NORTHEAST OHIO FOUR COUNTY REGIONAL PLANNING AND DEVELOPMENT ORGANIZATION

Upper Tuscarawas River

Watershed Action Plan

Final Report

July 1999

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This report is submitted in fulfillment of Milestone 5, from NEFCO's Scope of Work, for the Upper Tuscarawas River Watershed Action Plan. The scope calls for NEFCO to update critical watershed components including land use, critical resources, and riparian corridor habitat. It also calls for NEFCO to develop a strategic action plan to address threats to water quality and provide recommendations which are most appropriate for the watershed.

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Summary

The information contained in this report directly reflects the steps involved in formulating a watershed action plan. In order to create an effective and meaningful plan, an inventory of the various land uses, pollutants and valuable natural resources was needed.

The Upper Tuscarawas (Portage Lakes) River Watershed is an area of mixed development with increasing conversion of agricultural and open space to single family and commercial development. As land use changes, greater demands are placed upon the water resources, which are a vital component to the quality of life for many who live and/or work in the area.

Various potential pollution sources were identified in the watershed, and reflect the many types of land use taking place. Each of these sources was evaluated to assess their ability to impair surface and/or ground water quality. On-lot home and semi-public sewage disposal systems (HSDSs) and (SPSDSs), landfills and dumps, and construction sites appear to have the greatest potential impact from nonpoint source pollution (NPS) in the watershed as a whole, although individual subwatersheds may vary. The evaluation revealed that the greatest potential water quality threat from point sources of pollution is linked to off-lot HSDSs and SPSDSs. Other point sources of pollution include municipal wastewater treatment plants, several smaller semi-public sewage treatment plants (package plants) and industrial direct dischargers.

Critical resources, such as state resource waters, ground water resources, headwaters and biologically significant wetlands have been located within the watershed. While the watershed does not contain any streams designated as “state resource waters,” there are thirteen publicly-owned lakes and/or reservoirs that are designated as such. Perennial and intermittent streams (headwaters), which are tributaries to the Tuscarawas River, are present throughout the watershed and flow through mostly residential and agricultural areas. Groundwater yields of 100 gallons per minute and greater were mapped for the watershed. The highest yielding areas (500-1,000 gallons per minute) were found in Summit County along the Tuscarawas River. Biologically significant wetlands are present throughout the watershed, however; the location with the greatest species diversity is the wetland area surrounding Singer Lake (Subwatershed 5).

Six waterways were evaluated for riparian habitat quality, for a total of 42.61 river miles, which included the following: Tuscarawas River, Myersville Creek, Graybill Creek, Cottage Grove Creek, Wonder Lake Creek, and Nimisila Creek. The riparian evaluation revealed that 34.5 percent, of the six waterways assessed, consisted of high quality riparian habitat (i.e. forest, swamp, shrub, or old field). Myersville Creek contained the greatest percentage of high quality habitat (39.50 percent), and Graybill Creek had the lowest percentage, with only 19.01 percent.

To assist in remediation efforts to improve or preserve water quality, a watershed action plan has been developed. This action plan directly reflects the information gathered from other components of this report, especially the ranking of potential pollution sources. The action plan has identified goals, objectives, priority areas and activities to address water quality concerns. Each activity is associated with suggested responsible parties, possible funding sources, estimated time frames, expected improvements and evaluation procedures. This plan will serve as a "road map" to lead future implementation efforts.

Introduction

The intent of the Upper Tuscarawas River Watershed Action Plan is to protect and/or restore the water quality of the Upper Tuscarawas River Watershed. Prior to the implementation of an action plan, characterization of the interacting components within the watershed is required. This will enable key stakeholders to locally identify the most appropriate mechanism(s) not only for preservation/protection efforts, but also for maintaining the integrity of the natural resources and their habitats necessary for a healthy watershed, while at the same time promoting economic growth.

It is also the intent of this study to raise public awareness, especially among the watershed's residents, of the valuable natural resource areas in the Upper Tuscarawas River Watershed. This awareness will enhance the effort to develop and implement watershed stewardship projects through volunteer citizen groups or local landowners within the watershed, and to encourage their participation in the use of Best Management Practices (BMPs) included in the action plan for the protection of the water quality within the watershed.

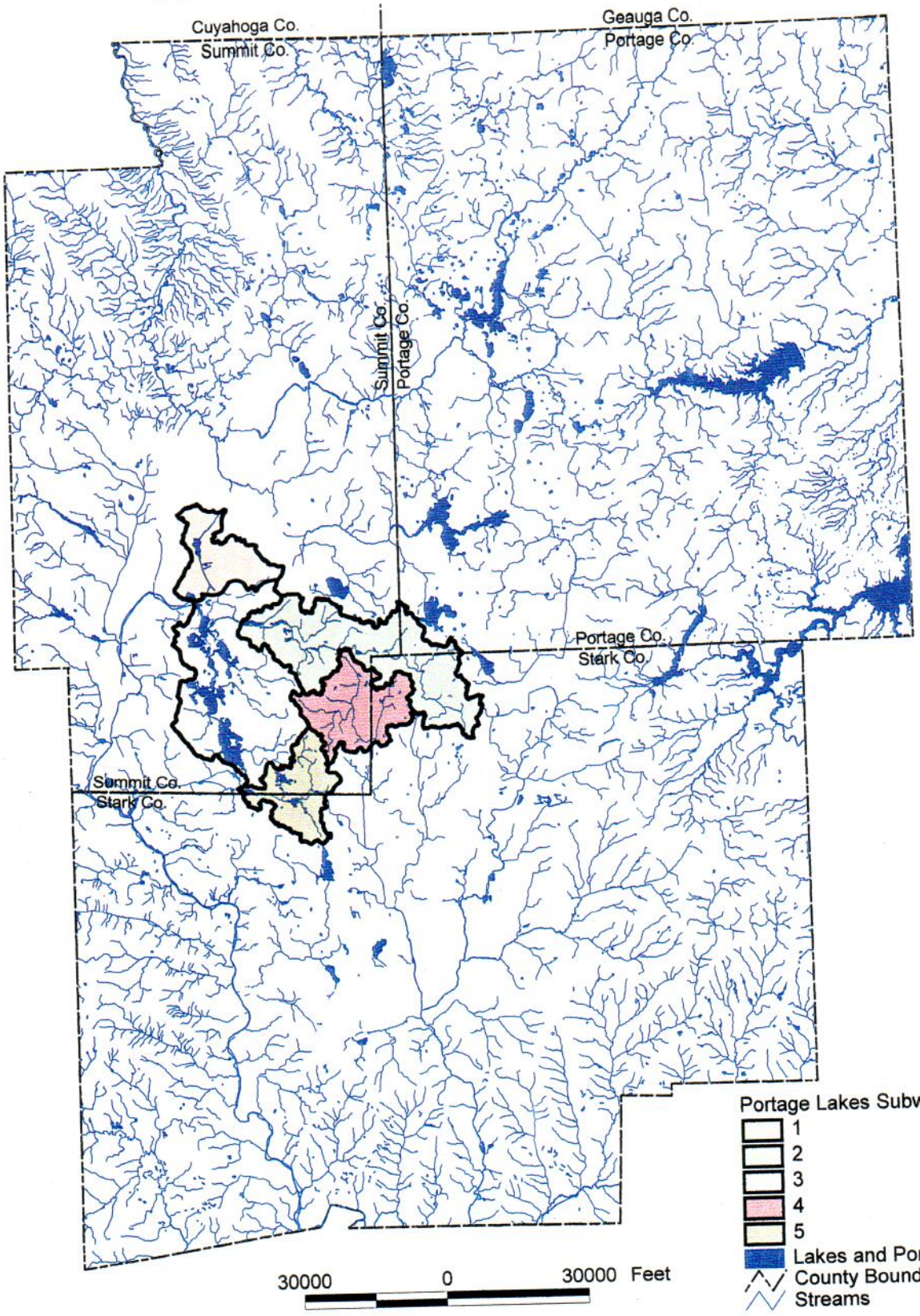
Study Area

The study area is located in the Upper Tuscarawas River Major Subwatershed, which is a subset of the Muskingum River Watershed of the Ohio River Drainage Basin. The Upper Tuscarawas River drains nearly 79 square miles in Summit County with portions in Stark County and Portage County (Figure 1). The headwaters arise in a suburban area of Stark County near Hartville. The river flows west through a series of small impoundments and eventually into the Portage Lakes.

The location and controlled drainage flow of the northern portion of the study area, which is located on a Mid-Continental Divide of the Lake Erie and Ohio River Basin, makes this study area rather unique because of the intricate nature of the Portage Lakes drainage system.

The Portage Lakes Drainage Area (Figure 2) is a very complex hydrologic system that is controlled by the Department of Natural Resources, Division of Water. The system consists of natural lakes and man-made reservoirs originally intended to maintain an adequate supply of water to serve the Ohio & Erie Canal and the growing industries in

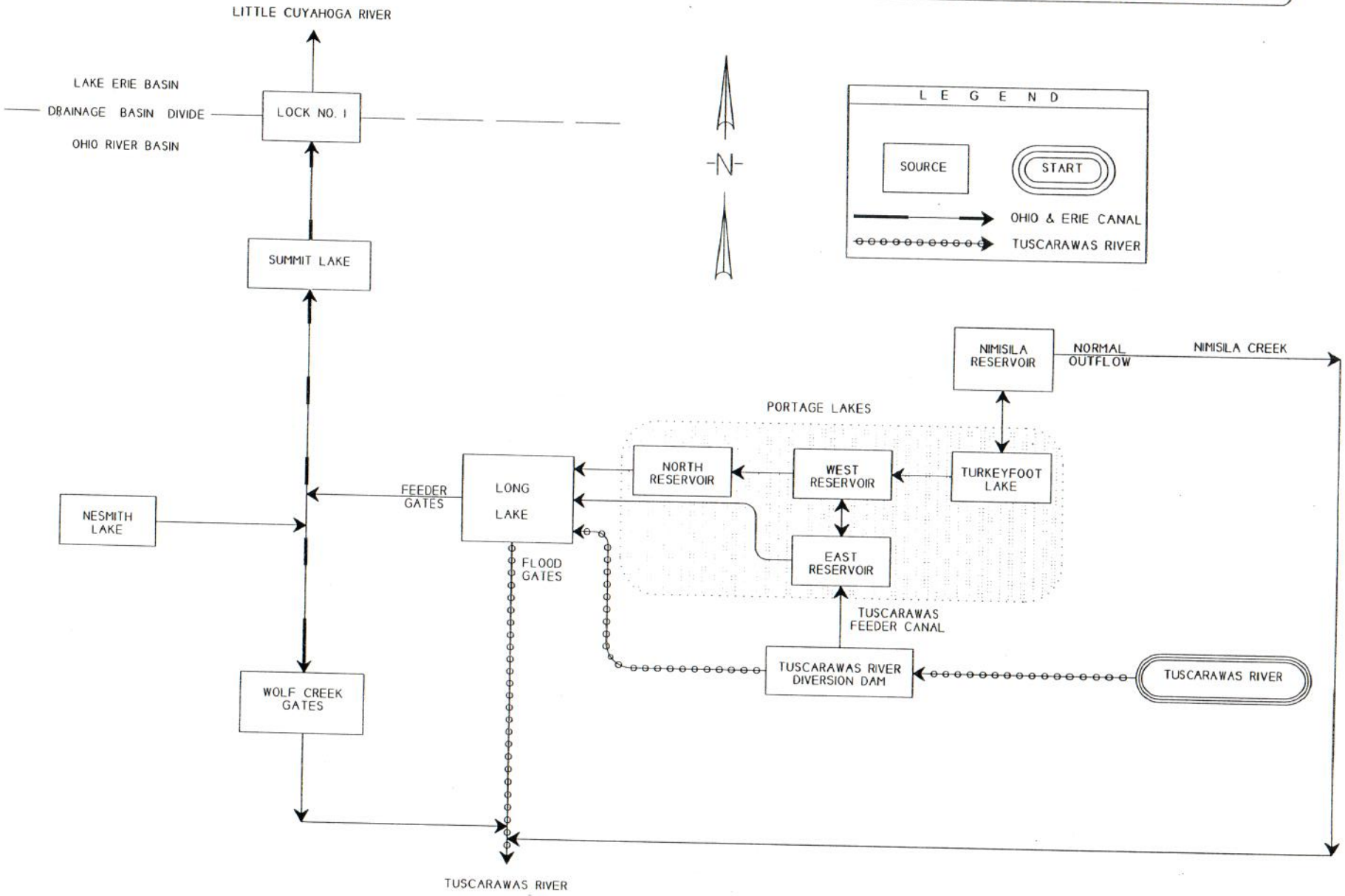
Figure 1
Study Area
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: ODNR, Division of Real Estate and Land Management; USGS.

FIGURE 2

FLOW CHART A: FLOW SCHEMATIC FOR THE PORTAGE LAKES AND THE OHIO & ERIE CANAL



Akron. The Portage Lakes hydrologic system includes the following water bodies: Nimisila Reservoir, Turkeyfoot Lake, Rex Lake, Mud Lake, West Reservoir, East Reservoir, Miller Lake, Hower Lake, North Reservoir, Long Lake, Tuscarawas Diversion Dam, Lake Nesmith, Summit Lake, Tuscarawas River and the Ohio & Erie Canal.

The Portage Lakes hydrologic system, from south to north, consists of Nimisila Reservoir, which normally discharges excess water through an uncontrolled spillway draining south into the Tuscarawas River via Nimisila Creek. Nimisila Reservoir was built in 1936-37 to augment the water supply to the Portage Lakes during low flow periods when the lakes are used primarily for recreational purposes. However, water may be released north into Turkeyfoot Lake through two 36 inch gated outlets. Turkeyfoot Lake is connected to Rex Lake to the west, Mud Lake to the east and West Reservoir to the north. The East Reservoir is connected to the West Reservoir by a channel from which the West Reservoir discharges receiving waters from East Reservoir, Miller Lake, Nimisila Reservoir, Turkeyfoot Lake, Rex Lake and Mud Lake into the North Reservoir. However, the East Reservoir and Miller Lake are also connected to Long Lake, consequently, water from East Reservoir and Miller Lake also flows into Long Lake. Water from Long Lake normally flows into the Tuscarawas River as discharges are controlled by two outlet works. The first outlet consists of an adjustable flood gate permitting normal flow into the Tuscarawas river. The second outlet consists of a 50 foot concrete weir having the same elevation as the lower flood gate. There are two 3 foot square gated conduits located near the second outlet which are being used to release water into the Ohio & Erie Canal. (ODNR, 1997, p. 1).

Another element of the Portage Lakes hydrologic system begins at the Tuscarawas Diversion Dam where two outlet works either discharge the water into the Tuscarawas River flowing into Long Lake, or divert water into the Feeder Race Canal through two 3 foot square gates where it discharges into the East Reservoir where, again, water may discharge directly into Long Lake or flow through West and North Reservoirs, eventually discharging into Long Lake.

As previously mentioned, water normally flows back into the Tuscarawas River from Long Lake, although water is also released into the Ohio & Erie Canal for aesthetic purposes and as a water supply for the canal in order to prevent stagnation. Water entering the Ohio & Erie Canal from Long Lake is controlled by two outlet works, one of which is located at Lock No. 1 in the City of Akron, with the other located just north of the confluence of the Canal and Wolf Creek located in the City of Barberton. Lake Nesmith and Summit Lake, located along the Ohio & Erie Canal, share the same water elevation.

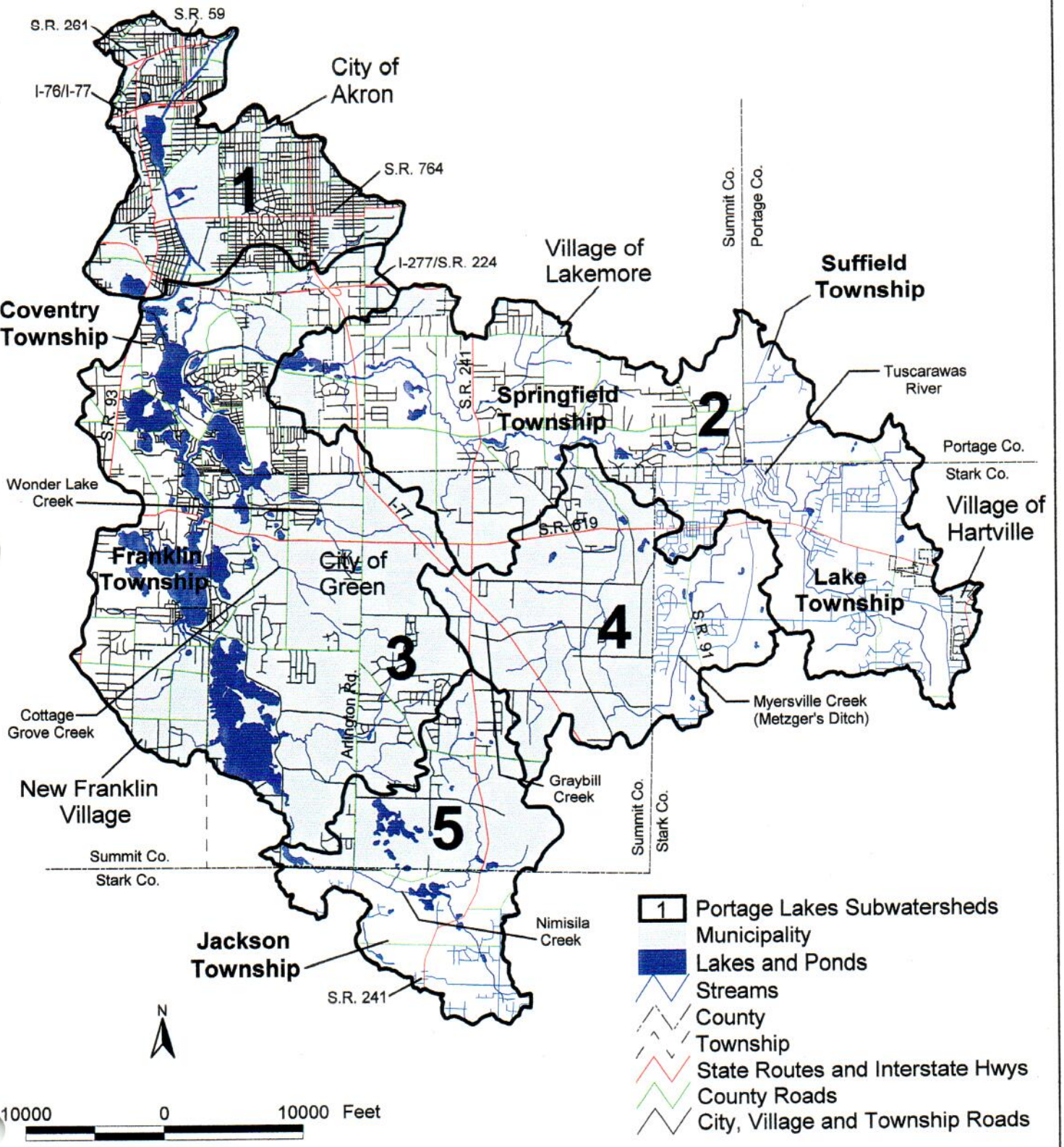
Summit Lake and a portion of the Ohio and Erie Canal, located in subwatershed 28 of the Cuyahoga River Basin, have been included in this study as they are a component of the Portage Lakes Drainage System. For purposes of this study, the study area will be referred to as the Upper Tuscarawas River Watershed, which will permit this study to remain consistent with previous NEFCO work. Located within the Upper Tuscarawas

River Watershed are, in whole or in part, the following government jurisdictions: Suffield Township in Portage County, the Village of Hartville, Lake Township and Jackson Township in Stark County, and the Village of Lakemore, the Village of New Franklin, the City of Green, the City of Akron, Springfield Township, Franklin Township, and Coventry Township in Summit County (Figure 3).

