats, and ultimately – and most important for adjacent landowners – evolution into a stable channel. To accomplish this goal the streamway approach should be adopted wherever possible (Ward et al., 2002; ODNR, 2004). Allowing riparian land, water and vegetation to naturally evolve will reduce or eliminate many of the current causes and sources of stress within the watershed. In addition, where feasible, previous physical modifications should be "undone" (e.g., remove the few remaining dams, restore cutoff channels, exclude livestock, and move dikes and levees away from the stream bank to accommodate the streamway approach).

Nutrient management on upland areas, coupled with the reestablishment of wooded riparian buffers, would reduce the severity of this particular impact. An intact riparian canopy would provide shading and transpiration which would maintain lower water temperatures and reduce nuisance algal growth. Vegetation would also stabilize the stream banks, reducing erosion and sedimentation, which are also identified as problems in many areas. Shading has also been shown to be critical in the overall plan to protect some of the endangered bivalve mussel species. These areas should be targeted for funding to protect these important species.

In some areas, free access livestock pasturage is causing both habitat and nutrient enrichment problems. Livestock exclusion and single point of access watering would allow reestablishment of riparian vegetation which would result in more stable stream banks, less erosion, some

filtering of nutrients and lower water temperatures. Again, funding should be targeted to provide support for this effort.

A.8.5 Develop a Spill Response Plan

Spills were documented to be an important controlling factor in the distribution and abundance of some of the rarer organisms inhabiting this watershed. Additionally, many of the spills investigated, particularly the larger ones, were preventable. A plan should be developed to prevent, reduce, and minimize the impact of spills on this valuable, high quality resource. Equally important would be to develop and implement a mechanism to educate the public about spill prevention and how to deal with spills when they occur.

A.8.6 Reduce Bacteria Levels

High levels of indicator bacteria (fecal coliform and E. coli) in streams are a concern because of human health. People can be exposed to contaminated water while wading, swimming and fishing. Fecal coliform and E. coli bacteria are relatively harmless in most cases, but their presence indicates that the water has been contaminated with feces from a warm-blooded animal. Although intestinal organisms eventually die off outside the body, some will remain virulent for a period of time and may be dangerous sources of infection, especially a problem if the feces contained pathogens or disease-producing bacteria and viruses. Reactions to exposure can range from a skin rash, sore throat or ear infection to a more serious flu-like symptoms.

Recreation is an important function of Big Darby Creek, with fishing, wading, and canoeing being popular during warmer months. A significant amount of the land is devoted to parks with easy access to the water. Unfortunately, exceedences of bacteria water quality criteria are common throughout the watershed. As a result of this most recent sampling, Ohio EPA has been working with WWTPs to reduce their impacts, but many sources remain: livestock (open access pasturage), land application of manure, inadequately treated wastes from on-lot septic systems.

The same BMPs for land application of manure that are used to reduce nutrients can also reduce pathogens (proper manure application rates, timing, buffer strips, etc.) and the facilities could also do additional processing of the manure prior to land application (e.g., composting, digestion). Such actions are required for regulated agricultural facilities; for non-regulated facilities it is voluntary. State and federal agricultural agencies should be able to help develop the appropriate plans.

Likewise, BMPs that address the habitat and nutrient enrichment problems caused by free access livestock pasturage would help with the bacteria issues. Possible actions include livestock exclusion (fencing) and single point of access watering.

Given the high recreation potential of the Big Darby watershed, if initial efforts to reduce bacteria by eliminating obvious sources are not sufficient, it may be necessary to engage in more indepth study to identify more elusive sources of bacteria contamination.

A.8.7 Monitor Watershed Condition

Due to the proximity of this watershed to the growing Columbus metropolitan area, the potential for adverse impacts from suburbanization is great. At the same time, corrective actions for some point sources of pollution are already underway. As with all watersheds, changes will occur and revisiting the watershed to measure progress or decline is important to decision-making. Given the exceptionally high quality of the Big Darby Creek watershed and the significant threats, such measurement is critically important in this case.

