7.1.3 Nutrient and Sediment

Nutrient and sediment loads in the Tuscarawas River watershed are primarily due to point source discharges, polluted run-off from row crop agriculture and livestock, storm water runoff, home sewage treatment systems, and channel degradation. NPDES permit revisions for point source dischargers will be carried out according to recommendations in this report. Other sources include failing HSTS and livestock manure, and abatement strategies for these sources of nutrients and solids are identical to those discussed earlier (see Section 7.1.1). In the urban and developing areas of the watershed, polluted run-off from residential and commercial land uses are creating elevated nutrient loads. Stream instability and landscape sediment loads will potentially threaten or impair the quality of the water resource as a result of any further development in the watershed which fails to address this cause and source of pollution.

Point Source Discharges

Changes in permit conditions are the most straightforward means to achieve the necessary reductions in nutrients from point sources. It is therefore recommended that permits be modified and/or renewed with reduced load limits for phosphorus. It is initially recommended that all wastewater treatment plants discharging greater than 100,000 gallons per day receive an initial phosphorus limit of 1 mg/l. Phosphorus limits for smaller plants will be evaluated on a case by case basis in relation to the specific dischargers potential to impact the watershed both locally and further downstream.

While the modeling conducted for Nimishillen Creek indicated an effluent phosphorus concentration of 0.4 mg/l was needed to meet the target concentration, it did not view the watershed holistically. Although computer simulations indicate the target would be met, at this time phosphorus is not a parameter for which Ohio has a water quality standard. From a water quality standard point of view the nonattainment exists for biological criteria and bacteria. Achieving a zero phosphorus load will not ensure that the biological standard is met because of the number of other forces also acting on the biological community such as habitat, embeddedness, and flow alteration. Without addressing all impairments, complete restoration is unlikely.

The initial load reduction achieved at Canton will be 60%, with an effluent limit of 1 mg/l. Reassessment of the biological communities will be the final determinant of watershed restoration effectiveness. ~~Waste~~ Effluent load allocations for phosphorus are included in Table 7-3.

Where an entity cannot immediately meet the 1 mg/l effluent limit, the discharge permit will contain a compliance schedule. The schedule will contain milestones and a time table for design, construction, and final compliance. A general schedule would involve a period of up to three years for completion of construction and final compliance. Depending on the nature and extent of work needed at an entity, the schedule can be adjusted to reflect specific milestones and time tables. An entity may elect to achieve

load reductions through a water quality trading plan approved pursuant to Ohio Administrative Code Chapter 3745-5.

Table 7-3. Recommended loads of phosphorus		
Facility	**NPDES**	**~~WLA~~ Effluent Load (kg/day)**
Louisville WWTP RM *	3PD00033	7.56
Republic Steel Corp. 010 outfall *	3ID00000	1.66
Republic Steel Corp. other outfalls *	3ID00000	0.09
Canton WPCF	3PE00000	147.63
Canton Water Department NE Plant	3IY00011	0.60
Marathon Ashland Petroleum	3IG00000	1.70
Timken Company	3ID00021	3.58
	Total	**162.82**
* These facilities discharge into the East Branch Nimishillen Creek watershed.		

Sources from Agricultural Run-off and Drainage Infrastructure

Many management practices abate sediment and nutrient loading to surface waters from crop fields. Examples include vegetated buffer strips, grassed waterways, nutrient management, conservation tillage, conservation crop rotations, wetland restoration, and water table management. For decades conservation professionals have researched these practices, improved their effectiveness, and worked with private landowners to implement them. Programs currently funded under the Farm Bill provide cost share and dollar incentives for land set asides, and structural and management conservation practices.

Vegetative buffer strips have been shown to be very effective at reducing overland loading of nutrients and sediment in scientific literature (Peterjohn and Correll, 1986; Osborne and Kovacich, 1993). Vegetated buffer strips (e.g., riparian trees or grass filter strips) slow the velocity of overland surface flow allowing sediment particle to fall out of suspension. Buffers also increase infiltration of surface water due to better soil structure, macropores created by roots and soil invertebrates, and reduced surface crusting (Prichard, 1998). Greater infiltration reduces surface discharges and the associated sediment and nutrient loads (Prichard, 1998). However, the effectiveness of buffers decreases dramatically when small concentrated flow paths allow water to rapidly move across them. Such flow paths typically develop at low points along the fields/buffer border or where the vegetation of the buffer is disturbed. These situations should be corrected as they are identified by landowners, farm operators, and conservation professionals (e.g., NRCS/SWCD staff). Sub-surface drainage creates a by-pass to the buffer strips where there is no contact between the vegetation and the drainage water and flow is not slowed. However, water table management (e.g., NRCS practice 554) is a means to reduce the volume and/or rate of discharging sub-surface drainage water thereby counteracting the short circuiting that occurs through buffer strips.

Benefits of buffer strips that go beyond improving chemical water quality of surface runoff are related to channel stability, structural habitat, light availability, stream temperature, and food resources. Providing a stream buffer may reduce the need and/or importance for stream bank management and erosion control as crop losses would not be occurring. In some cases armoring stream banks to minimize erosion prevents the naturalization of the stream's geomorphology (i.e., channel evolution) and perpetuates stream stability issues. Additionally, tree cover shades streams which may limit algal growth and reduce stream temperatures. Temperature is inversely proportional to the stream's capacity to hold dissolved oxygen, and high temperatures can severely impact aquatic life. Woody debris and detritus contributed to the stream system by riparian trees also have a significant role in the quality and diversity of habitat and food resources of the aquatic ecosystem (Ward, 1992; Wallace et al., 1997; Baer et al., 2001). These factors have a significant impact on the aquatic biological community and therefore the capacity for the system to attain its designated aquatic life use.

Sources from Urban and Residential Run-off

The relatively high volume of runoff generated in urban and high density residential areas increases the potential for pollution. Sediment and nutrient residues on surfaces that are impervious or poorly pervious (e.g., compacted lawns, gravel drives, etc.) are more easily transported in this higher volume of runoff and negligible attenuation of the loading occurs due to infiltration. Reducing imperviousness and improving on-site retention and infiltration can abate sediment and nutrient loading by reducing the runoff discharge.

Lawn care and yard maintenance that limits the application of nutrients and increases the likelihood of uptake and retention are recommended. This includes reducing the amount and/or frequency of fertilizer applications. The timing of application should be such that it is unlikely immediately precede a runoff event (e.g., precipitation or irrigation). More stable alternatives to chemical fertilizers should be adopted such as organic based materials (e.g., composts and manures). Organic materials also provide carbon which improves soil structure and increases permeability (i.e., leads to greater storm water infiltration).

The NRCS in collaboration with the National Association of Conservation Districts (NACD) and the Wildlife Habitat Council (WHC) developed a backyard conservation manual that highlights ten activities that collectively are designed to improve water and soil quality and wildlife habitat. This document can be found on the world-wide web at http://www.nrcs.usda.gov/feature/backyard/.

Assimilative Capacity

Increasing the assimilative capacity of the stream system itself is a viable means to help achieve water quality goals. Such an increase can help abate pollutant loads in the event that controls for landscape based and point sources are inadequate. One of the most important ways to increase the assimilative of the system is to provide and/or preserve floodplain connection. Other means include ensuring high quality substrate (i.e., an adequate hyporheic zone), and appropriate channel morphology (e.g.,

sinuosity, width depth relationships). A sufficient source of carbon is needed to support many of the organisms that are critical for in-stream biological processing therefore detritus from riparian trees and floodplains is important (Wallace et al., 1997; Baer et al., 2001; Crenshaw et al., 2002).