Data Sources

The following information was obtained in consultation with a number of state and county agencies including the Ohio Environmental Protection Agency (Ohio EPA) Northeast District Office (NEDO), Division of Surface Water, Division of Drinking and Ground Waters, Division of Solid and Infectious Waste Management, and Division of Emergency and Remedial Response. Other data sources include: AMATS, the Summit County Auditor's office, the Akron City Health Department, the Stark County Regional Planning Commission, Summit, Stark, and Portage County Health Departments, the Summit and Stark County Engineer, the Summit Soil and Water Conservation District (SWCD) and Stark and Portage SWCDs. The Ohio Department of Natural Resources (ODNR) provided information from its Division of Water, Division of Ground Water Resources, Division of Soil and Water, Division of Geological Survey, Division of Oil and Gas, Division of Natural Areas and Preserves, Natural Heritage Data Services, Division of Real Estate and Land Management, and Division of Mines and Reclamation. The United States Geological Survey and the United States Department of the Interior also provided valuable information. Additional data was obtained from the State Fire Marshall's Bureau of Underground Storage Tank Regulations. The digital data received from these sources was then imported into NEFCO's Geographic Information System (GIS), thereby permitting NEFCO to conduct a more complex and comprehensive evaluation of the study area. Furthermore, the GIS permits NEFCO to conduct complicated spatial analyses, modeling of map features, data storage and retrieval, data manipulation and display of geographically-referenced information.

Figure 3
Government Jurisdictions
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: ODNR, Division of Real Estate and Land Management; USGS.

I. Land Use/Land Cover

Summary

Characterization of a watershed's land use/land cover can lend a better understanding of potential threats to water quality. A study of the Upper Tuscarawas River Watershed's land use/land cover was achieved by combining and enhancing existing digital information with newly digitized data from orthophotos. Results of the study revealed that the watershed is comprised of several types of land use/land cover. The most substantial form of land use in the watershed is residential. Residential areas have the potential to be sources of nutrients, bacteria and other pollutants. Significant portions of undeveloped land remains, in the form of wooded/wetland and open area. These areas may help alleviate the impacts from stormwater runoff from urbanized areas. Agricultural land still remains, however; these lands are under tremendous pressure from development as urban sprawl continues.

Introduction

An effective watershed action plan should take into consideration the various forms of land use taking place. Understanding land uses within the watershed can offer clues as to the types of nonpoint source pollutants, subwatersheds at high risk of NPS, and appropriate BMPs to address the problems. Land use in the Upper Tuscarawas Watershed was derived from existing digital data and orthophotos. The orthophotos were digitized for incorporation into a GIS. Land use/land cover categories for the Summit County and Portage County portions of the study area include: residential, commercial/industrial/public/semi-public, transportation, agricultural, wooded/wetland, open area/urban park, and water. Land use/land cover for the Stark County portion of the study area include: residential, institutional and governmental, communications, industrial, general retail and service, parks and recreation, and open area. The land use/land cover for the watershed is illustrated in Figure 4. Tables 1 and 2 present the acreage and percentage of land use/land cover in the watershed.

Source Materials

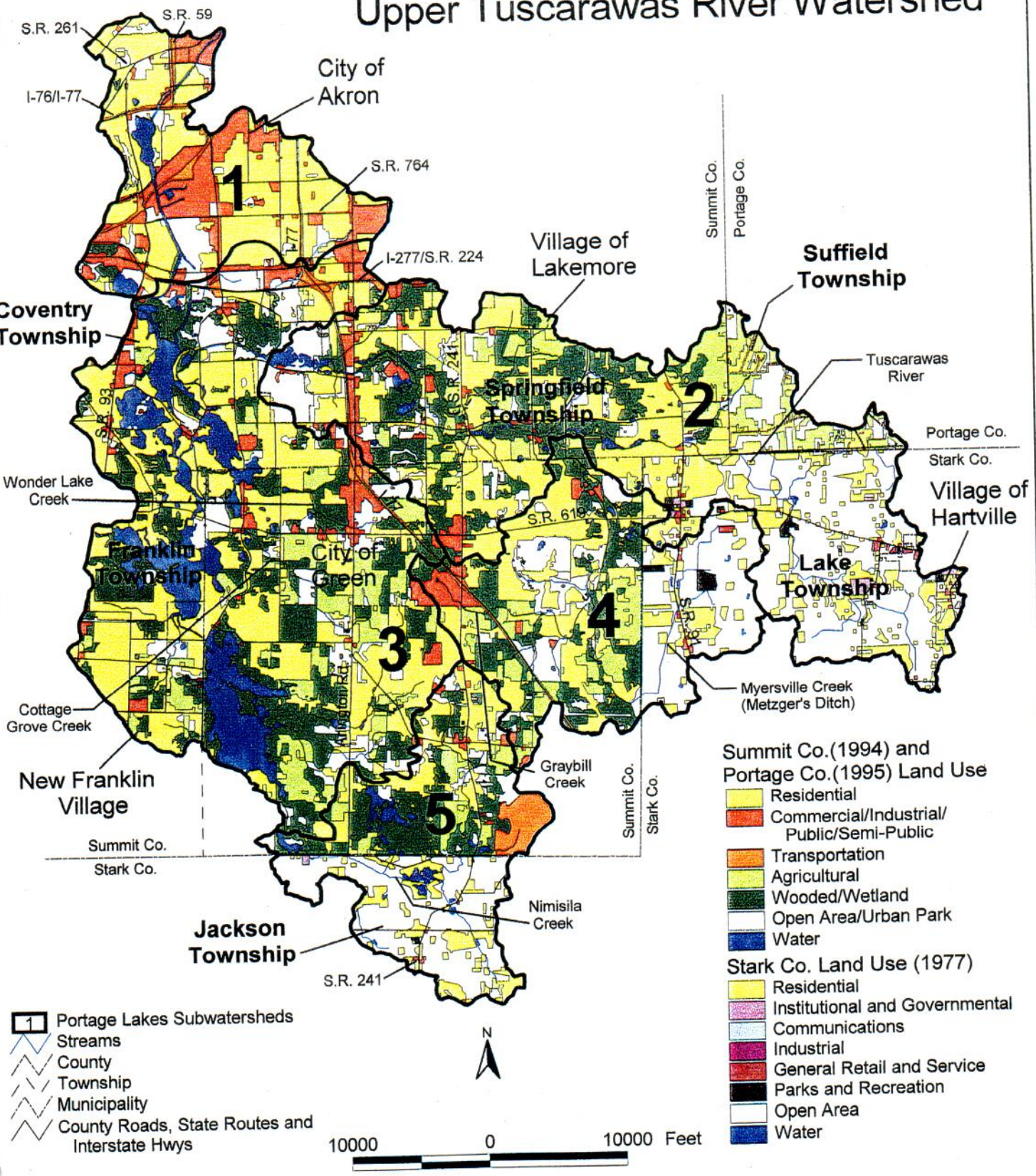
The source materials include the following:

1. Summit County - 1997 orthophotos produced from 1994 aerial photos by the Summit County Auditor's Office and digitized through the University of Akron's Cartography Laboratory.

2. Portage County - 1995 Ohio Capability Analysis Program (OCAP) data and enhanced via 1995 aerial photos.

3. Stark County - 1977 OCAP data

Figure 4
Land Use/Land Cover
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: ODNR, Division of Real Estate and Land Management (Portage Co. 1995, Summit Co. 1994, Stark Co. 1977); USGS.

Table 1

Land Use Data, by County, in the Upper Tuscarawas River Watershed

SUMMIT COUNTY *(1)*		
1994 LAND USE	Acres in County	Percent in County
Residential	15,777	38.66
Commercial/Industrial/Public/Semi-Public	3,267	8.00
*Transportation	1,190	2.92
Agricultural	3,827	9.38
Wooded/Wetland	9,240	22.64
Open Area/Urban Park	4,888	11.98
Water	2,622	6.42
TOTAL	40,811	100.00
PORTAGE COUNTY *(2)*		
1995 LAND USE	Acres in County	Percent in County
Residential	307	23.15
Commercial/Industrial/Public/Semi-Public	3	0.23
*Transportation	67	5.05
Agricultural	478	36.05
Wooded/Wetland	0	0.00
Open Area/Urban Park	471	35.52
Water	0	0.00
TOTAL	1,326	100.0
STARK COUNTY *(3)*		
1977 LAND USE	Acres in County	Percent in County
Residential	2,695	26.97
Institutional and Governmental	103	1.03
Communications	6	0.06
Industrial	2	0.02
General Retail & Service	123	1.23
Parks and Recreation	136	1.36
Open Area	6,928	69.33
Water	0	0.00
TOTAL	9,993	100.00

*These percentages represent total acreage for interstate highways and airports.

Source:

(1) NEFCO 1998, unpublished data

(2) ODNR, Ohio Capability Analysis Program, 1995

(3) ODNR, Ohio Capability Analysis Program, 1977

Table 2

Land Use Data, by Subwatershed, in the Upper Tuscarawas River Watershed

LAND USE	Acres and Percent in each Subwatershed											
	1		2		3		4		5		TOTAL	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Summit Co. *(1)* **& Portage Co.** *(2)*												
Residential	2,900	52.35	3,729	24.72	6,841	37.95	1,738	23.02	875	14.77	16,084	30.85
Commercial/Industrial/ Public/Semi-Public	1,427	25.76	502	3.34	1,008	5.59	272	3.60	61	1.03	3,270	6.27
*Transportation	500	9.02	111	0.74	257	1.43	77	1.02	313	5.28	1,257	2.41
Agricultural	0	0.00	1,442	9.56	1,634	9.06	836	11.07	393	6.63	4,305	8.26
Wooded/Wetland	102	1.84	2,335	15.48	4,196	23.27	1,392	18.43	1,217	20.52	9,240	17.72
Open Area/Urban Park	440	7.94	1,618	10.73	2,001	11.10	916	12.13	384	6.47	5,359	10.28
Water	171	3.09	192	1.27	2,091	11.60	43	0.57	124	2.09	2,622	5.03
Stark Co. *(3)*												
Residential	0	0.00	1,539	10.20	0	0.00	540	7.15	616	10.37	2,695	5.18
Institutional and Governmental	0	0.00	92	0.61	0	0.00	0	0.00	11	0.18	103	0.20
Communications	0	0.00	1	0.01	0	0.00	5	0.07	0	0.00	6	0.01
Industrial	0	0.00	2	0.01	0	0.00	0	0.00	0	0.00	2	0.00
General Retail & Service	0	0.00	77	0.51	0	0.00	36	0.48	11	0.18	123	0.24
Parks and Recreation	0	0.00	60	0.40	0	0.00	71	0.94	5	0.08	136	0.26
Open Area	0	0.00	3,382	22.42	0	0.00	1,625	21.52	1,922	32.40	6,928	13.29
Water	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
TOTAL	5,540	100.00	15,082	100.00	18,028	100.00	7,551	100.00	5,932	100.00	52,130	100.00

*These percentages represent total acreage for interstate highways and airports.

Source:

(1) NEFCO 1998, unpublished

(2) ODNR, Ohio Capability Analysis Program, 1995

(3) ODNR, Ohio Capability Analysis Program, 1977

Discussion

The watershed constitutes a total area of approximately 52,131 acres (Table 1). The majority of the watershed is located in Summit County (78.29 percent), with smaller portions in Stark (19.17 percent) and Portage (2.54 percent) Counties.

Due to insufficient data and resources, the Stark County land use information used in this report dates back to 1977. Because of this, many land use/land cover categories for Stark County are different than the categories chosen for Summit and Portage Counties.

The land use/land cover categories for Summit and Portage County include: 1) Residential (high, medium and low density); 2) Commercial/Industrial/Public/Semi-Public: shopping centers, office buildings, warehouses, parking lots, heavy and light industrial operations, educational, religious, health care, and correctional facilities; 3) Transportation: airports, railways and highways; 4) Agricultural: cropland, pasture and orchards; 5) Wooded/Wetland: deciduous and evergreen forest land, forested and non forested wetlands; 6) Open Area/Urban Park: undeveloped areas, golf courses, cemeteries, parks and landfills and dumps; 7) Water: lakes, ponds and streams.

Land use/land cover categories for Stark County include: 1) Residential (high, medium and low density); 2) Institutional and Governmental, which can include educational, health, religious and other public use facilities; 3) Communications indicate areas used for airwave communications, such as telephone, radio, radar or television antennas; 4) Industrial (heavy and light industry); 5) General Retail and Service; 6) Parks and Recreation (golf courses, camp grounds and parks); 7) Open Area: undeveloped areas, cemeteries and landfills and dumps.

Table 2 reveals that the predominate land use in the watershed is residential (36.01 percent). Other significant forms of land use/land cover consist of wooded/wetland (17.73 percent), open area (13.29 percent) and open area/urban park (10.72 percent). Comparison of Stark County 1977 OCAP data and 1997 aerial photos reveals that a substantial amount of undeveloped land has been converted to residential or commercial use since the late 1970s. Therefore; actual percentages of residential and/or commercial-related land use for Stark County would be significantly greater than the percentages listed in Table 1, and the percentage of open area would be lower.

As residential development continues, the demand for clean and safe water is on the rise. Residential areas have the potential to be sources of nutrients and bacteria, particularly if located on poor soils for HSDSs and if sewers are unavailable. Nutrients and bacteria can originate from failed HSDSs, while other pollutants can arise as the result of lawn fertilizers, pesticides and general household wastes. As development proceeds, the level of imperviousness and storm water drainage increases. The impacts of storm water runoff from urbanized areas can destabilize streams and ditches. Streams respond to increased flows by eroding (usually along stream banks),

transporting and depositing sediment downstream. Increased sediment and attached nutrients may well exacerbate other pollutant impacts, i.e. reducing a stream's ability to assimilate pollution.

Significant portions of wooded/wetland and open areas are located throughout the watershed (Tables 1 and 2). For example, vast tracts of wooded/wetland areas are located along the Tuscarawas mainstem in Subwatershed 2, around Nimisila Reservoir and north of Long Lake in Subwatershed 3, and around Singer Lake in Subwatershed 5. These areas may have remained intact due to their natural limitations for certain types of development. The presence of these natural areas probably moderates the impact of runoff from many of the land uses throughout the watershed. These natural areas act as buffers and filters to moderate water flow and reduce erosion and the transport of pollutants downstream.

Conclusion

Because of the diversity of land use/land cover present in the watershed, a wide variety of preventative and restorative measures are needed to ensure healthy water quality. The increasing pressure of development should be taken into consideration when designing activities to protect the Upper Tuscarawas River Watershed. Efforts to promote environmentally-sound and sustainable development should be encouraged. Riparian, wetland, and shoreline protection and restoration activities and storm water management are essential to protecting water quality.

II. Potential Pollution Sources

Summary

Potential pollution sources in the Upper Tuscarawas River Watershed vary widely, but generally are typical of a watershed of mixed development. Limited sampling by the Ohio EPA performed in April 1992 indicated that East Reservoir receives most of the material flowing into the lakes. Phosphorous and nitrate-nitrite contributions to the lakes are in amounts expected for an urban area with various forms of land use. Bacteriological data suggest a trend toward pollution of streams by human waste. Overall, the watershed is characterized by eutrophic conditions (high biological productivity). Activity along the shorelines of the Portage Lakes and in the adjacent subwatersheds does seem to be providing a source of sediment that is substantial enough to impair biological productivity. Instream lakes, such as Tritts Mill Pond and Pine Lake, apparently have reduced the sediment load in the Tuscarawas River; however, it has resulted in volume loss to these upstream lakes (NEFCO, 1996, p.14, 37, and 69).

Sources of pollution can include home sewage disposal systems (HSDSs), public and semi-public sewage treatment plants (package plants), agricultural runoff, construction sites, petroleum production activity, landfills and dumps, industrial land use areas, and leaking underground storage tanks.

The following pages examine the potential pollution sources in the watershed as they exist today. Wastewater treatment plants were the primary point sources of pollution. Self-monitoring requirements were reviewed for domestic wastewater dischargers. Nonpoint sources of pollution in the watershed were identified by focusing on studying land use (human activity) within the watershed.

Unsewered areas, older residential areas, and soil characteristics were used to estimate the potential for septic systems or Home Sewage Disposal Systems (HSDSs) in the watershed to fail. The distribution of these areas, and all other sources of NPS pollution in the watershed, was evaluated at a subwatershed level for prioritization purposes.

Introduction

Understanding the problem areas that adversely affect or impair the water quality of the Upper Tuscarawas River Watershed requires a knowledge of the condition of the watershed (NEFCO, 1997d, p. 11). Insight can be gained by looking at the contributions from point sources, nonpoint sources and land use. This section of the report examines the present potential pollution sources in the watershed, and attempts to prioritize the subwatersheds that appear to be the most impaired. Potential point sources of pollution will be discussed and particular emphasis will be given to potential nonpoint source (NPS) pollution within each subwatershed. It is intended that the

results of this study help guide land use decisions made by key stakeholders in order to protect/maintain the integrity of the Upper Tuscarawas River Watershed. Such an analysis can help these stakeholders identify and prioritize subwatersheds that are in need of remediation efforts or that are adversely affected by certain land uses.

It is also the intent of this study to raise public awareness, especially with the watershed's residents, of the pollution sources in the Upper Tuscarawas River Watershed. It is hoped that information in this report will stimulate watershed stewardships, through government organization, volunteer citizen groups, or land owners within the watershed, to help develop and implement best management practices (BMPs), which can ameliorate water quality problems associated with (NPS) pollution in the watershed.

Relevant Data

Aquatic Life Use Designations

The ultimate goal of many watershed action plans is the restoration or preservation of aquatic life use designations and beneficial uses within the watershed. According to the Ohio Environmental Protection Agency (Ohio EPA) the aquatic life use designation within the watershed is warmwater habitat. The water supply designations are agricultural and industrial, and the recreational use designation is primary contact. Beneficial uses include unrestricted consumption of fish and wildlife and drinking water, restoration of aquatic and terrestrial biotic communities and their habitats, and unrestricted recreational and commercial uses. Currently, three of the five stream segments monitored by the Ohio EPA are not attaining their aquatic life use designation in at least part of the stream miles monitored within the segment. Reasons for this vary, and include flow and other habitat alterations, siltation, organic enrichment, and unknown toxicity. Appendix A contains the use attainment status and causes and sources of impairment for stream segments monitored within the watershed.

Fecal Coliform Testing

NEFCO assisted the Ohio EPA-Northeast District Office (NEDO) in selecting monitoring stations, for fecal coliform, in the Upper Tuscarawas River Watershed. Sixteen stations were chosen, and two of these stations had insufficient flow for monitoring. Five of the sixteen stations chosen were monitored for several parameters by NEFCO in 1992. Five of the sixteen stations were also located within sewered areas. Table 3 presents the results from the July 28, 1998 monitoring by the Ohio EPA.

Table 3
Fecal Coliform Counts From Samples Taken on July 28, 1998 in the Upper Tuscarawas River Watershed

Station	Stream	Road	Fecal Coliform (per 100 mL)
*1	Ohio Canal	Wilbeth Rd.	600
*2	Tuscarawas River	South Main St.	300
3	Long Lake Canal	Carmany Rd.	1,300
4	Wonder Lake Creek	Cottage Grove Rd.	240
5	Tributary	Killinger Rd.	130
6	Cottage Grove Creek	South Main St.	Dry
***7**	Turkeyfoot Tributary	Roble Rd.	3,300
***8**	Tuscarawas River	Pickle Rd.	400
9	Tuscarawas River	Myersville Rd.	160
10	Tuscarawas River	Portage Line Rd.	Dry
11	Tuscarawas River	Mogadore Ave.	720
12	Tributary to Nimisila Creek	Koons Rd.	1,200
13	Myersville Creek	Heckman	230
*14	Myersville Creek	Raber Rd.	270
15	Nimisila Creek	Arlington Rd.	600
16	West Reservoir Tributary	Baypath Dr.	<20

*Refer to monitoring stations within sewered areas.
**Information received from Ohio EPA-NEDO, 1998.
Bold numbers correspond to NEFCO monitoring stations in 1992, which included fecal coliform.