Although future monitoring may not be possible at the same comprehensive level of coverage as the 2001/2002 survey, specific areas should be targeted based on the findings of this report. The Big Darby Creek watershed should receive follow-up intensive sampling within one to two years after the majority of the recommendations contained within this report and the TMDL report are implemented.

Monitoring should be conducted in the Big Darby Creek watershed for three purposes:

- To further investigate unknown situations, specifically in Flat Branch and Robinson Run
- To document improvements or declines
- To ensure compliance with permits.

Details on the specific goals of this monitoring are provided below.

A.8.7.1 Investigative Monitoring

The 2001/2002 monitoring identified impairments in two areas, but additional monitoring is needed to better identify stressors and sources.

Flat Branch and upper Big Darby Creek - Big Darby Creek downstream from the confluence with Flat Branch is currently impaired by a complex blend of environmental stressors including hydromodification, changes in hydrology, turbidity, elevated nutrients, depressed dissolved oxygen concentrations and elevated metals. Sorting out and solving this problem will require the collaboration and the ongoing commitment of private industry and businesses, farming interests, and the conservation community as well as local and state governmental entities.

The impact of development proceeding without adequately addressing measures to protect aquatic resources has been well documented in this portion of the watershed. Future development of the improved and widened US Rt. 33 corridor must be done under the umbrella of a comprehensive plan if further and more severe impacts to the upper watershed of Big Darby Creek are to be avoided. This would include, but not be limited to, dealing with industrial

dischargers, controls for both the volume and quality of storm water runoff, and nutrient management plans for fertilizer.

Robinson Run - The fish communities in lower Robinson Run show impacts from episodic stresses. The proximity to Ranco Inc. and their closed landfills necessitates an in-depth investigation of Robinson Run that includes sampling for parameters that might be leaching from the landfill.

A.8.7.2 Periodic Follow-up Monitoring

Big Darby Creek Mainstem

Headwaters of Big Darby Creek - The large sediment bedload delivered to Big Darby Creek from the relocation of TR 152 and the channel relocation of upper Big Darby Creek has resulted in the only site on the mainstem of Big Darby Creek not attaining its recommended designated use. Expectations are that the stream should recover through natural recovery processes and this should be documented through follow-up sampling. Additionally there are several potential recovery plans being proposed. The impact of these projects on water resource quality should be documented if implemented.

Flat Branch and upper Big Darby Creek - This area is discussed in the previous section. As stressors are identified and eliminated, follow-up sampling will be needed to document changing conditions.

Vicinity of Milford Center and Unionville Center - Big Darby Creek immediately downstream from Milford Center was subject to a significant spill that had an adverse and long term impact to the biological communities immediately downstream. Fish and macroinvertebrate communities had yet to recover fully from the spill two years after its occurrence. Spills have also been reported from an agricultural chemical application firm at SR 38 and a large livestock breeding operation in Unionville Center. One of the lowest MIwb fish community score was recorded downstream from SR 38. Periodic follow-up sampling should be undertaken to plot the rate of recovery of the biological communities resulting from the original spill and sampling to determine the impact associated with these two facilities. Site inspections at these facilities should include the development of plans to eliminate future spills or releases.

Darbydale to Darbyville - Significant improvements to water resource quality are expected in this reach of Big Darby Creek as a result of significant improvements in wastewater treatment. Several poorly operated package WWTPs will be eliminated, sending their waste to either the upgraded and expanded PCI WWTP or to the newly constructed Darbydale WWTP. While these improvements will eliminate several problem areas, they will also concentrate these sources into single points of discharge. Since the net loadings to the stream segments receiving these point sources may actually increase, monitoring should be conducted to determine that effluent limits are meeting resource quality goals.