Fecal coliform counts of less than 200 per 100 ml (milliliters) of water is desirable for primary contact waters (swimming) and less than 1,000 per 100 ml for secondary contact waters (boating and fishing). Generally, less than 1,000 counts per 100 ml is permissible for primary contact waters and less than 5,000 per 100 ml for secondary contact waters (Campbell and Wildberger, 1992, p. 10).

The Ohio EPA has developed specific acceptable levels of bacteria for surface waters within Ohio. Statewide criteria for primary contact waters is included below. For each designation at least one of the two bacteriological standards (fecal coliform or E. coli) must be met.

Primary Contact

Fecal Coliform - geometric mean fecal coliform content, either most probable number (MPN) or membrane filter (MF), based on not less than five samples within a 30-day period, shall not exceed 1,000 per 100 ml and fecal coliform content (either MPN or MF) shall not exceed 2,000 per 100 ml in more than 10% of the samples taken during any 30-day period.

E. coli - geometric mean E. coli content (either MPN or MF), based on not less than five samples within a 30-day period, shall not exceed 126 per 100 ml and E. coli content (either MPN or MF) shall not exceed 298 per 100 ml in more than 10% of the samples taken during any 30-day period.

Potential Point Source Pollution Inventory

A point source is defined as a source that discharges pollutants, or any effluent, from a known discharge point, such as a pipe, ditch, or sewer and into a waterbody after treatment (Miller, 1988, p. 348). Point sources can be traced back to the discharger, i.e., the owner/operator of a factory, sewage treatment plant or even an off-lot home sewage disposal system (HSDS). Treatment generally consists of removal of solids and disinfection. The discharge often contains a high proportion of dissolved nutrients and chemicals. Municipal point sources were identified as a major source of impairment to assessed stream segments of Metzger's Ditch, which is located in Subwatershed 4. Municipal point sources with smaller flows were considered a minor source of impairment to stream segments studied along the Tuscarawas River (Appendix A).

Approximately seventy-nine point sources were identified discharging domestic wastewater into the watershed. These include wastewater treatment plants (WWTPs) which encompass both public and semi-public sewage treatment plants (package plants). Industrial direct dischargers (process and stormwater) were also identified in the watershed, these are noted in Table 13 under Active Industrial Operations. Table 4 shows the distribution of domestic wastewater dischargers by subwatershed and design flow in millions of gallons per day (mgd). Most of the information in Table 4 is from a 1984 inventory of package wastewater treatment plants, however; plants listed with design flows greater than or equal to 0.1 mgd were verified and updated as needed.

Table 4 Distribution and Design Flow for Domestic Wastewater Treatment Plants by Subwatershed						
Subwatershed	Design Flow (Q) in Millions of Gallons Per Day (mgd)					
	10.0>Q>1.0	1.0>Q>0.25	0.25>Q>0.1	0.1>Q>0.025	Q<0.0251	Total Maximum Designed Discharge
1						0.0000
2	1			1	18	4.1390
3			1		44	0.2129
4					7	0.0400
5					7	0.0345
Total	1	0	1	1	76	4.4264
Source: NEFCO,1984, Inventory of "Package Wastewater Treatment Plants", Summit County Department of Environmental Services and Stark County Engineer, Pers. Com., August, 1998.						

Self-Monitoring

The Ohio EPA has the authority to regulate all wastewater treatment plants, enforce water quality regulations, and review plans or permits-to-install for any new plants (Ohio EPA and Local Health Department Work Group, 1996). However, under the provisions of House Bill 110, the Ohio EPA allows contracts with local health departments to inspect, and collect fees for, package plants with design flows of 25,000 gpd or less. To protect surface and ground waters from pollutants associated with WWTPs, the Ohio EPA requires that all sanitary dischargers monitor their effluent stream for certain parameters with a frequency based on design flow, and report the results to its agency once a month.

Table 5 lists the final effluent self-monitoring requirements for WWTP owners/operators. There is one plant with a design flow greater than 1.01, but less than 10.0 mgd: Summit County Plant #91-Upper Tuscarawas (4.0 mgd) discharges to Subwatershed 2. This plant is monitored for fifteen out of sixteen parameters listed on the table, as seen in the column on the extreme left hand side. There is one WWTP with a design flow greater than 0.1 mgd and less than 0.249 mgd: Summit County Plant #48-Zelray Park (0.123 mgd) discharges into Subwatershed 3. This plant corresponds to the middle column on the table, and is monitored for all parameters except nitrates, nitrites, and turbity/odor/color. The remaining seventy-seven package plants correspond to the two columns on the right hand side of the table. These are monitored for eleven parameters, but do not include nitrates, nitrites, phosphorous, oil and grease, metals, and free cyanide (Ohio EPA, 1994a., p. 2).

Table 5 Final Effluent Self-Monitoring Requirements					
Parameter	**Design Flow (Q) in Millions of Gallons Per Day (mgd)**				
	10.0>Q>1.0	**1.0>Q>0.25**	**0.25>Q>0.1**	**0.1>Q>0.025**	**Q<0.0251**
Flow	Daily	Daily	Daily	Daily	Daily
Temperature	Daily	Daily	Daily	Daily	1/week
Residual Chlorine	Daily	Daily	Daily	Daily	1/2 weeks
Dissolved Oxygen	Daily	Daily	Daily	1/week	1/ week
pH	Daily	Daily	Daily	1/week	1/month
Suspended Solids	3/week	2/week	2/week	1/week	1/month
Biological Oxygen Demand (BOD)	3/week	2/week	2/week	1/week	1/month
Carbonaceous BOD	3/week	2/week	2/week	1/week	1/month
Ammonia (NH_3)	1/month	2/week	1/2 weeks	1/2 weeks	1/month
Nitrites (NO_2)	1/month	1/month	Not monitored*	Not monitored*	Not monitored*
Nitrates (NO_3)	1/month	1/month	Not monitored*	Not monitored*	Not monitored*
Phosphorous (P)	1/week	1/month	1/quarter	Not monitored*	Not monitored*
Oil and Grease	1/2 weeks	1/month	1/month	Not monitored*	Not monitored*
Bacteria	3/week	2/week	1/week	1/month	1/month
Metals, Free Cyanide	1/month	1/quarter	2/year	Not monitored*	Not monitored*
Turbidity/Odor/Color	Not monitored*	Not monitored*	Not monitored*	Daily	Daily
*Effluent is not monitored for the corresponding listed parameter as of 1997. Source: Ohio EPA, 1994a., p.2					

Table 6 lists the Ohio EPA's influent self-monitoring requirements. It indicates that the influent for 98 percent of the domestic wastewater dischargers (corresponding to the two columns on the right hand side) is not monitored. However, the influent of larger plants with a discharge greater than 0.25 mgd, is monitored for suspended solids, carbonaceous BOD, pH, metals and total cyanide, as shown in the two columns on the left hand side of the table. Plants discharging between 0.249 mgd and 0.1 mgd are required to monitor suspended solids and carbonaceous BOD (Ohio EPA, 1994a., p. 3).

Table 6 Influent Self-Monitoring Requirements					
Parameter	**Design Flow (Q) in Millions of Gallons Per Day (mgd)**				
	10.0>Q>1.0	**1.0>Q>0.25**	**0.25>Q>0.1**	**0.1>Q>0.025**	**Q<0.0251**
Suspended Solids	3/week	2/week	1/week	Not monitored*	Not monitored*
Carbonaceous BOD	3/week	2/week	1/week	Not monitored*	Not monitored*
pH	Daily	Daily	Not monitored*	Not monitored*	Not monitored*
Metals, Total Cyanide	1/month	1/quarter	Not monitored*	Not monitored*	Not monitored*
*Influent is not monitored for the corresponding listed parameter as of 1997. Source: Ohio EPA, 1994a., p. 3					

Table 7 lists upstream/downstream self-monitoring requirements. It indicates that the majority of all wastewater dischargers in the watershed (corresponding to the two columns on the right hand side, as mentioned) are not required to perform upstream/downstream monitoring. For comparison, the owners/operators of larger plants with a discharge greater than .25 mgd, are required to monitor upstream/downstream for pH, ammonia, temperature, bacteria, hardness, dissolved oxygen, and metals, as shown in the two columns on the left hand side of the table. Plants discharging between 0.249 and 0.1 mgd are required to monitor for all parameters listed in table 6, except for metals (Ohio EPA, 1994a., p. 3).

Table 7 Upstream/Downstream Self-Monitoring Requirements					
Parameter	**Design Flow (Q) in Millions of Gallons Per Day (mgd)**				
	10.0>Q>1.0	**1.0>Q>0.25**	**0.25>Q>0.1**	**0.1>Q>0.0251**	**Q<0.0251**
pH	1/month	1/month	1/quarter	Not monitored*	Not monitored*
Ammonia (NH_3)	1/month	1/quarter	1/quarter	Not monitored*	Not monitored*
Temperature	1/month	1/month	1/quarter	Not monitored*	Not monitored*
Bacteria	1/month	1/quarter	1/quarter	Not monitored*	Not monitored*
Hardness	1/month	1/quarter	1/quarter	Not monitored*	Not monitored*
Dissolved Oxygen	1/month	1/month	1/quarter	Not monitored*	Not monitored*
Metals	1/month	1/quarter	Not monitored*	Not monitored*	Not monitored*
*Upstream/downstream areas of package plant discharges are not monitored for the corresponding parameter. Source: Ohio EPA, 1994a., p. 3					

Tables 4, 5, 6 and 7 show that it is difficult to assess the cumulative impact of these dischargers on the Upper Tuscarawas River Watershed because of the lack of monitoring requirements for the majority of the plants. Even though the two WWTPs, which correspond to the extreme left hand and middle column on Tables 4-7, contribute 93 percent of the total design flow, they only represent approximately 2 percent of the total number of plants in the watershed. Plants with design flows less than 0.1 mgd represent about 98 percent of the total number of WWTPs and account for 7 percent of the design flow. These smaller plants are not required to monitor the majority of nutrients, influent, and upstream/downstream (refer to the two columns on the right hand side of Tables 5-7). Over half (57 percent) of the package plants discharging less than 0.1 mgd are located in Subwatershed 3, nearly 25 percent are in Subwatershed 2, and Subwatersheds 4 and 5 each contain approximately 9 percent (refer to Table 4).

Discussion at recent public meetings raised the issue of a proposal by Akron to supply water and sewer services to communities in the Upper Tuscarawas River Watershed. NEFCO staff believes that there may not be a significant impact to the health of streams in the watershed regarding the proposed water utility supply from the City of Akron to Springfield and Coventry Township. Some streams may even see an improvement in water quality. Loadings of pollutants downstream of the Springfield #91 wastewater treatment plant may likely be reduced, due to the tying-in of home/semi-public sewage disposal systems and small wastewater treatment plants. Providing services to these areas would eliminate many discrete points of pollution sources, in effect reducing the total load to the Tuscarawas River. The net increase in flow would be observed somewhat in Long Lake and downstream of Long Lake out of the study area.

Pollutant Loads

The above discussions on self-monitoring reveal the need to analyze the pollutant loads for wastewater treatment plants. Plants with design flows less than 100,000 gallons per day (gpd) lack nutrient, influent, and upstream/downstream self-monitoring requirements. The total design flow for such plants is 303,400 gpd. Unfortunately, there are no USGS gaging stations in the watershed to measure flow. Because of this, it is difficult to accurately tabulate the total pollutant loads.

The watershed approach to environmental planning requires that the watershed be viewed as one hydrologic unit--with inputs and outputs of surface and ground waters coming from hydrologic subunits within the watershed (and even from aquifers that extend beyond the watershed boundary). It has been shown in this report that as one hydrologic unit, the watershed has a combined treated wastewater design flow of 4,426,400 gpd. This does not include the discharge of wastewater from off-lot HSDSs. There are an estimated 4,900 of these systems in the Summit County portion of the watershed (Summit County Health Department, Pers. Com., August, 1998). Each of these systems could potentially discharge 360 gallons of treated wastewater per day (NEFCO, 1997a, p. 18). Therefore, over one and a half million gallons per day,

combined, could be discharged to the watershed from off-lot HSDSs. The locations of these systems, with respect to subwatersheds, are not readily available and therefore were not included in the calculation.

For all of these reasons, NEFCO recognizes that in order to protect/maintain the water quality of the Upper Tuscarawas River Watershed, each package plant with design flows less than 100,000 gpd would need to be monitored, to the same degree that a single plant with a design flow of 303,400 gpd is monitored. Only this would allow an analysis of pollutant loads from package plants in the watershed to be accurately completed. Also the location of each off-lot HSDS in the watershed would further identify which subwatersheds are most impacted by off-lot wastewater contributions to lakes and streams.

Potential Nonpoint Source Inventory

The term nonpoint source (NPS) refers to a water pollution that results from a variety of human land uses. Nonpoint source pollution occurs during rain or snow melt events and transports pollutants, through runoff, to a lake, stream, or ground water table. Since nonpoint source discharges are a product of weather patterns, they are more sporadic and intermittent than point source dischargers (Ohio EPA, 1997, p. 26).

Sources of potential nonpoint source pollution in the watershed include mineral extraction, landfills and dumps, oil and gas drilling activity, and road salt use. The major contributors are failing home sewage disposal systems, agriculture, construction and urban runoff (NEFCO 1996, p.69). An inventory of potential NPS pollutant contributors are described below based on land use, i.e., human activity, and natural limitations such as soils.

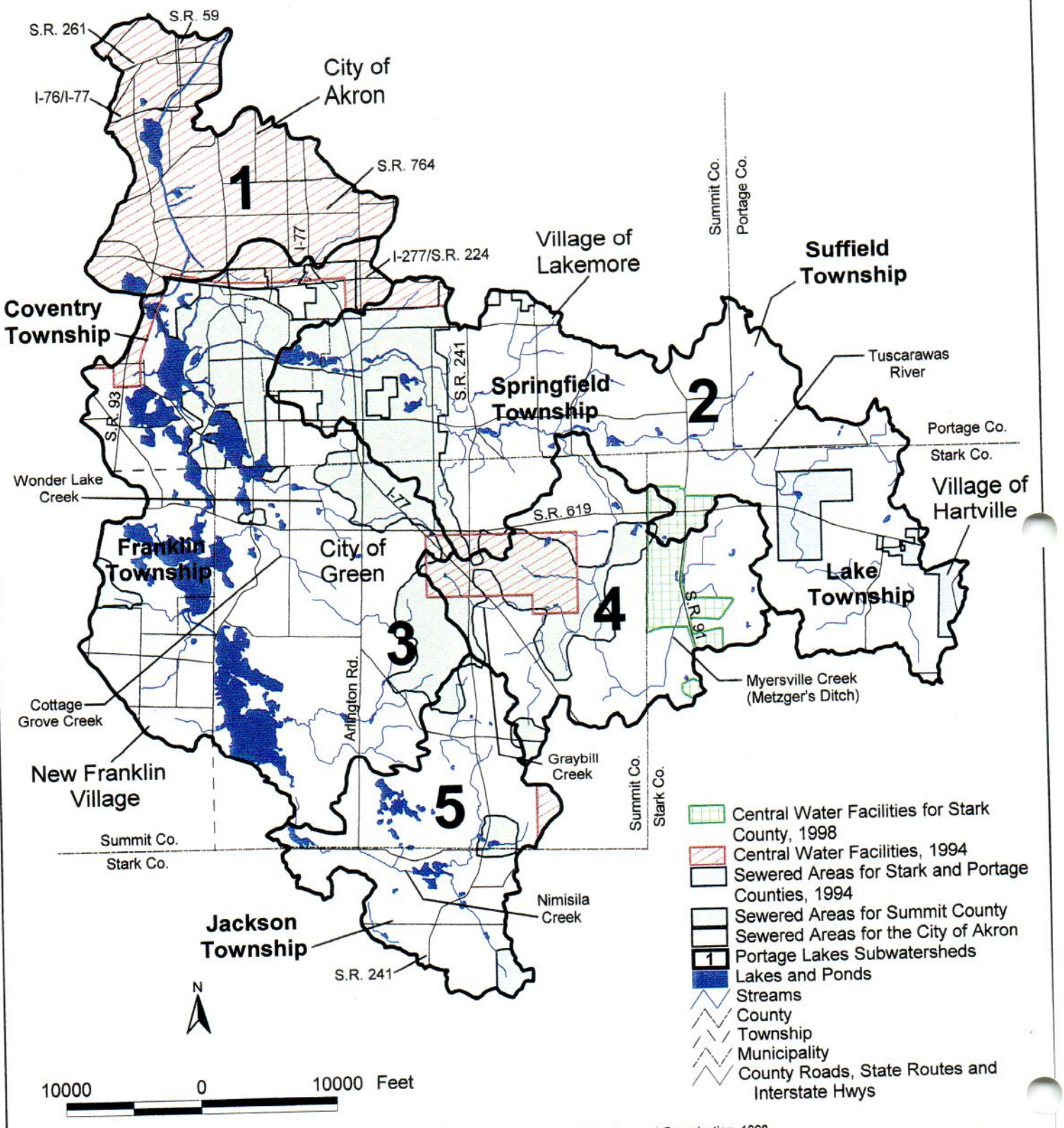
It is difficult to pinpoint the exact source of NPS pollution, adding to the reasons why it is one of the most complex environmental problems facing Ohio today. According to the 1990 Ohio EPA State of Ohio Nonpoint Source Assessment, nonpoint sources of pollution affect over 13,000 (45 percent) of Ohio's 29,000 perennial stream miles (ODNR and Ohio EPA, 1993, p. 3)

Unsewered Areas

Figure 5 illustrates the extent of sewered areas in the watershed and proposed sewer service areas. All present unsewered areas are a potential source of NPS pollution (Ohio EPA, 1997, p. 28). More than half of subwatersheds 2,3,4, and 5 is unsewered.

Individual home sewage disposal systems (HSDSs) are used to treat domestic wastewater before returning it to surface and ground waters. There are approximately one million of these systems in Ohio. These systems can offer a reliable method for treating wastewater, however; it is estimated that 25-50 percent of a county's HSDSs could be malfunctioning or failing (NEFCO, 1997c, p.4). Malfunctions or failure of these

Figure 5
Sewered Areas and Central Water Facilities
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.

Source Material: ODNR, Division of Real Estate and Land Management; Stark County Metropolitan Sewer District Water System, 1998; NEFCO, 1994; USGS.

systems can be caused by poor operation and maintenance and inadequate design or construction, which can lead to a clogged leach field, overloading of the system hydraulically or organically, short circuiting in the septic tank, aerobic system, and/or leach field. All of these problems can result in insufficient treatment of wastewater or effluent. Problems also occur from installation of the systems in highly vulnerable ground water areas, e.g., thin soils over fractured or solutioned bedrock or very sandy soils with shallow water tables (ODNR and Ohio EPA, 1993, pp. 54-55). When these systems are operating improperly they can contribute nutrients, pathogens, heavy metals, and other pollutants to the watershed (Conservation Foundation, 1987, p. 106). Untreated sewage released from many failing on-site HSDSs goes unreported. There are an estimated 8,850 on-lot systems in the Summit County portion of the watershed alone (Summit County Health Department, Pers. Com., August, 1998). On-lot HSDSs were identified as a major source of impairment to Nimisila Creek stream segments studied in Subwatershed 5 by the Ohio EPA (Appendix A).

Identification of critical areas where HSDSs are likely to fail is three-fold. First, the map of sewered areas, shown in Figure 5, shows the general area of the watershed which is unsewered and can be a potential source of NPS pollution from HSDSs. Also, subwatersheds 2 and 3 contain the most significant concentrations of residences served with HSDSs (NEFCO, 1996, p. 79). Second, residential areas over twenty years old are more likely to contain malfunctioning or failing HSDSs since the average life expectancy of a properly functioning HSDS is about twenty years.

The third element, for the identification of critical areas where HSDSs are likely to fail relates to soil types. The soils in the immediate area and adjacent to the Portage Lakes, subwatershed 3, offer extremely high porosity and permeability (NEFCO, 1996, p. 77). These soils may not do an adequate job of treatment before the wastewater reaches the limiting layer. Poorly drained soils should also be taken into consideration when identifying critical areas for HSDS failure. Such soils can be easily overloaded and will have difficulty treating all the wastewater from a household. Both quickly and slowly permeable soil types increase the probability for HSDS failure, and could contribute higher levels of nutrients and bacteria to the surface and/or ground water.

There is a potential for the areas, which contain soils conducive for HSDS failure, to contaminate wells with disease causing organisms (see Pipeline, 1996, Vol. 7, No. 3). According to an article in a 1984 EPA Journal, “Sources of Ground Water Pollution,” by David Miller, septic disposal ranked the highest in total volume of wastewater disposal and is the most frequent source of ground water contamination.

Another major concern is the inflow of nutrients to the waterway. Algal growth in response to these nutrients can upset the treatment and disinfection processes (NEFCO, 1997d, p. 27).

The non-discharging (non-mechanical) semi-public sewage disposal systems, which are like HSDS, but serve operations such as convenience stores, gas stations and

offices, were identified in the watershed. Appendix B lists the operation and its address, licensee, license number, and receiving subwatershed. One hundred and fifty of these systems have been identified in the watershed. Subwatershed 3 contains the highest percentage of these systems with 53 percent, Subwatershed 2 contains approximately 31 percent, Subwatershed 4 contains roughly 8 percent, there are approximately 5 percent in Subwatershed 5, and Subwatershed 1 contains 0 percent. At least seven operations are listed as restaurants, which should be connected to a package plant or larger sewage treatment plant (NEFCO, 1997a, p. 49).

Abandoned Drinking Water Wells

ODNR and Ohio EPA (1993) states that, "Less well recognized sources of contamination such as poorly constructed and non-regulated water supply wells, and abandoned water supply wells provide a direct avenue for contaminants to enter the ground water system" (p. 27). The ground water system is hydrologically connected to the surface water of the watershed. Once it is contaminated, ground water can become a potential NPS pollution to surface water.

Areas of the watershed that depend on ground water were identified by looking at Figures 4 and 5. Figure 4 depicts different land uses taking place within the watershed. Figure 5 shows areas with central water facilities. Residential, rural, commercial and industrial areas, without central water facilities, rely ground water as the source of drinking water.

Wells that have not been sealed properly, or wells that have been sealed but were poorly constructed, can cause shallow ground water or surface water to migrate downward into the aquifer (Fetter, 1994, p. 534). Recognizing this, the Ohio Department of Natural Resources, (ODNR), Division of Water, Ground Water Resources Section, began requiring that accurate and prompt water well sealing reports were to be filed with its agency, but that just began at the beginning of this decade.

ODNR and Ohio EPA (1993) has stated that, "Abandonment problems also occur in areas where the natural water quality over time will diminish the performance of a well. Instead of cleaning an existing well to improve yield, homeowners will often have a new well drilled and will fail to properly seal the old wells" (p. 30).

Trucking Activity

Trucking companies are important factors in economic development and growth. However; the locations of trucking companies, which contain loading docks and terminal yards, and primary roads in the watershed can indicate areas for potential sources of NPS pollution. These areas encompass tracts of nearly impermeable areas. Surface water runoff can transport spilled chemical compounds from dock surfaces, terminal yards, and roads. If storm water catch basins, which have been designed to

retain pollutants, are not in place down gradient from these areas, this runoff can contaminate soils, ground water and/or streams. Severe water quality impacts could be expected if BMPs to avoid, contain and clean up spills are not implemented (NEFCO 1997a, p. 29).

As far as primary roads are concerned, state and interstate highways are often considered a more serious threat for NPS pollutants. This is because the Ohio Department of Transportation (ODOT) allows the transport of hazardous pollutants along these roads. (Refer to Figure 3 for the location of state and interstate highways in each subwatershed.)

Petroleum Production Activity

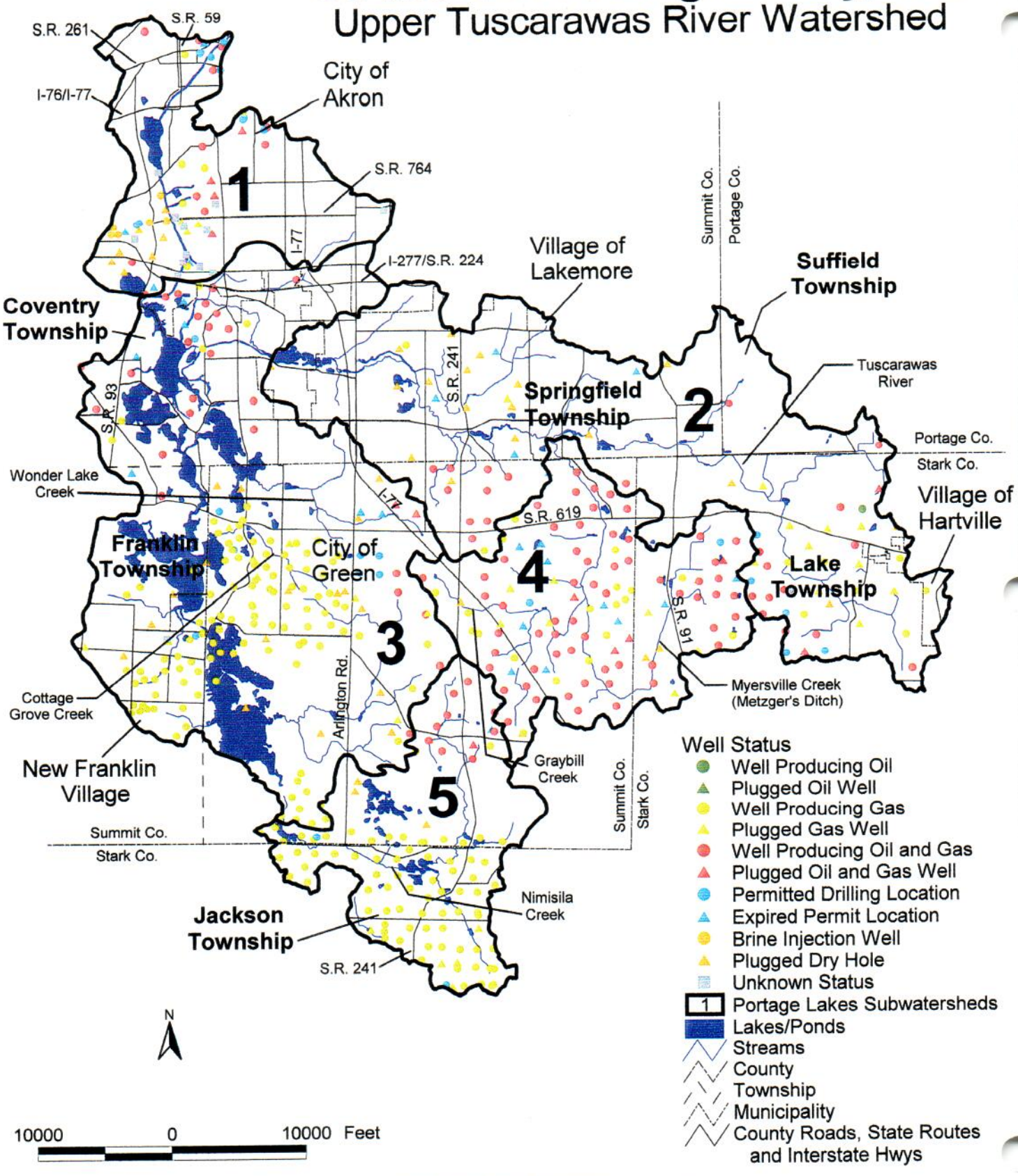
Figure 6 shows the distribution of all oil and gas drilling activity on record with Ohio Department of Natural Resources (ODNR), Division of Geological Survey, for the watershed. There are a total of 524 sites, which include: wells producing oil, plugged oil wells, wells producing gas, plugged gas wells, wells producing oil and gas, plugged oil and gas wells, potential drilling locations for oil and gas exploration, plugged dry holes, brine injection wells and unknown status. Potential drilling locations include areas which are currently permitted or have been permitted for drilling activity in the past. In most cases, expired permits become re-activated.

Table 8 breaks down how many sites are in each subwatershed:

Table 8
Oil and Gas Drilling Activity in the Upper Tuscarawas Watershed

Type of Well	Subwatershed				
	1	2	3	4	5
Oil Well	--	1	--	--	--
Plugged Oil Well	--	--	--	--	--
Gas Well	6	9	112	20	76
Plugged Gas Well	3	11	9	7	5
Oil and Gas Well	11	23	25	61	8
Plugged Oil and Gas Well	4	2	2	4	1
Permitted Location	10	5	8	2	2
Expired Permit Location	4	4	6	11	1
Plugged Dry Hole	7	18	17	5	4
Brine Injection Well	6	--	--	--	--
Unknown Status	12	1	1	--	--

Figure 6
Oil and Gas Drilling Activity, 1997
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Develoment Organization, 1998.
Source Material: Ohio Department of Natural Resources, Division of Geological Survey, 1997, and Division of Real Estate and Land Management; USGS.

Total	**63**	**74**	**180**	**110**	**97**

Every well drilled and shown on Figure 6 and listed in Table 8 is a potential source of NPS pollution. If wells are abandoned without proper plugging, pollutants from these sources could affect the watershed's ground water and surface water. For example, in Medina County, ODNR and Ohio EPA (1993) stated that, "Some wells have begun to spontaneously repressure, flowing oil and brine to the surface and into creeks" (p. 70). ODNR and Ohio EPA (1993) also stated that, "Ohio is the only oil and gas producing state that continues to allow use of prepared clay to seal surface casing and plug wells."

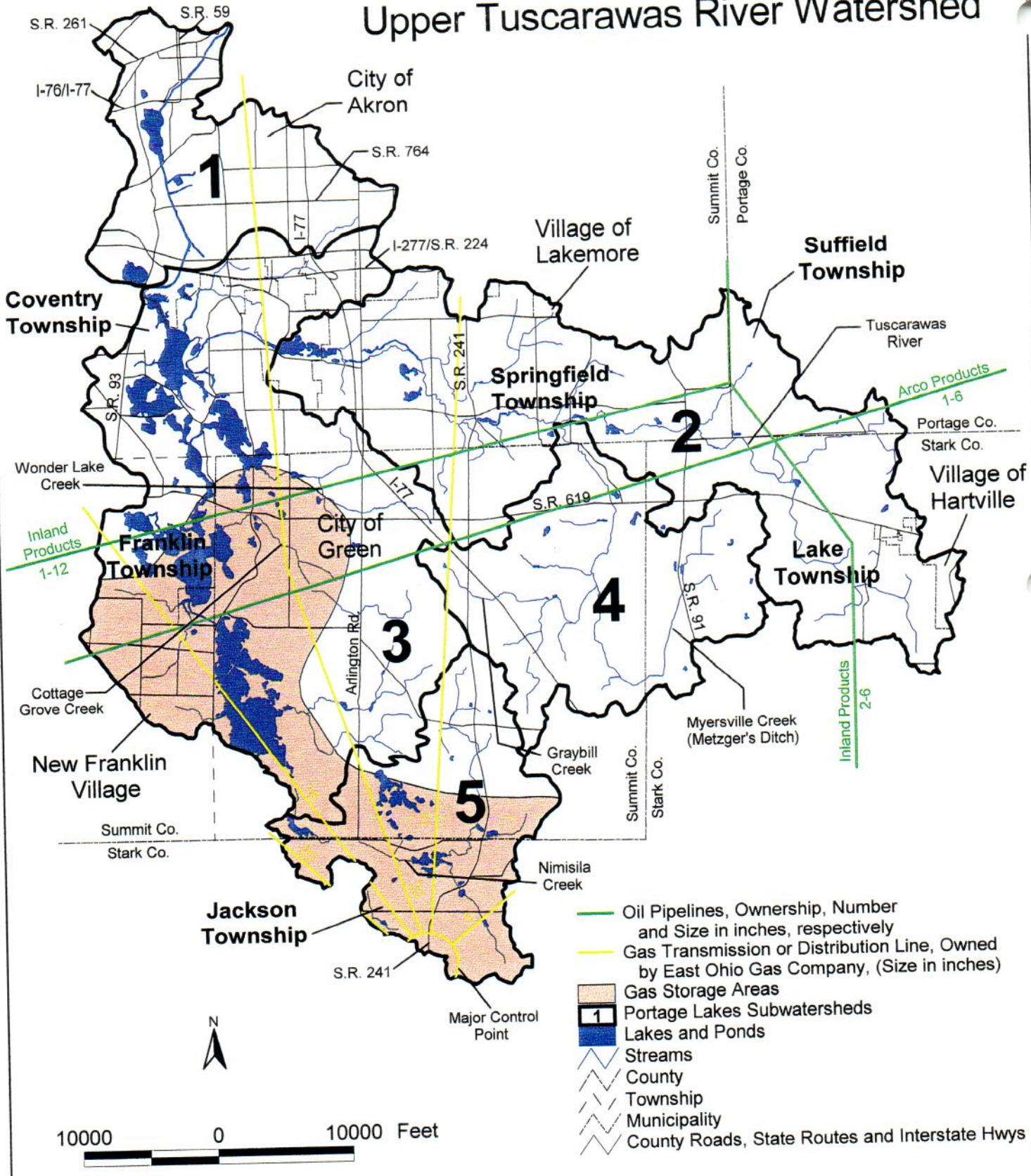
If BMPs to avoid, contain and/or mop up spills are not implemented, active oil and gas wells in the watershed can spill crude oil in unrecovered amounts on land and directly into the watershed's streams. Combined or alone, these unrecovered amounts of crude oil could have a negative impact on the watershed. Spilled crude oil can disrupt terrestrial and aquatic ecosystems, damage fish and waterfowl populations, and negatively affect recreation and economic development and growth (Miller, 1988, p.349). It can cause ground water, that is pumped for drinking water supplies, to have a foul taste and odor if a spill occurs near a ground water recharge zone.

In addition to oil and gas wells, oil and gas pipelines could have a negative impact on the watershed, if BMPs are not implemented to prevent rupturing these underground utilities. Four oil pipelines, five natural gas transmission lines, and a gas storage area were identified in the watershed. Figure 7 shows the approximate locations of these pipelines and storage areas, and their owners; it is for general reference only and should not be used to locate pipelines prior to digging or other construction activities. The pipelines were mapped by ODNR, Division of Geological Survey, over a large area using long, straight line segments. Consequently, the accuracy at the township level has been reduced.

However, the pipelines map is very useful at the watershed level. It conveys that there are four oil pipelines, a twelve-inch and three six-inch diameter lines. All four of these are present in Subwatershed 2. Subwatersheds 3 and 4 each contain segments of two of the six inch lines. Subwatersheds 1 and 5 do not contain any oil pipelines. There are two twenty inch, two eighteen inch, and one six inch gas transmission lines in the watershed. Subwatershed 1 contains a portion of one of the twenty inch lines, Subwatershed 2 contains a portion of one of the eighteen inch lines, Subwatershed 3 contains segments of both eighteen inch lines and one of the twenty inch lines, Subwatershed 4 has a small portion of an eighteen inch line, and Subwatershed 5, which is where a major control point is located, contains segments of all five gas transmission lines. Gas storage areas are present in subwatersheds 3 and 5.

Given the increasing amount of development activity in the watershed, all nine of these pipelines have the potential of being hit and damaged during excavations associated with such activity. If contingency plans are not implemented by decision makers and if BMPs are not implemented, by excavators, to avoid hitting and damaging one of these

Figure 7
Oil and Gas Pipelines
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: Ohio Department of Natural Resources, Division of Real Estate and Land Management; Division of Geological Survey; USGS.

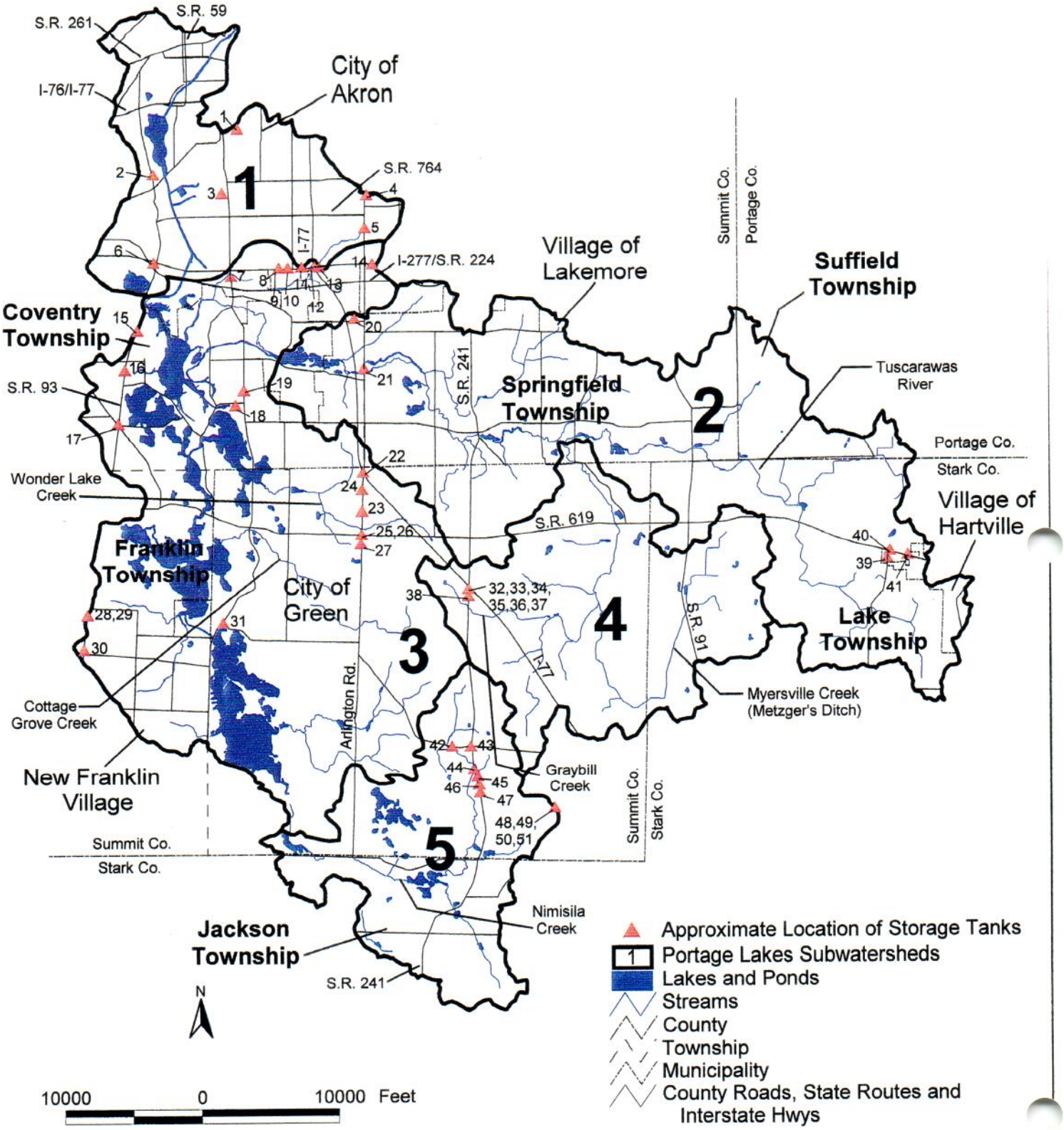
pipelines, the results could be catastrophic for the watershed and its occupants. Fires, explosions and engulfing smoke clouds, could be the worst-case scenario if a pipeline were to be hit and damaged by a spark-generating piece of excavating machinery. Afterward, the resulting loss of vegetation would exacerbate mass wasting in areas of the watershed with highly erodible soils and steep slopes. The increased sediment loading to the streams and burned or unburned hydrocarbons resulting from this chain of events, would greatly reduce the streams' assimilative capacity, which would likely impact water quality in the Tuscarawas River and Portage Lakes. Ohio's "call-before-you-dig" law helps reduce the potential of an underground utility being hit. Under this law, all excavators must call the Ohio Utilities Protection Service (O.U.P.S.), an answering service for utility locating companies, forty-eight hours before they dig or pay for all damages that result from hitting an underground utility. Natural gas transmission pipelines are given high priority by underground utility locators. These lines are marked (painted and flagged) with wider margins than smaller diameter lines. The owner of the transmission pipelines are informed of the date and location of the excavation so that they can oversee it when it takes place (NEFCO, 1997a, p. 29).