Snake Island project - This collaborative project between ODNR, adjacent landowners and the Ohio Department of Rehabilitations and Corrections to open up the historical high flow channel around Snake Island would locally increase the channel length and reduce gradient. The hope is that this action will reduce stream bank erosion and re-establish historically important bivalve mussel habitat. Monitoring would document the effectiveness of this habitat enhancement project, if implementation funds are eventually secured..

Big Darby Creek Mouth - Another collaborative project along the very lower reaches of Big Darby Creek resulted in moving severely eroding dikes away from the stream channel and allowing the stream to re-establish natural meanders. This site should be sampled periodically over time to track its progress and determine the merit of extending this streamway project to similar locations further upstream.

Big Darby Creek Tributaries - Due to limited monitoring resources, sampling was confined to the lower reaches of many tributary streams. This has had the consequence that recommendations for changes to aquatic life uses were limited to areas where definitive use decisions could be made. Efforts to extend the designation process further up into the headwaters would require additional sampling.

Robinson Run - Robinson Run is discussed in the previous section. As stressors are identified and eliminated, follow-up sampling will be needed to document changing conditions.

Sweeney Run - Additional chemical and biological samples in Sweeney Run are warranted to determine water quality upstream from Plain City and help locate municipal storm water runoff sources that affect stream quality.

Lake Run - A temporal impact is believed to have prevented Lake Run from achieving EWH instream biological community performance. Thus, changing the use designation is being deferred until follow-up monitoring can be conducted. Monitoring is recommended after the stream has a chance to flush out contributed sediments and recover.

Treacle Creek - Fish sampling was not conducted at the historical site near the mouth. This prevented determining if the trend of decline seen previously was continuing. Impacts seen downstream from the confluence in Little Darby Creek strongly suggest that this pattern is continuing and needs to be documented. Sampling should be conducted in Treacle Creek and into Little Darby Creek to better determine the impact associated with this tributary to Little Darby Creek.

Spring Fork - Access again was denied for monitoring a specific stream segment. The number of violations from the Green Meadows MHP WWTP strongly suggest that this entity may be adversely impacting what was one of the highest quality stream segments that Ohio EPA has documented in Ohio. Sampling this segment would better permit determination of the magnitude of this impact and assist in the regulation of this NPDES discharger.

Wamp Ditch - Due to resource constraints, water chemistry samples were not collected in this small stream. It appears that nutrient enrichment probably was the cause for the observed impairment. Water chemistry sampling would document the nature of this impairment.

Hellbranch Run - Considerable interest in this subwatershed has led to many proposals for protection and remediation. Periodic monitoring would document the effectiveness of these projects and show the effects of suburbanization of this subwatershed.

A.8.7.3 Compliance Monitoring

Increased compliance sampling is warranted at several permitted discharges within the Big Darby Creek watershed. These include the following.

Flat Branch WWTP - This WWTP has had numerous recent reported NPDES violations and discharges to the segment of the Big Darby Creek mainstem that has the lowest documented fish community scores. The entity also receives a considerable amount of commercial and industrial influent that is difficult to treat with the existing WWTP design. Therefore, closer oversight is warranted to ensure proper operation and compliance.

Mechanicsburg WWTP - This entity has a long history of causing water quality problems in Little Darby Creek. The most recent sampling documented a bypass pipe downstream from the WWTP that resulted in the lowest fish community index scores in Little Darby Creek and partial attainment of the EWH use.

Plain City WWTP - This WWTP is currently causing impairment of the fish communities. Plans are underway to upgrade and expand the WWTP. Plain City is in close proximity to the Columbus metropolitan area and in an area of major growth, which will further tax its ability to treat domestic waste as its service populations grows. Plain City is also located at the head of the segment that has the greatest level of riparian protection. For all these reasons, a high quality effluent from this facility must be maintained.

PCI WWTP - This facility is targeted to receive influent from many package WWTPs that are currently producing poor quality effluent and from unsewered areas in the lower watershed. Despite overall improved treatment of the total waste volume, higher net pollutant loadings will be delivered to this very high quality segment of Big Darby Creek. Close attention is warranted as the many changes and tie-ins occur.