Underground Storage Tanks

Underground storage tanks (USTs) are used to store fluids for large industries, small businesses, farmers, and individual homeowners. Industries frequently store fuel, acids, metals, solvents, chemicals, and chemical wastes in USTs. Because such underground storage reduces worker exposure, plant clutter, and fire hazards, they are the most common form of storage for petroleum products at gas stations, plant sites, airports, and other areas where large volumes of fuel or other petroleum products are used. Many existing underground tanks are made of carbon steel and are not protected from corrosion. These steel tanks can range in size up to 10,000-gallon service station tanks and 50,000-gallon industrial tanks. The life expectancy of a steel underground storage tank is 15 to 20 years. Therefore, the rapid increase in the use of such tanks that began in the mid 1900s may be followed by an increasing problem of leaking tanks (Conservation Foundation, 1987, p. 131).

Regulations concerning USTs, which include reporting of leaking tanks, began in the late 1980s to protect human health and the environment. Fifty-one underground storage tanks were identified in the watershed from the Bureau of Underground Storage Tank Regulations' (BUSTRs) leaking underground storage tank (LUST) database files. Figure 8 shows their locations in the watershed. Almost half of these (45 percent) are located in Subwatershed 3. Subwatershed 5 contains almost 20 percent, and the remaining subwatersheds contain approximately 10 percent. Appendix C lists the facility name and address, facility identification number, priority, status of the USTs, (i.e., a confirmed release vs. a suspected release), class, last update, and eligibility of the incident for oversight and/or spending through the LUST Trust Fund (LTF) (see Appendix C for details).

Figure 8
Leaking Underground Storage Tanks
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: ODNR, Division of Real Estate and Land Management; Bureau of Underground Storage Tank Regulation, 1998; USGS.

In addition to LUST database files, BUSTR also has database files for regulated underground storage tanks (RUSTs). Often these regulated tanks have leak detectors or ground water monitoring wells, so as to lower the potential of a UST becoming a LUST, should a release of contaminants occur.

Note: BUSTR's rules were being revised at the time that this report was being written. They were expected to go through a formal review process starting September 1998. The final revised rules were not expected until about Spring 1999. Under the proposed rule changes, a site needing "no further action (NFA)" may have higher levels of contaminants present than the original rules allowed (BUSTR, Pers. Com, August 1998).

Gasoline Use, Storage and/or Transportation

As indicated earlier in this report, gasoline is often stored beneath the surface in underground storage tanks. Such tanks have a potential to corrode and leak their contents to surface and/or ground water.

Transportation of gasoline is also a potential NPS of pollution, due to leaks or spills, which can be transported to waterways through runoff events. The impact of gasoline transportation in the watershed can be assessed by looking at the location of roads, state routes, and interstate highways and their proximity to streams and lakes (Figure 3). Interstate 77 travels through all subwatersheds except 5. Interstate 277 travels through parts of Subwatersheds 1 and 2. Portions of State Routes 261, 59, and 764 are located in Subwatershed 1. State Route 224 travels north/south through Subwatersheds 1, 2, 3 and 5. State Route 241 also flows north/south and is located in portions of Subwatersheds 2, 4, and 5. State Route 619 travels east/west through Subwatersheds 2, 3, and 4. State Route 91 travels north/south through Subwatersheds 2 and 4.

Agricultural Areas

Runoff from agricultural areas in the watershed is a potential source of sediment, organic wastes, nutrients, pesticides, and herbicides. The tendency for agricultural pollutants to adversely affect water quality depends on soil properties, the pollutant characteristics, weather conditions, and farming practices.

Figure 4 illustrates that portions of Subwatersheds 2, 3, 4, and 5 contain agricultural land use areas. However, as the watershed continues to become more urbanized, agricultural areas are being converted to single family, recreational, commercial, or industrial use. This is gradually decreasing the impacts of agriculture on the watershed. Pollution associated with agriculture, such as sediment, is most likely being deposited in upstream lakes along the Tuscarawas River and tributaries to the Portage Lakes (NEFCO, 1996, p. 78).

Construction Sites

Construction sites are considered potential areas for NPS pollution because of sediment runoff into waterways. Excess sediment can cause volume loss in lakes and streams, increase the turbidity of the water, and smother fish spawning beds. Soil particles can also bind to other contaminants such as heavy metals and nutrients, thus transporting them into surface water. According to a Wisconsin Department of Natural Resources study, a stream's typical suspended sediment load is composed of sediments it receives from construction sites at the rate of about 4.4 tons/acre/year. Whereas, the next highest source of sediment--agricultural land in row crops without any BMPs that would ameliorate sediment yield--contributes about 1.7 tons/acre/year (ODNR and Ohio EPA, 1993, p.79). (Wisconsin and northeast Ohio have similar geomorphology).

Since the watershed is situated between the City of Akron and the City of Canton, there is a high potential for growth as urban sprawl continues. Subwatersheds 2,3,4, and 5 have experienced rapid rates of development during the past ten years. In fact, land development/suburbinization was listed as a source of impairment to studied stream areas along Metzger's Ditch in Subwatershed 4 (Appendix A). Present land use/land cover associated with agricultural, wooded/wetland, and open land/urban park (Figure 4) has the possibility for future development.

Active construction sites were identified through the Summit and Stark Soil and Water Conservation Districts (SWCDs). Portage County does not have any active construction sites in the watershed at this time. Table 9 lists the location, name of site, size, and start date on file for each subwatershed. All of these sites have Storm Water Pollution Prevention Plans (SWPPPs), in accordance with the requirements of the Clean Water Act. These plans utilize BMPs to ameliorate soil erosion, transport, and deposition. The SWCD SWPPPs' goal is to prevent as much sediment as possible from entering the watershed; however, there are limitations of the various BMPs utilized. For example, silt fences are designed to catch 75 percent of the sediment, whereas sediment basins can catch 90 percent. Proper installation and maintenance are also important to a particular BMP's success.(Summit SWCD, Pers. Com., January, 1999).

Table 9
Active Construction Sites in the Upper Tuscarawas River Watershed with Storm Water Pollution Prevention Plans (SWPPPs)

Subwatershed	Location	Name of Site	Size (Acres)	Start Date
2	City of Green	Camden Ridge	17.0	09/03/97
2	Springfield Twp.	Rolling Meadows Estates	53.0	05/30/97
2	Springfield Twp.	Terminal Warehouse Incorporated	16.0	05/14/98
2	Lake Twp.	Greentree Allotment	107.0	N/A
2	Lake Twp.	Glenwood Country Estates	10.0	N/A
2	Lake Twp.	Cricket Crossing	32.0	N/A
2	Lake Twp.	The Boroughs	43.3	N/A
3	City of Akron	Villages at Coventry	150.0	N/A
3	Coventry Twp.	Manchester Road Property	1.0	06/02/98
3	Coventry Twp.	Salt Wells	1.0	03/11/98
3	City of Green	Robins Trace	99.0	05/20/98
3	City of Green	The Estates at Meadow Wood	22.0	06/04/98
3	City of Green	Hyde Park Subdivision	102.0	10/15/94
3	City of Green	The Terraces on the Green	29.0	08/13/97
4	City of Green	Mystic Pointe	171.0	10/09/96
5	Jackson Twp.	Cedar Grove	13.0	N/A
5	Jackson Twp.	Portage Glen	24.2	N/A
5	Jackson Twp.	Marks Driving Range	14.0	N/A

Source: Summit Soil and Water Conservation District and Stark Soil and Water Conservation District, 1998

Table 10 lists the total acres currently under construction for each subwatershed with Storm Water Pollution Prevention Programs.

Table 10
Total Number of Acres Under Construction in the Upper Tuscarawas River Watershed with SWPPPs

Subwatershed	Total Acres Under Construction
1	0.0
2	278.3
3	301.0
4	171.0
5	51.2

Source: Summit Soil and Water Conservation District and Stark Soil and Water Conservation District, 1998

In addition to the active construction sites included above, a future area of development is planned for an area just east of Dollar Lake, in Coventry Township (Subwatershed 3). This 80 acre site is designed for condominiums, apartments and cluster housing. There are an additional 35 acres of wetlands, owned by the same entity, which are not planned for development. Due to the close proximity of this proposed development to Dollar Lake and Feeder Race, it is recommended that appropriate sediment control measures be implemented.

Subwatersheds 2 and 3 contain the most area under construction at this time. However; Subwatersheds 4 and 5 have areas desirable for future development; therefore are likely to have considerable construction sites in the future.

Impervious Areas

Impervious areas in the watershed are those areas where vegetation has been replaced by nearly impermeable surfaces, such as roads, sidewalks, parking lots, and roof tops. The conversion of open space to residential and commercial use has occurred in almost 60 percent of the acreage noted to have changed land use from 1979 to 1990 (NEFCO, 1996, p. 80). As these are converted, the level of impervious cover increases and prevents the infiltration of water into the soil. This can reduce ground water recharge, exacerbate runoff and stream bank erosion, and impact the natural aquatic community. Research indicates that stream degradation occurs at levels of imperviousness as low as 10 percent (Ohio EPA, 1997, p.27). The location of residential and other urbanized areas, as well as roads, in the watershed indicate where a high degree of impervious surfaces are found (Figure 4).

Impervious areas can also be the source of a magnitude of pollutants, since gasoline, oil, and chemical spills are likely to occur on impervious surfaces, such as: trucking

docks and yards, gasoline stations, and roads. The possibility of urban runoff/storm sewers to effect water quality has been documented in the Ohio EPA's 305b report (Appendix A). They were considered a primary or major source of impairment to monitored stream segments of the Tuscarawas River.

Golf Courses

A golf course can be a potential source of NPS pollution to surface and ground water if fertilizers, pesticides and herbicides, which keep the greens artificially green, are not applied in moderation and at appropriate times, hours before it rains. Seven golf courses were identified in the watershed. All of these are located in Summit County. Subwatershed 2 contains three golf courses: Firestone Raymond C., Chenoweth, and Firestone Country Club. One Firestone golf courses is located to the north, and the other to the south of the Firestone Reservoir. Turkeyfoot golf course is located in Subwatershed 3 directly north of Mud Lake. Subwatershed 4 contains three golf courses, which are all located in close proximity to streams: Mayfair, Ohio Prestwick, and Raintree. The close proximity to lakes and streams may raise the potential for these operations to be a source of NPS pollution to the watershed. Phone conversations with the majority of these golf courses indicate that most of the greens keepers were using some form of integrated pesticide management (Pers. Com., July 1998).

Nurseries/Greenhouses and Landscaping Operations

For the same reasons as stated above for golf courses, nurseries/greenhouses and landscaping operations can be potential sources of nutrients, pesticides and herbicides. Washing mobile spraying equipment can be an additional source of NPS pollution from the operations.

Twelve nurseries/green houses and/or landscaping operations were located in the watershed. Table 11 lists their name and address, and location by subwatershed.

Table 11 Nurseries/Green Houses and Landscaping Operations in the Upper Tuscarawas River Watershed	
Name and Address of Operation	**Location (Subwatershed)**
Mary's Garden Center 1008 Brown St. Akron, OH 44301	1
Cardinal Tie Inc. 190 W. Waterloo Rd. Akron, OH 44319	1
Arlington Greenhouse 2129 S. Arlington St. Akron, OH 44306	2
Waples 3235 Sherbrook Dr. Uniontown, OH 44685	2
Metker-Ech Inc. 1421 Edison St. NW Hartville, OH 44632	2
K & S Greenhouse 60 W. Turkeyfoot Lake Rd. Akron, OH 44306	3
Earth 'N Wood Landscaping Supply 1818 S. Arlington Rd. Akron, OH 44306	3
Donzell's Flower and Garden Center 937 E. Waterloo Rd. Akron, OH 44306	3
Hoffman's Garden Center 10211/2 E. Caston Rd. Uniontown, OH 44685	3
Delbert Smith Inc. 12777 Mogadore Ave. NW Uniontown, OH 44685	4
MD Bolin & Associates 153 Spruce Dr. North Canton, OH 44720	5
Earth 'N Wood Products 5335 Strausser St. NW North Canton, OH 44720	5
Source: Summit County Farm Bureau, 1998 and Ameritech Yellow Pages Website (http://yp.ameritech.net).	

In addition to the operations listed above, a sod farm was identified directly to the east of Myersville Creek and just south of State Route 619. It has been proven to be contributing pesticides to Myersville Creek (Ohio EPA, Pers. Com., August 1998).

If vegetated buffer strips are in place down gradient they can assimilate some of these pollutants, but ground water contamination is still at risk from pesticides and herbicides. Operations relatively close to lakes and streams may raise its potential to be a source of NPS pollution to the watershed.

Lawn and Garden/Household Maintenance

Homeowners, in the watershed, using pesticides, herbicides and fertilizers to keep their yards artificially green and bug-free, can have a negative impact on ground water and surface water quality--if these chemical compounds and nutrients are not used with care and moderation. Pesticides and herbicides can soak through the ground and contaminate ground water, which most of the watershed relies on for a drinking water source. They can also be transported by runoff to streams, especially when it rains shortly after they are applied, and biologically amplify in food chains. Also, some undesirable insects and plants may become immune to a manufacturer's recommended dosage of a pesticide or herbicide, causing larger and larger doses to be needed and subsequently added to the watershed.

Fertilizers, if used in excess near the proximity of surface water, can add unwanted nutrients to streams. Excess nutrients in water can cause algae blooms and, thereby, increase the biological oxygen demand (BOD) in a stream. This reduction in oxygen may cause fish kills and reduce a stream's ability to assimilate other pollutants (NEFCO, 1997a, p. 44).

Spills associated with pesticide and herbicide use could occur frequently in the watershed, but the size of the spills are not large enough to be reportable by law (Ohio EPA, 1996, p.27). Most of these small spills by homeowners, therefore, go undocumented.

Some of these spills are accidental, but others occur intentionally simply because the spilled material is classified as household hazardous waste, which cannot be picked up by sanitary waste haulers. In the past, it has been easier and less expensive for the homeowner to dispose of household hazardous waste, such as paints, solvents, used motor oil, tires and batteries, on his/her own property. These items were usually, but unlawfully, dumped or buried in the soils behind a garage or barn, or perhaps down a storm sewer (NEFCO, 1997a, p. 44). In Summit County most or all of these items can be recycled at the Solid Waste District's household hazardous waste center in Stow.

Fuel Oil Use

The transport of fuel oil and above-ground storage tanks, containing fuel oil used for heating homes, are also potential sources of NPS pollution in the watershed. Unless BMPs, to avoid, contain and mop up fuel oil spills, are implemented, fuel oil use can contribute, significantly, to the impact of NPS pollution in the watershed (NEFCO, 1997a, p. 39).

Areas in the watershed lacking natural gas service were identified by the Central Locating Service in Akron. This service locates utilities for the "call-before-you-dig" law. These areas would have a higher potential for fuel oil use. The only area identified was the southwest portion of Subwatershed 3, including Franklin Township and the western portion of the City of Green around Turkeyfoot Lake and Nimisila Reservoir.

Salt Storage and Seasonal Spreading of Salt

The heavy application of deicing salt, as well as improper storage, can contribute to surface and ground water contamination. The salts are washed off roads with snow melt and can flow into surface water or seep into ground water. Chloride levels of 1,000 to 25,000 mg/l have been documented in road runoff (Conservation Foundation, 1987, p. 162).

Five salt storage sites were identified in the watershed. All of these sites are located in a covered area, such as a shed, to protect it from the elements and to minimize runoff. Table 12 lists the subwatershed, community, and street address location for each identified site, in addition to the average amount stored per month.

Table 12
Salt Storage Sites within the Watershed

Subwatershed	Community	Street Address	Average Amount Stored/Month (Tons)
2	Lake Twp.	12360 Market St. Hartville	75
3	Summit Co.	1405 Boettler Rd. Uniontown	500
3	Portage Lakes State Park	5031 Manchester Rd. Akron	2
3	Coventry Twp.	65 Wymore Dr. Akron	100-150
5	Green City	5383 Massillon Rd	75

Source: NEFCO, 1987

Transportation areas, e.g., roads and parking lots, are locations where large applications of road salt occurs during the winter months. High traffic roads, such as state and interstate highways, are prime targets for deicing efforts.

The application of road deicing salts can increase the salinity (dissolved solids) of surface and ground waters. High levels of dissolved solids can affect the taste and sodium content of drinking water (NEFCO, 1997a, p. 56). And, Ohio EPA (1997) states that, "High concentrations of salts can inhibit aquatic plant growth and have an adverse

effect on aquatic life" (p. 33). This indicates that salt storage sites and transportation areas can be potential sources of NPS pollution to the watershed if BMPs are not implemented to minimize the release of its contents to the environment.

Polychlorinated Biphenyls (PCBs) Use

PCBs are mixtures of about 70 different, but closely related, chlorinated hydrocarbon compounds that are used/have been used in electrical transformers and capacitors. They enter the environment when transformers or capacitors leak, catch fire, or explode. Miller (1988) has stated that PCBs are insoluble in water, soluble in fats, and very resistant to biological and chemical degradation; thus they are biologically amplified in food chains. Even the healthiest of streams can have difficulty assimilating PCBs.

Hazardous levels of PCBs have resulted in fish consumption advisories by the Ohio Department of Health (ODH) for three areas of the watershed. High levels of PCBs were detected in fish tissue samples taken from the Ohio Canal, Lake Nesmith, and Summit Lake. A fish consumption warning, due to PCBs and Hexachloro-benzene, was also placed on a portion of the Tuscarawas River, just outside of the watershed, between Barberton and New Philadelphia. Refer to Appendix D for a listing of ODH Fish Consumption Advisories for the watershed.

While the exact location of PCBs sources have not been identified in the watershed, they are recognized as potential causes of nonpoint source pollution.

Mining Activity

Active mining in the watershed consists of sand and gravel open-pit operations. Aerial photos from 1995 and 1997, in addition to conversations with members of the local community, indicate that two such operations are present in the watershed. One operation is located at the northern tip of Subwatershed 4, on both sides of Myersville Creek, another is located in Subwatershed 5-southeast of Willowdale Lake on Nimisila Creek.

Active sand and gravel operations can be a source airborne sediments, and sediments transported by runoff, if BMPs to keep dust contained are not implemented.

The Ohio Department of Natural Resources, Division of Mines and Reclamation, topographic maps, and previous NEFCO reports (1985) identified several previous sand and gravel mining areas in Subwatersheds 2, 3, 4, and 5. Some abandoned pits could now be small ponds and lakes if they were abandoned when the water table was an impediment to the operation. These ponds and lakes would be hydrologically connected to ground water; they, or the abandoned equipment that they may contain, can be a source of NPS pollution, such as sediments and hydrocarbons, to ground water (NEFCO, 1997a, p. 54).

Clusters of abandoned coal mines were noted by NEFCO (1985) to the east of East Reservoir and Mud Lake. So far, drainage from these mines does not seem to be impacting water quality of inflowing streams (NEFCO, 1996, p. 76).

Industrial Land Use Areas

Active or abandoned industrial areas are considered potential areas for nonpoint source pollutants due to the use and disposal of a wide range of chemicals and other contaminants, which could impair surface or ground water quality.

Twenty-five active industrial operations were identified within the watershed boundary. Table 13 lists the name, address, and location by subwatershed for these operations.

Table 13 (cont.)
Active Industrial Operations in the Upper Tuscarawas River Watershed

Name and Address of Operation	City/Township	Location (Subwatershed)
Akron Polymer Lab 1080 S. Main St.	Akron	1
*Bridgestone/Firestone Inc. 1200 Firestone Pkwy.	Akron	1
*Goodrich B.F. (Chemical Division) 240 W. Emerling Ave.	Akron	1
*Hamlin Steel Products 2741 Wingate Ave.	Akron	1
Ohio Mechanical Handling Co. 1856 S. Main St.	Akron	1
*Hartville Ready Mix 1460 Edison St. NW	Hartville	2
Hinds Co. 2884 Killian Rd.	Springfield Township	2
Hinds Co. 2410 Massillon Rd.	Springfield Township	2
*Killian Latex 2064 Killian Rd.	Springfield Township	2
Modern Day Enterprises Inc. 708 Killian Rd.	Akron	2
NRM Extrusion 2542 S. Arlington Rd.	Akron	2
*Pressler Meats 2553 Pressler Rd.	Springfield Township	2
Pro-Fab Inc. 2570 Pressler	Springfield Township	2
Pioneer Plastics Corp. 3330 Massillon Rd.	Green	2

Table 13 (cont.) Active Industrial Operations in the Upper Tuscarawas River Watershed		
Universal Plastics 2587 S. Arlington Rd.	Akron	2
Akron Steel Fabricators Co. 3291 Manchester Rd.	Coventry Township	3
*BP Weaver Woodland Maywood & Kaylin Dr.	Franklin Township	3
Elastomer Enterprises/Empire Corp. 1946 Trapas Ave.	Akron	3
HM Design 3681 Manchester Rd.	Coventry Township	3
Industrial Rubber Machinery Inc. 503 Portage Lakes Dr.	Akron	3
Goodyear Industrial Products 3700 Massillon Rd.	Green	4
Machinery Exchange 3700 Massillon Rd.	Green	4
McAfee Tool & Die Inc. 1717 Boettler Rd.	Green	4
Goodyear Tire & Rubber Co. Airsprings Plant 2575 Greensburg Rd.	Green	5
Akron-Canton Regional Airport	North Canton	5
*Listed as an Industrial Direct Discharger (Process and Storm Water) with the Ohio EPA, August, 1998.		
Source: Ameritech Yellow Pages and Website (http://yp.ameritech.com) and Ohio EPA, 1998.		

The Ohio EPA Division of Emergency and Remedial Response (DERR) has developed a database, referred to as the Master Sites List (MSL), to list and track DERR sites since 1988 and to manage program resources. The list is comprised of sites in Ohio where there is evidence of, or it is suspected that waste management has resulted in the pollution of air, water or soil and there is a confirmed or substantial threat to human health or the environment. These sites include operating or abandoned industrial facilities, contaminated or potentially contaminated public water supplies with the source of pollution undiscovered, or other locations where the environmental media is contaminated through a variety of waste management activities. Contaminated sediments were considered a slight or minor source of impairment to assessed segments of the Tuscarawas River (Appendix A). This may be due, in part, to the three sites on the MSL in close proximity to the Tuscarawas River.

Table 14 lists sites on the MSL in the watershed as of 01/01/97.

Table 14
Areas in the Upper Tuscarawas River Watershed on the Master Sites List (MSL)

County	Sitename and Address	USEPA ID#	Ohio ID#	*Type	Subwatershed Location
Summit	Firestone Tire & Rubber Co. 1200 Firestone Pkwy. Akron, OH 44317	OHD001288109	277-0302		1
Summit	Lockhart HB Const. Co. 800 W. Waterloo Rd. Akron, OH 44314	ODH002948347	277-0470		1
Summit	Barberton Aluminum & Metal Co. (SIA) 753 W. Waterloo Rd. Barberton, OH 44203	OHD980421572	277-0081		1
Summit	Summit Equipment and Supply Inc. 875 Ivor Ave. Akron, OH	OHD055523401	277-0778	A	1
Summit	Gastown Unit #3692/ Unknown Source 3540 S. Arlington Rd. Akron, OH 44312	Not Assigned	277-1311	W	2
Summit	Tru-Cast Products 2128 Killian Rd. Springfield Twp. 44312	OHD003452992	277-0826		2
Summit	Archmere Dr. a.k.a Rubber City S&G Archmere Dr. Akron, OH 44319	OHD980611883	277-0050	A	2
Summit	Kim Tam S.R. 91 Uniontown, OH 44685	Not Assigned	277-1119		2
Summit	Weaver Woodlands/ Franklin Twp. Maywood & Kaylin Dr. Franklin Twp. 43216	Not Assigned	277-1207	A	3
Stark	Industrial Excess Landfill (IEL) 1 mi. South of S.R. 619 & Cleveland Ave.	OHD000377911	276-0416	AN	4

*Type - Indicates if a site is Active ("A"), a Contaminated Public Water Supply ("W") and/or a site on the federal National Priorities List ("N"). A site can be more than one type or none (indicated by a blank field).
Source: Ohio EPA website (http:www.epa.ohio.gov/derr/cres/msl.html).

A total of ten sites were located within the watershed. Subwatershed 1 contains four sites and Subwatershed 2 contains four sites. Subwatersheds 3 and 4 each contain one site on the MSL. Appendix E contains a brief description of the MSL.

The U.S. EPA has proposed a cleanup plan for the Summit Equipment and Supply site in subwatershed 1. This site was once a former scrap and salvage yard and is located west of Nesmith Lake. The proposed plan calls for: soil excavation, removal, and

disposal of contaminated soils with high levels of PCBs, mercury, and copper; long-term monitoring of the site for toxic volatile organic compounds and heavy metals; ensuring that no wells are drilled on the site or nearby due to aquifer contamination; and allowing chromium on the property to degrade naturally to a less toxic and mobile form. The site is being managed by the Department of Defense because it was the source of 80 percent of the transformers that caused the PCB contamination. Nine other polluters are also being held liable for the cleanup.

Landfills and Dumps

Older sanitary landfill sites and open dumps were often unlined and uncovered and probably located without consideration to the potential water quality problems they could create. Percolation of leachate from landfills is inevitable unless the site is completely sealed so that no moisture enters. Heavy metals, pathogens, and other hazardous constituents can be included in the leachate.

Illegal disposal of unconfined quantities of hazardous or nonhazardous wastes ("midnight dumping") can also pose a continuous and uncontrolled threat to surface and/or groundwater (Conservation Foundation, 1987, p. 118).

Active or inactive landfills and dumps identified within the watershed include: solid waste and construction and demolition debris (C&D) landfills, in addition to industrial and scrap tire dumps. Table 15 lists the address, Political Subdivision (PSD), type of facility and waste, location by subwatershed, along with facility name, owner of record, size, and dates of operation, if available.

Adding to the operations identified in Table 15, a fly ash and tire debris dump is reported for a section of the Ohio Canal near Waterloo road (Akron City Health Department, Pers. Com., August, 1998). A septage land application site is also located on a farm at the end of Aqua Dale Drive in Green, in Subwatershed 3.

An initial clean-up, through the Coventry Township Solid Waste Management Authority Office, is proposed to take place in the next one to two years for the scrap tire dump on Manchester Road. If tire dumps catch fire they can produce pyrolytic oil runoff and pollute the environment (Summit County Health Department, Pers. Com., August, 1998).

Table 15
Active/Inactive Landfills and Dumps in the Upper Tuscarawas River Watershed

Facility Name and Address	PSD	Owner/ Operator of Record	Type of Facility	*Waste Types	Size (in Acres)	Subwatershed Location	Dates of Operation/ Status
Archmere Dr. Dump 2441 Mallard Rd.	Springfield Twp.	Summit County	Solid Waste	C&D, M, H	N/A	2	? - 1965/Inactive
1940 Tisdale Dr.	Green	N/A	C&D	C&D	N/A	2	?/Inactive
Coventry Twp. Dump N. Turkeyfoot Rd., NE of Vaughn Rd.	Coventry Twp.	Coventry Twp.	Solid Waste	M	N/A	3	?-1963-?/Inactive
245 Portage Lakes Dr.	Coventry Twp.	N/A	Solid Waste	M	N/A	3	N/A
1130 Kingston Rd.	Green	Ron Hoover	C&D	C&D	<2.0	3	?/Inactive
2368 S. Main St.	Coventry Twp.	Norton Salt	C&D	C&D	<1.0	3	?/Inactive
2977 Manchester Rd.	Coventry Twp.	Buckley Auto Wrecking	Scrap Tire	Tires (30 - 50K)	N/A	3	?/Inactive
780 E. Waterloo Rd.	Coventry Twp.	Lightener Tire	Scrap Tire	Tires (4 - 6K)	N/A	3	?/Active
Industrial Excess Landfill NE corner of Cleveland Ave and south of S.R. 619	Lake Twp.	N/A	Solid Waste, Industrial Waste	M, H,	~35.0	4	1962-1980/ Inactive
3046 Myersville Rd.	Green	Rubber City Sand & Gravel	C&D	C&D	2.0	4	?/Inactive
2632 E. Turkeyfoot Lake Rd.	Green	Paul Bailey	C&D	C&D	2.0-3.0	4	?/Inactive

Source: Summit County Health Department, Environmental Health Division, 1998 and Ohio EPA, Pers. Com., August, 1998

As far as landfills and dumps are concerned, it is suspected that the Industrial Excess Landfill (IEL) poses the greatest threat to water quality in the watershed. It was designated a federal Superfund site in 1984. The knowledge of explosive methane gas and groundwater contamination just west of the site contributed to a high hazardous ranking score and the placement of the IEL onto this priority list. Following this action, the government purchased thirteen homes, which were considered impacted by the IEL. Current ground water conditions do not demonstrate the presence of organic contamination off-site. Recent ground water sampling has been performed to determine whether previously detected inorganics are artifacts of sampling methodologies, or represent a portion of the actual contaminant load at the site.

The roughly 35 acre area was once a sand and gravel pit before it became a landfill in 1962. The landfill was originally used to dispose of fly ash, which is known to be high in trace metals. It has been reported that solid waste was also disposed of at the IEL. Liquid and drummed waste from industrial operations were discarded during the final years of the landfill's operation, until it closed in 1980.

It hasn't been demonstrated, but it is suspected that the landfill has a potential to impact surface water. The Ohio EPA 305b report (Appendix A) indicated that landfills were identified as both a major and threatening source of impairment to studied segments of Metzger's Ditch. The IEL is located just west of this stream and is the only landfill identified which is in close proximity to this stream. Larry Antonelli, with Ohio EPA's Division of Emergency and Remedial Response, does not believe that contaminates would be concentrated enough to affect the health of the Tuscarawas River. He does believe there is the possibility of ground water discharge to surface water at locations along Metzger's Ditch (Myersville Creek). The landfill sits roughly four feet above the water table in some areas.

A waterline was completed in 1991 to serve over one hundred households west of the dump after low-level contamination was found in some wells. The system was later expanded by Stark County, although only 60 percent of the households have tied into the alternate water supply. Ground water sampling over a year ago by the EPA revealed aluminum, iron, manganese, and thallium in monitoring wells off the site. These metals were found in levels that exceed federal health advisory standards. However, these metal species have secondary maximum contaminants levels (SMCLs) which are non-enforceable and correspond to aesthetic ground water quality. A new round of water testing will be performed by the companies being held liable for the clean-up. An estimated 55 locations will be sampled from ground water monitoring wells on and near the IEL. In addition, the U.S. EPA may test a few residential wells west of the dump. The testing will concentrate on the detection of metals and organic contaminants.

Regional ground water flow is from east to west. Ground water mounds have been identified to the north and southeast of the IEL. These mounds exhibit radial flow

conditions; however, USGS has confirmed these local flow conditions are quickly overtaken by the kinetics of the east to west regional flow.

The Concerned Citizens of Lake Township (CCLT) is a grassroots group, which was organized in response to concerns from local residents regarding the risks associated with the assistance and clean-up of the IEL. Chris Borello, the president of CCLT, has been closely involved with IEL-related issues for fifteen years. It is her belief that radiation is present at the landfill, however; the Ohio EPA, USEPA, ATSDR, and the ODH disagree. The Ohio EPA believes that the most threatening contaminants to the water quality near the IEL include benzene, which was detected on-site at levels above the maximum contaminant level as mandated by the Federal Safe Drinking Water Act. Thallium, aluminum, and cadmium are also considered contaminants of concern by the EPA and have been detected in off and on-site groundwater samples. So far, no comprehensive study has been conducted to determine whether exposure to the landfill has caused health problems to the roughly 27,000 people who live within three miles of the IEL.

If the 1989 Record of Decision (ROD) by the USEPA is implemented without changes, millions of gallons of water will be pumped from beneath the IEL site and discharged into Metzger's Ditch (Myersville Creek) after treatment. The ROD requires the responsible companies to pump the contaminated water to the surface, where contaminants would be removed and the treated water would then be discharged into surface water.

The agencies are looking into ways to prevent further contamination of ground water by deterring rainwater from filtering into the buried waste and migrating to the water table. The construction of a clay cap and geosynthetic combination over the site has been proposed. An active methane gas venting system is in effect and expansion of this system is also up for discussion (Ohio EPA, Pers. Com., August, 1998).

Boating Activities

If motorized watercraft are not properly maintained, fuel leaks can discharge pollution directly into lakes and ponds. Heavy boating activity on lakes can also contribute to pollution by eroding unprotected shorelines. Plant biomass may be impaired through direct cutting and uprooting by scouring the sediment surface (Asplund, T.A. and C.M. Cook, 1997). Boating activity can also resuspend lake sediments, which decreases water clarity and, under specific conditions, releases pollutants originally bound to soil particles (Hansen, P.S. et. al., 1997).

A survey of the Portage Lakes revealed that heavy boating-use lakes did show some severe erosion on exposed shores. However, shoreline erosion was minimal for most parts of the lakes, with the majority of the lakes having some sort of protection along at least part of its shores. Types of protection identified included rip rap, retaining walls, and natural emergent vegetation (NEFCO, 1996 p. 55-63).

Nutrients from Natural Sources

Domestic animal and waterfowl feces can contribute to nutrient enrichment of lakes and streams. This can lead to excessive algal blooms resulting in oxygen depletion and fish kills.

The largest likely contributors to this problem are Giant Canada Geese, which have become the number one source of animal complaints in the Northeastern United States. The nuisance goose problem is caused, in part, by the expansion of favorable habitat--suburbia. The abundance of short, tender grass for grazing and habitats free of predators has allowed geese populations to rise. Lawns abutting a body of water are especially attractive to geese. Problems can be alleviated by planting tall trees, hedges, or tall grasses around the body of water (Moore, M. V., et al., 1998).

Conclusion

There are a wide variety of potential pollution sources in the watershed. Seventy-nine wastewater treatment plants and package plants are the primary point sources. The greatest combined flow of discharged wastewater from these plants occurs in Subwatershed 2. There are an estimated 4,900 off-site home sewage disposal systems (HSDSs) in the Summit County portion of the watershed. These can also be considered point sources, but their locations are very difficult to pinpoint. This makes determining their water quality impacts difficult.

The total pollutant loads contributed by the package plants in the watershed cannot be tabulated because adequate flow measurements are not available, and the majority of the plants have design flows less than 250,000 gallons per day (gpd). Only package plants with design flows above 250,000 gpd are monitored comprehensively. One way to get an accurate count of the pollutant loads is to require that all package plants in the watershed be monitored to the same degree that plants with design flows greater than 250,000 gpd are monitored.

Major sources of potential nonpoint source (NPS) pollution in the watershed are directly related to land use (human activity). Unsewered areas; abandoned drinking water wells; trucking activity; petroleum production activity; underground storage tanks (USTs); gasoline use, storage and/or transportation; agricultural areas; construction sites; impervious areas; nurseries/greenhouses and landscaping operations; lawn and garden/household maintenance; golf courses; fuel oil use; salt storage and seasonal spreading of salt; polychlorinated biphenyls (PCBs) use in electrical transformers; mining activity (past and present); industrial land use areas; boating activities; landfills and dumps; and nutrients from natural sources are all potential sources of NPS pollution in the Upper Tuscarawas River Watershed.

The majority of the watershed is unsewered. There is a very high potential for unsewered areas to be a source of untreated/poorly treated sewage, which contain nutrients and disease-causing organisms, when home sewage disposal systems fail.

NPS pollution from producing and plugged oil and gas wells can have a negative impact on the entire watershed. Additionally, trucking activity, fuel oil use, gasoline use, and underground storage tanks can contaminate the soils, surface water and ground water. Lawn and garden/household maintenance, though poorly documented, can be a source of nitrogen-phosphorus-potassium (N-P-K), pesticides, herbicides and household hazardous waste throughout the watershed.

Agricultural areas in the watershed can also be potential sources of N-P-K, pesticides, herbicides, organic wastes and associated disease-causing organisms. However, the impact of agricultural areas is gradually decreasing as agricultural areas are converted to single family, commercial, or industrial areas.

Construction sites can contribute sediment loadings to nearby lakes and streams through runoff events, and degrade water quality in streams or lakes. Heavy metals and nutrients can bind to soil particles and travel to the waterway along with sediment. Subwatersheds 2, 3, 4 and 5 are experiencing rapid rates of development as urban sprawl continues.

Impervious areas can facilitate the transportation of spilled pollutants and exacerbate runoff problems. All of the parking lots, roads, highways and state/interstate highways in the watershed are impervious areas. Subwatershed 1 contains the highest percentage of impervious area.

Other lesser known potential sources of NPS pollution in the watershed include abandoned and active sand and gravel mining operations, which can be a source of sediments and other pollutants; salt storage sheds, which can be a source of sodium (dissolved solids); and golf courses and nurseries, which can all be sources of N-P-K, pesticides and herbicides. Also, abandoned water wells, which can be a source of any pollutant that migrates down the annular space between the borehole and the casing and/or falls directly down the well, can be potential sources of NPS pollution (NEFCO, 1997a, p. 58).

Industrial land use areas, landfills and dumps can contribute a variety of chemical wastes to the watershed. These substances pose serious threats to water quality if they are not handled or disposed of properly. Subwatershed 4 contains the Industrial Excess Landfill (IEL), which has polluted groundwater and poses threats to surface water.

Upstream impoundments, channelization and unknown sources have been identified as sources responsible for use impaiment in monitored stream segments by the Ohio EPA. Flow and habitat alterations, metals, toxicity, nutrients, and organic enrichment are

some of the identified causes for impairment of selected stream areas by the Ohio EPA (Appendix A). Considering all of these dispersed sources and causes of potential pollution, it has become apparent that the entire watershed has a high potential to be affected by pollution. However, Subwatershed 3 seems to be the most threatened from a variety of point and nonpoint source pollutants, although each subwatershed has one or more specific sources of pollution with a higher potential to impair surface and/or ground water quality than the other subwatersheds. Targeting efforts to maintain a riparian corridor and slow runoff in high risk areas may be an effective way to control some of the NPS pollution.

Future actions could include testing for the presence of contaminants downstream from nearby pollution sites. If a site is causing an impact on the watershed, targeting efforts to contain and clean up that site may also be an effective plan.

Pollution Potential Ratings

Table 16 summarizes the above mentioned identified point and potential nonpoint pollution sources and shows the Pollution Potential Ratings that were assigned to each subwatershed, for each of these sources. The Ratings were assigned using criteria mentioned throughout this report, in addition to ratings from meeting participants. Some of the criteria are summarized in Appendix F. Other criteria came in the form of expert opinions, which were gathered during a similar NEFCO study focusing on the Yellow Creek Watershed (NEFCO, 1997a). These expert opinions came from such agencies and organizations as the Medina and Summit County Health Departments, the Ohio EPA and DNR, the Medina and Summit Soil and Water Conservation Districts, the Cuyahoga River Remedial Action Plan (RAP) and the Cuyahoga River Community Planning Organization (CRCPO).

Each Rating is a whole number value ranging from 1 (virtually no potential) to 5 (very high potential to impair surface and/or ground water). As seen in Table 16, trucking activity and related maintenance, leaking underground storage tanks (LUSTs), gasoline use, impervious areas, and industrial land use areas have a high potential to impair the surface and/or ground water quality of Subwatershed 1. Whereas, it is off-lot and on-lot home/semi-public sewage disposal systems (HSDSs) and (SPSDSs), in addition to wastewater treatment plants (WWTPs), that have the highest potential to impair the waters of Subwatershed 2. By summing the ratings for each subwatershed, it can be seen that the greatest potential for identified pollution sources to have a negative impact on water quality and biological communities is located in Subwatershed 3, which is where the Portage Lakes are located. Both off-lot and on-lot HSDSs and SPSDSs have a very high potential to effect water quality in the Portage Lakes area. Subwatershed 4 is mainly threatened by impacts from landfills and dumps. Oil and gas pipelines and construction sites have a high potential to affect the water quality of Subwatershed 5.

Table 16
Pollution Potential Ratings* for each Subwatershed of the Upper Tuscarawas Watershed

Identified Potential Pollution Source	Subwatershed				
	1	2	3	4	5
a. Off-Lot (Discharging) Home/Semi-Public Sewage Disposal Systems (Septic Tanks)	1	4	5	3	3
b. Failing On-Lot Home/Semi-Public Sewage Disposal Systems (Septic Tanks)	1	4	5	3	2
c. Wastewater Treatment Plants (WWTPs)	1	4	4	3	3
d. Trucking Activity and Related Maintenance (Including Diesel Fuel Use)	4	3	3	3	2
e. Oil and Gas Wells (i.e., Oil and Gas Production and Exploration/Drilling Activity)	2	2	4	3	3
f. Oil and Gas Pipelines (i.e., Oil and Gas Transportation)	2	3	4	3	4
g. Leaking Underground Storage Tanks	4	2	4	3	3
h. Registered Underground Storage Tanks (Insufficient information to evaluate this category)					
i. Gasoline Use (Including Storage and Transportation of Gasoline)	4	3	4	3	3
j. Impervious Areas (e.g., Rooftops, Roads, Parking Lots, etc.)	4	3	4	3	3
k. Agricultural Areas	1	3	2	3	3
l. Construction Sites	1	3	4	4	4
m. Nurseries/Greenhouses and Landscaping Operations	2	2	2	2	2
n. Lawn and Garden/Household Maintenance Activity	3	3	4	3	3
o. Golf Courses	1	3	3	4	1
p. Fuel Oil Use (Including Storage and Transportation of Fuel Oil)	2	2	3	2	2
q. Salt Storage and Seasonal Spreading of Salt	3	3	3	2	3
r. Polychlorinated Biphenyls (PCBs) Use (Used in Some Electrical Transformers)	3	2	2	2	2
s. Abandoned Drinking Water Wells	1	2	2	2	2
t. Mining Activity	1	2	3	3	3
u. Industrial Land Use Areas	4	3	2	2	2
v. Boating Activities	1	1	2	1	1
w. Landfills and dumps	2	3	3	5	2
x. Excess Nutrients From Natural Sources (e.g., Geese)	1	2	3	1	2

*Key to Pollution Potential Ratings:
1 = Virtually no potential to impair surface water and/or ground water quality.
2 = Low potential to impair surface water and/or ground water quality.
3 = Moderate potential to impair surface water and/or ground water quality.
4 = High potential to impair surface water and/or ground water quality.
5 = Very high potential to impair surface water and/or ground water quality.

Ranking of 24 Potential Pollution Sources

The previous discussion on Pollution Potential Ratings evaluated the potential for each pollution source to impair water quality on a subwatershed-by-subwatershed basis. This analysis continued with a ranking of the 24 identified potential pollution sources to the watershed, as a whole. To accomplish this, NEFCO decided that it would be appropriate to employ the existing rankings that were developed under the Ohio Comparative Risk Project (OCRP). The background of the OCRP and its "ranking of 45 potential threats to human health, ecosystems, and quality of life in Ohio" (Ohio EPA, July 1997, p. 1) can be found in Appendix H.

Each of the 24 identified potential pollution sources in the watershed was correlated to one of the 7 OCRP-ranked groups of the 45 threats. Some did not correlate directly, but they did correlate indirectly (Table 17). In instances where a potential pollution source correlated to more than one OCRP-ranked group, the group with the highest rank was chosen--since the higher ranked groups represent greater risks. For example, although there is construction and demolition debris (OCRP Group 6) from construction sites, uncontrolled development (OCRP Group 2) can also be correlated to construction sites and poses a greater threat. Consequently, this potential pollution source was correlated to OCRP Group 2.

The OCRP group number (1-7) was reassigned in reverse order to match the ordering scheme for the Pollution Potential Ratings that NEFCO developed (higher numbers in the Ratings indicate a greater potential to impair water quality; therefore, it was necessary for the OCRP ranked group numbers to reflect this). The reassigned OCRP group number was used as a weighting factor (Table 18). It was multiplied by the sum of all five Ratings that were developed for a given identified potential pollution source. The product of this multiplication is the ranking score (Table 18). Since the OCRP was used to help achieve these results, higher ranking scores indicate the potential pollution source with a greater threat to ecosystems, human health and the general quality of life in the watershed. The final ranked list of the 24 identified potential pollution sources to the watershed is shown in Table 19 along with the Pollution Potential Ratings.

Since off-lot (discharging) home/semi-public sewage disposal systems ranked the highest, they are deemed to present the greatest overall risk to the watershed. Future actions could include better management of these systems, especially in the subwatersheds with a high Pollution Potential Rating for these sources. Failing on-lot systems and landfills and dumps ranked the next highest, i.e., they each received the same ranking score. The Ratings on Table 19 indicate that off-lot and failing on-lot systems have a high to very high potential to impair the waters of Subwatershed 3. However, although this may be true, it should be recognized that Subwatershed 3 is the receiving watershed of Subwatersheds 2, 4, and 5. Since the Ratings in Table 19 indicate that off-lot and/or failing on-lot systems also have a high potential to impair the waters of Subwatershed 2, and a moderate potential to impair Subwatersheds 4 and 5; it is those subwatersheds that could be targeted, first, for better home sewage disposal

Table 17
Correlation of Upper Tuscarawas River Watershed Potential Pollution Sources to the Ohio Comparative Risk Project's (OCRP's) Ranked Threats

Identified Potential Pollution Source	OCRP Ranked Threat	OCRP Ranked Group No.	Weighting Factor
a. Off-Lot (Discharging) Home/Semi-Public Sewage Disposal Systems	Inadequate Infrastructure	1	7
b. Failing On-Lot Home/Semi-Public Sewage Disposal Systems	Inadequate Infrastructure	1	7
c. Wastewater Treatment Plants (WWTPs)	Municipal Wastewater Discharges	5	3
d. Trucking Activity and Related Maintenance (Including Diesel Fuel Use)	Nonpoint Source	3	5
e. Oil and Gas Wells (i.e., Oil and Gas Production and Exploration/Drilling Activity)	Oil and Gas Exploration	4	4
f. Oil and Gas Pipelines (i.e., Oil and Gas Transportation)	Oil and Gas Exploration	4	4
g. Leaking Underground Storage Tanks	Underground Storage Tanks	4	4
h. Registered Underground Storage Tanks	Underground Storage Tanks	4	4
i. Gasoline Use (Including Storage and Transportation of Gasoline)	Underground Storage Tanks	4	4
j. Impervious Areas (e.g., Rooftops, Roads, Parking Lots, etc.)	Storm Water Runoff from Non-Agricultural Areas	5	3
k. Agricultural Areas	Nonpoint Source/Agricultural Runoff	3	5
l. Construction Sites	Uncontrolled Development	2	6
m. Nurseries/Greenhouses and Landscaping Operations	Pesticide Spraying	3	5
n. Lawn and Garden/Household Maintenance Activity	Storm Water Runoff from Non-Agricultural Areas	5	3
o. Golf Courses	Pesticides Spraying	3	5
p. Fuel Oil Use (Including Storage and Transportation of Fuel Oil)	Spill and Accidental Releases	6	2
q. Salt Storage and Seasonal Spreading of Salt	Storm Water Runoff from Non-Agricultural Areas	5	3
r. Polychlorinated Biphenyls (PCBs) Use (Used in Some Electrical Transformers)	Spill and Accidental Releases	6	2
s. Abandoned Drinking Water Wells	Abandoned Water Wells	4	4
t. Mining Activity	Mining Activities	3	5
u. Industrial Land Use Areas	Industrial/Commercial Wastewater Dischargers	1	7
v. Boating Activities	Recreation	6	2
w. Landfills and Dumps	Unregulated/Abandoned Hazardous Waste Facilities	1	7
x. Excess Nutrients from Natural Sources (e.g., Geese)	Nonpoint Source/ Agricultural Runoff	3	5

Table 18
Weighting Factors and Ranking Scores for Each Identified Potential Pollution Source in the Upper Tuscarawas River Watershed

Weighting Factor	Identified Potential Pollution Source	Subwatershed					Ranking Score
		1	2	3	4	5	
7	a. Off-Lot (Discharging) Home/Semi-Public Sewage Disposal Systems	1	4	5	3	3	112
7	b. Failing On-Lot Home/Semi-Public Sewage Disposal Systems	1	4	5	3	2	105
3	c. Wastewater Treatment Plants (WWTPs)	1	4	4	3	3	45
5	d. Trucking Activity and Related Maintenance (Including Diesel Fuel Use)	4	3	3	3	2	75
4	e. Oil and Gas Wells (i.e., Oil and Gas Production and Exploration/Drilling Activity)	2	2	4	3	3	56
4	f. Oil and Gas Pipelines (i.e., Oil and Gas Transportation)	2	3	4	3	4	64
4	g. Leaking Underground Storage Tanks	4	2	4	3	3	64
4	h. Registered Underground Storage Tanks (Insufficient information to evaluate this category)						
4	i. Gasoline Use (Including Storage and Transportation of Gasoline)	4	3	4	3	3	68
3	j. Impervious Areas (e.g., Rooftops, Roads, Parking Lots, etc.)	4	3	4	3	3	51
5	k. Agricultural Areas	1	3	2	3	3	60
6	l. Construction Sites	1	3	4	4	4	96
5	m. Nurseries/Greenhouses and Landscaping Operations	2	2	2	2	2	50
3	n. Lawn and Garden/Household Maintenance Activity	3	3	4	3	3	48
5	o. Golf Courses	1	3	3	4	1	60
2	p. Fuel Oil Use (Including Storage and Transportation of Fuel Oil)	2	2	3	2	2	22
3	q. Salt Storage and Seasonal Spreading of Salt	3	3	3	2	3	42
2	r. Polychlorinated Biphenyls (PCBs) Use (Used in Some Electrical Transformers)	3	2	2	2	2	22
4	s. Abandoned Drinking Water Wells	1	2	2	2	2	36
5	t. Mining Activity	1	2	3	3	3	60
7	u. Industrial Land Use Areas	4	3	2	2	2	91
2	v. Boating Activities	1	1	2	1	1	12
7	w. Landfills and Dumps	2	3	3	5	2	105
5	x. Excess Nutrients From Natural Sources (e.g. Geese)	1	2	3	1	2	45

*Key to Pollution Potential Ratings:
1 = Virtually no potential to impair surface water and/or ground water quality.
2 = Low potential to impair surface water and/or ground water quality.
3 = Moderate potential to impair surface water and/or ground water quality.
4 = High potential to impair surface water and/or ground water quality.
5 = Very high potential to impair surface water and/or ground water quality.

Table 19
Ranking of 24 Potential Pollution Sources to the Watershed and Pollution Potential Ratings* for each Subwatershed

Potential Pollution Source	Subwatershed				
	1	2	3	4	5
1. Off-Lot (Discharging) Home/Semi-Public Sewage Disposal Systems	1	4	5	3	3
2. Failing On-Lot Home/Semi-Public Sewage Disposal Systems	1	4	5	3	2
2. Landfills and Dumps	2	3	3	5	2
3. Construction Sites	1	3	4	4	4
4. Industrial Land Use Areas	4	3	2	2	2
5. Trucking Activity and Related Maintenance (Including Diesel Fuel Use)	4	3	3	3	2
6. Gasoline Use (Including Storage and Transportation of Gasoline)	4	3	4	3	3
7. Leaking Underground Storage Tanks	4	2	4	3	3
7. Oil and Gas Pipelines (i.e., Oil and Gas Transportation)	2	3	4	3	4
8. Mining Activity (Sand and Gravel Mining)	1	2	3	3	3
8. Agricultural Areas	1	3	2	3	3
8. Golf Courses	1	3	3	4	1
9. Oil and Gas Wells (i.e., Oil and Gas Production and Exploration/Drilling Activity)	2	2	4	3	3
10. Impervious Areas (e.g., Rooftops, Roads, Parking Lots, etc.)	4	3	4	3	3
11. Nurseries/Greenhouses and Landscaping Operations	2	2	2	2	2
12. Lawn and Garden/Household Maintenance Activity	3	3	4	3	3
13. Wastewater Treatment Plants (WWTPs)	1	4	4	3	3
13. Excess Nutrients From Natural Sources (e.g., Geese)	1	2	3	1	2
14. Salt Storage and Seasonal Spreading of Salt	3	3	3	2	3
15. Abandoned Drinking Water Wells	1	2	2	2	2
16. Fuel Oil Use (Including Storage and Transportation of Fuel Oil)	2	2	3	2	2
16. Polychlorinated Biphenyls (PCBs) Use (Used in Some Electrical ransformers	3	2	2	2	2
17. Boating Activities	1	1	2	1	1
18. Registered Underground Storage Tanks (Insufficient information to evaluate this category)					

*Key to Pollution Potential Ratings:
1 = Virtually no potential to impair surface water and/or ground water quality.
2 = Low potential to impair surface water and/or ground water quality.
3 = Moderate potential to impair surface water and/or ground water quality.
4 = High potential to impair surface water and/or ground water quality.
5 = Very high potential to impair surface water and/or ground water quality.

system management practices. When dealing with the remaining identified potential pollution sources, the best results should be seen by taking this watershed approach to protecting/restoring water quality. However; this type of prioritization is not meant to overshadow the importance of localized impacts, which may be affecting designated uses such as primary recreation, which may be a vital component to an area's quality of life. In these areas, the watershed paradigm may not be appropriate.

Construction sites ranked third; and they have a high potential to impair the waters of Subwatersheds 3, 4 and 5. Industrial land use areas ranked fourth; and it has a high potential to impair the waters of Subwatershed 1. Trucking activity and related maintenance ranked fifth. Gasoline use ranked sixth. Leaking underground storage tanks and oil and gas pipelines both ranked seventh. Mining activity, agricultural areas and golf courses all ranked eighth. Oil and gas wells ranked ninth. Impervious areas ranked tenth. Nurseries/ greenhouses, and landscaping operation ranked eleventh. Lawn and garden/household maintenance activity ranked twelfth. Wastewater treatment plants and excess nutrients from natural sources ranked thirteenth. Salt storage and seasonal spreading of salt ranked fourteenth. Abandoned drinking water wells ranked fifteenth. Fuel oil use and PCBs ranked sixteenth. Boating activities ranked seventeenth. Registered underground storage tanks ranked eighteenth, due to insufficient information to evaluate it as a potential source.

Appendix I contains the ranking of 24 potential pollution sources for each of the five subwatersheds. Table 19 and Appendix I are significant environmental planning tools for the Upper Tuscarawas River Watershed. Future actions could use this information in conjunction with all of the figures and tables contained in the analyses, to identify sites that should be sampled for the presence of contaminants. If a site is causing a negative impact on the watershed, targeting efforts to contain and clean-up that site may be an effective plan. Also, local governments can use Table 19 and the tables in Appendix I and this analysis to protect/restore the water quality in their portion of the watershed when developing/revising zoning ordinances. Finally, for the reason that Table 19 and the tables in Appendix I are useful for breaking down the 24 identified potential pollution sources and the relatively large watershed into manageable pieces, is that organizers of public outreach/environmental education activities in the watershed can use it to help focus their efforts and limited resources. By doing these activities, the risks to human health, ecosystems, and quality of life in the watershed can be reduced, and the quality of water flowing from the Tuscarawas River and the Portage Lakes should continue to improve.

III. Critical Resources

Summary

The critical resource areas in the Upper Tuscarawas Watershed include state resource waters, headwaters, ground water resources and biologically significant wetlands. This report examines existing conditions of critical resource areas within the Portage Lakes drainage area Subwatershed portion of the Upper Tuscarawas Watershed, which were mapped for protection and preservation efforts as part of the development of an Action Plan to be directed by the Portage Lakes Task Force.

After review of the 1997 State of Ohio Water Quality Standards, Chapter 3745-1 of the Ohio Administrative Code, NEFCO determined that there are no streams designated as "state resource waters." However, there are thirteen (13) publicly-owned lakes and/or reservoirs within the watershed study area that are designated as "state resource waters." Singer Lake, located in the southern portion of the City of Green is not designated as a state resource water because it is not publicly-owned. Nevertheless, it should be recognized as a critical resource area worthy of protection based on the numerous rare and endangered species identified by the Ohio Department of Natural Resources (ODNR), Division of Natural Areas and Preserves.

The watershed is largely dominated by perennial and intermittent streams (headwaters) that are tributaries of the Tuscarawas River. Headwaters that are located in subwatersheds 3 and 5 flow directly into the Portage lakes system which will eventually enter the Tuscarawas or the Ohio-Erie Canal from the Long Lake spillway. The headwaters drain and flow through mixed types of land use comprised primarily of residential or agricultural areas.

The ground water resources for the watershed were identified and mapped for areas in which yields of 100 gallons per minute and greater are produced according to Summit, Stark and Portage County ground water resources digital data layers obtained from the ODNR, Division of Real Estate and Land Management. These areas were also compared to the most recent available ground water resource paper maps for accuracy and consistency. Ground water areas containing yields of 500 to 1000 gallons per minute were found in Summit County along the Tuscarawas River. However, an area containing saline ground water unfit for human consumption was located in Summit County just south of Summit Lake.

Biologically significant wetlands were determined by overlaying known locations for Ohio's rare and endangered plant and animal species with 1987 Ohio Wetlands Inventory (OWI) maps. In order to be considered as a biologically significant wetland, at least one rare or endangered plant or animal must be present. The OWI was produced from May 1987 Landsat Thematic Mapper data. However, it is recommended that field verification should be conducted. Wetland areas shown on these maps do not necessarily correspond to the Army Corps of Engineers' jurisdictional definition of

wetlands. The Biologically Significant Wetlands are dispersed throughout the watershed, however, the most biologically significant wetland area is located in the Singer Lake area, located in subwatershed 5, with twenty-five sites identified by ODNR's Division of Natural Areas and Preserves.

Introduction

It is important to identify, inventory and produce detailed maps of critical resources areas when developing a strategy to protect water quality within a watershed. Critical resources, such as state resource waters, headwaters, groundwater resources, biologically significant wetlands and unique species and features have been examined within the Upper Tuscarawas River Watershed.

Critical resource areas in the watershed may assist in raising public awareness. This awareness will enhance the effort to develop and implement watershed stewardship projects through volunteer citizen groups or local landowners within the watershed, and encourage their participation in the use of BMPs included in the action plan for the protection of water quality within the watershed.

Characterization of Critical Resource Areas

For purposes of this report, the term "critical resources" refers to natural resources that are considered to be essential elements for the interrelation of all components of the natural environment, and are recognized as integral components to the restoration and preservation of environmental quality. Furthermore, critical resources are key to a community's overall general welfare and development in that they create and maintain conditions which promote social, economic, recreational and aesthetically pleasing surroundings.

After considerable reflection, NEFCO has determined that the following natural resources meet the aforementioned criteria to be considered as critical resources: state resources waters, headwaters, groundwater resources and biologically significant wetlands.

High Quality Waters

State resource waters, as described in Chapter 3745 of the Ohio Administrative Code (OAC), are surface waters of the state that lie within national, state and metropolitan park systems; wetlands, categorized as category 2 or 3 in accordance with Rule 3745-1-54 of the OAC; wildlife refuges, preserves; and also wild, scenic and recreational rivers, if so designated by Ohio EPA. Also included are publicly-owned lakes and reservoirs and waters of exceptional recreational or ecological significance, e.g. waters which provide a habitat for identified threatened or endangered species, as determined by the Director of the Ohio EPA.

Effective May 1, 1998, “State Resource Waters” are surface waters so designated in rules 3745-1-08 to 3745-1-30 of the Ohio Administrative Code (OAC) and all publicly-owned lakes and reservoirs (OEPA, 1998, p.4). The OAC now considers all surface waters of the state as, “High Quality Waters,” or one of the 5 categories under the high quality waters classification. For example, in rule 3745-1-05(E)(1) a) Lake Erie is designated as a Superior High Quality Water; b) publicly-owned lakes and reservoirs are designated as State Resource Waters; c) all surface waters designated as state resource waters in rules 3745-1-08 to 3745-1-30 of the Administrative Code shall retain the state resource water designation until such time as the water bodies are considered under paragraph (E)(2) or (E)(3); d) all surface waters of the state meeting the definition of limited quality waters are so designated, unless the water body is the source of drinking water for a public water supply, in which case it shall be considered a general high quality water. However, no later than one year after the effective date of this rule (May 1, 1998), and at least once every three years thereafter, the director, in consultation with the director of the department of natural resources, shall consider available information on water bodies in Ohio and determine appropriate high quality water designations. At this time, the director shall rescind designations of state resource waters, in rules 3745-1-08 to 374501-30 of the Administrative Code (OEPA, 1998, pp. 27-28).

Prior to May 1, 1998, “State resource waters” also included all wetlands. However, wetlands have received new designations of either “Limited quality waters,” for wetlands designated as category 1 or “General high quality waters,” for wetlands designated as category 2 or 3 in accordance with rule 3745-1-54 of the OAC.

The following wetland categories enable the Ohio EPA to evaluate wetlands in greater detail depending on the level of functions they perform:

Category 1 Wetlands provide little wildlife habitat, floodwater storage, water quality, or recreation functions. They typically have some or all of the following characteristics: not connected to other bodies of water, low species diversity, a predominance of non-native species, no significant habitat or wildlife use, and limited potential to be restored to a fully functioning wetland. They do not contain rare, threatened, or endangered species or critical habitat for threatened or endangered species.

Category 2 Wetlands support moderate wildlife habitat, flood water, water quality, or recreational functions. They tend to be dominated by native species, generally do not contain threatened or endangered species or their habitats. They may be degraded, but have a reasonable potential to be restored to full function.

Category 3 Wetlands support superior habitat, flood water storage, water quality, or recreational functions. They have high levels of diversity, and contain mostly native species. They may include wetlands which contain or provide habitat for threatened or endangered species, high quality forested wetlands, mature forested riparian wetlands, and vernal pools (wooded pools that flood in spring). A subcategory of Category 3

wetlands, which includes types of wetlands that are regional or statewide, such as bogs and fens, would be protected from all but temporary disturbances to water quality.

Table 20 lists all of the publicly-owned lakes and reservoirs greater than 5 acres that are found within the Portage Lakes Watershed, according to Ohio EPA's Ohio Water Resource Inventory, Volume 3: Ohio's Public Lakes, Ponds, and Reservoirs, 1992.

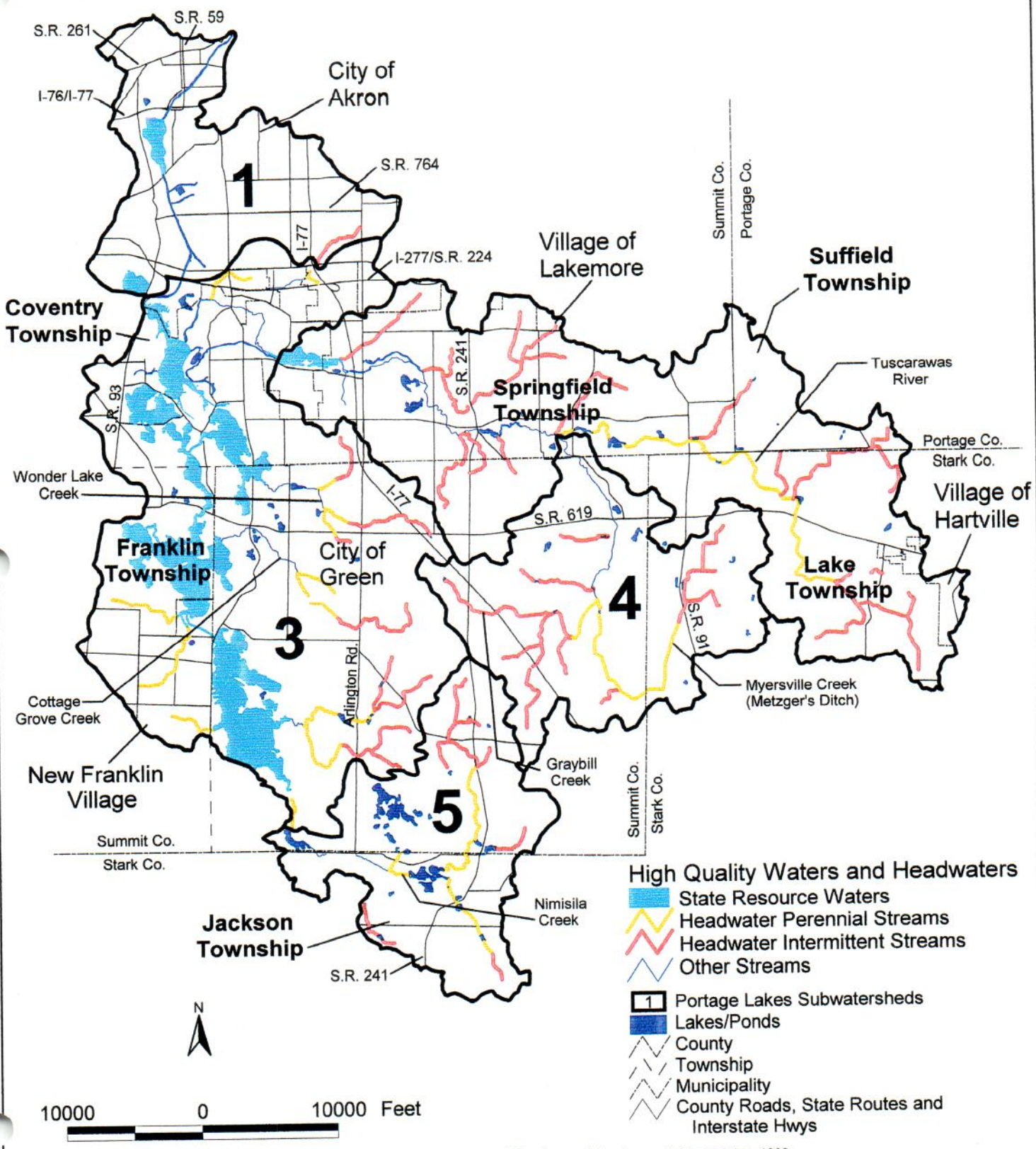
Table 20
Publicly-Owned Lakes/Reservoirs/Ponds Greater than 5 Acres

Waterbody I.D.	Name	Surface Area (acres)	Lake Uses	Lake Type
OH10 33-359	East Reservoir	201	R	NL
OH10-33-354	Firestone Reservoir	83	WS R	DPI
OH10 33-357	Hower Lake	23	R	DPI
OH10 33-355	Lake Nesmith	80	R	NL
OH10 33-365	Miller Lake	28	R	DPI
OH10 33-358	Long Lake	180	WS R	NL
OH10 33-365	Mud Lake	85	R	NL
OH10 12-360	Nimisila Reservoir	825	WS R	DPI
OH10 33-365	North Reservior	160	R	NL
OH10 33-363	Rex Lake	48	R	DPI
OH10 33-352	Summit Lake	100	R	NL
OH10 33-364	Turkeyfoot Lake	318	R	NL
OH10 33-361	West Reservoir	104	R	NL

Lake Uses: R = Recreations; WS = Water Supply
Lake Type: NL = Natural Lake; DPI = Dammed Impoundment

Singer Lake was not included as a state resource water in the above-referenced list. However, the significant amount of biodiversity found at Singer Lake makes it worthy of consideration as a critical habitat, as will be discussed later in the study. Figure 9 shows the location of lakes and reservoirs that are considered to be state resource waters. In addition, all first order streams and intermittent streams are highlighted in color.

Figure 9
High Quality Waters of the State and Headwaters
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: ODNR, Division of Natural Resources, Division of Real Estate and Land Management; Ohio EPA,1997; USGS.

Headwaters

For purposes of this study, headwaters include all intermittent and first order perennial streams. Headwater streams are the collecting system--the small tributaries that are the origin of most rivers. They are the primary interface between land uses and water resources. Headwaters serve as building blocks for healthy streams and rivers.

As one examines the watershed, it becomes evident that the watershed consists primarily of intermittent and first order perennial streams. The identification of intermittent and first order streams was determined through the Department of the Interior, United States Geological Survey (U.S.G.S.) 7.5 Minute Series Topographic maps at a scale of 1:24,000:

a. 4665 I NE; Canal Fulton Quadrangle
b. 4765 IV NW; North Canton Quadrangle
c. 4765 IV NE; Hartville Quadrangle
d. 4666 II SE; Akron West Quadrangle
e. 4766 III SW; Akron East Quadrangle

Intermittent streams are defined as stream channels which carry water during part of the year and which are dry the other part, but which receive flow from the groundwater table when it is high enough (Streams, 1968, p. 11).

Perennial streams are streams which carry water year round and which are fed by a fairly stable groundwater flow (Streams, 1968, p. 11).

The first order or the upper most reach of streams (Figure 9) are part of the critical resource areas that NEFCO has identified as areas for protection against human activities that may adversely affect the mainstem. These stream segments are more likely to have a higher quality of biological and aquatic life use attainment. At the same time, these stream segments may need protection from nonpoint source runoff from agricultural practices, or may need protection from storm water runoff from development that could increase flow and, consequently, increase the amount of heavy metals, salts, nutrients transported downstream, in addition to erosion, transport, and deposition of sediment. Downstream problems, such as flooding, bank erosion, and deepening of channels are often directly linked to headwater stream degradation. Additional reasons to protect headwater areas are as follows: 1) to maximize contact of water volume for absorption of pollutants by vegetation; 2) to maximize the opportunity for groundwater percolation per volume of flow; 3) to increase aquatic-soil-plant interfaces for plant and animal habitat; and 4) to reduce stream energy for erosion by maximizing the wetted perimeter of a stream.

Ground Water Resources

Ground water resource areas are included as critical resource areas that warrant protection because ground water is one of NEFCO's most important resources. For this reason, it is NEFCO's intent that, with proper management and increased public awareness, the protection of ground water/aquifers from disruptive activities caused by agriculture or urbanization may help prevent ground water threats, maintain the hydrologic balance, and also prevent the contamination of ground water supplies or aquifer drawdown. This will insure the present and future availability of safe, clean drinking water for those living in the Upper Tuscarawas River Watershed.

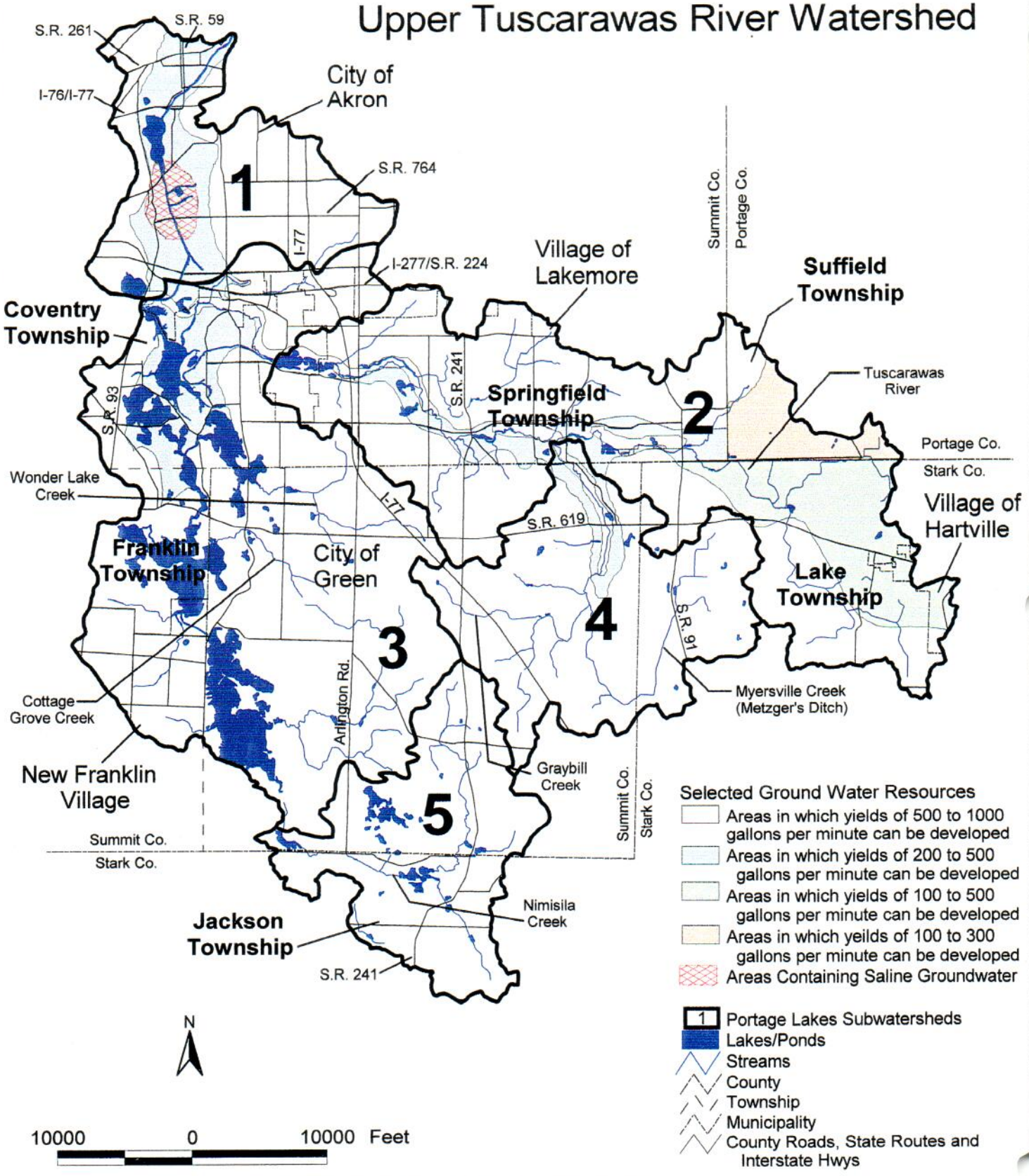
Figure 10 shows the ground water resources for the watershed. The Summit County portion was revised by ODNR Division of Water, Ground Water Section, in 1994; Portage County in 1979; and Stark County in 1974, reprinted in 1988. The major ground water categories are based on well yields, which may vary depending upon the type of aquifer, e.g. confined bedrock vs. unconsolidated buried glacial valley aquifer.

Portage County - Most of the Portage County portion of the Upper Tuscarawas Watershed is located in areas in which yields of 100 to 300 gallons per minute can be developed (orange area). The area in Portage County is interbedded and interlensing sand, gravel, silt and clay in buried valleys. Yields of as much as 300 gallons per minute are available where sufficient coarse material is found.

Stark County - The only area in Stark County that yields greater than 100 gallons per minute is located in the Lake Township area (green area). This area's wells, which may yield 100 to 500 gallons per minute, can be developed. It is considered a good ground water area. Permeable sand and gravel deposits not traversed by major streams may supply sustained yields of several hundred gallons per minute. According to ODNR Division of Water these are suitable for industrial and municipal well field development.

Summit County - Areas in which yields of more than 100 gallons per minute can be developed are located along the Tuscarawas River. These areas are generally located in the southern portion of Springfield Township and the central portion of Coventry Township extending north following the canal corridor. The yellow areas (Figure 10) in Summit County contain permeable sand and gravel deposits traversed by major streams. Wells may yield 500 to 1,000 or more gallons per minute, and are adequate for municipal and industrial well field deposits according to ODNR. The gray areas are of permeable sand and gravel deposits not traversed by major streams. Infiltration supplies cannot be developed, and sustained yields may range from 200 to 500 gallons per minute. Seasonal yields (short term pumping) in excess of 500 gallons per minute may be available. The area within the red zone located just south of Summit Lake contains large amounts of salt, making ground water from this area unsuitable for human consumption.

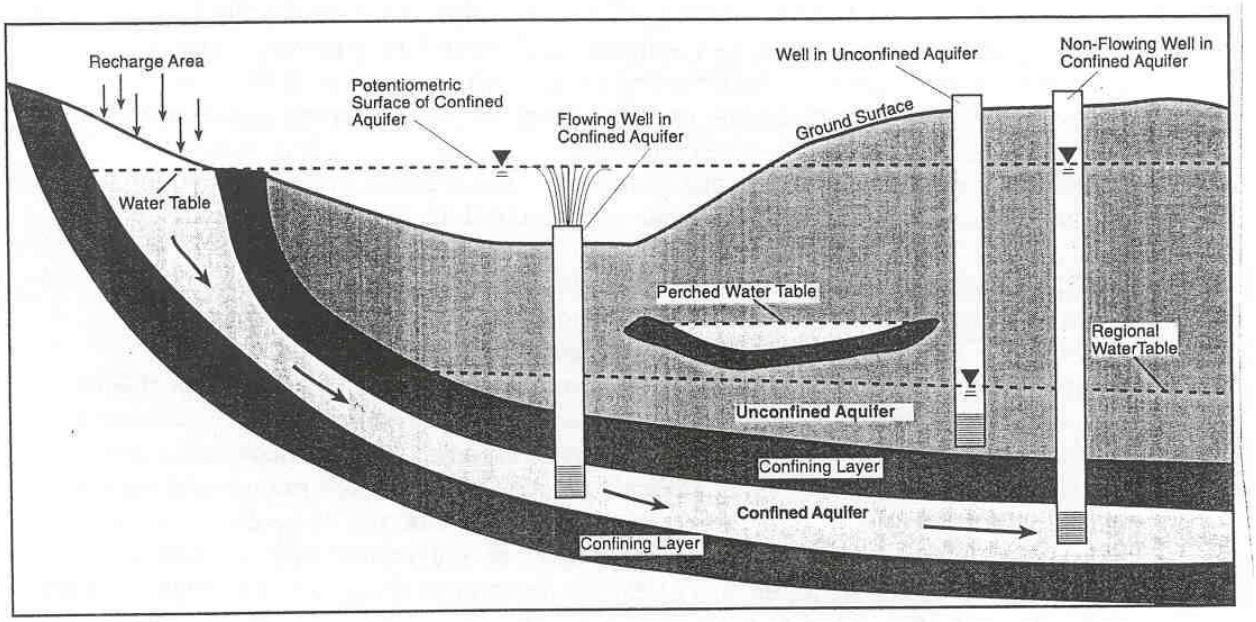
Figure 10
Selected Ground Water Resources
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: ODNR, Division of Water, Ground Water Resources Section, 1994, Division of Real Estate and Land Management; USGS.

Figure 11 shows the interconnectivity (hydrologic cycle) of surface and ground water. Ground water resource areas consist of a geological formation, part of a formation, or a group of formations capable of yielding a significant amount of water to either a well or spring. Additionally, there are perennial streams that discharge to the Tuscarawas River within the watershed. During the baseflow conditions of drier months, ground water containing contaminants could be a source of nonpoint source (NPS) pollution to the surface waters of this watershed. During wetter months, once contaminated, surface waters can become NPS pollution to the ground water of the watershed as it recharges. However, this is a worst-case scenario, which could take many years to occur.

Figure 11
Confined and unconfined aquifer



Source: State Coordinating Committee on Ground Water, 1996

It is for this reason that ground water resources should be protected from disruptive activities that may threaten ground water in order to maintain the hydrologic balance and also prevent contamination of ground water supplies or aquifer drawdown.

Ground water is susceptible to pollutants and, once polluted, it is very costly to clean up. Contamination of ground water resources may occur from toxins that were dumped on the ground in the past making their way into the ground water. Examples of surface

pollutants are pesticides, fertilizers, road salt, toxic chemicals, septic systems, and underground storage tanks.

Biologically Significant Wetlands

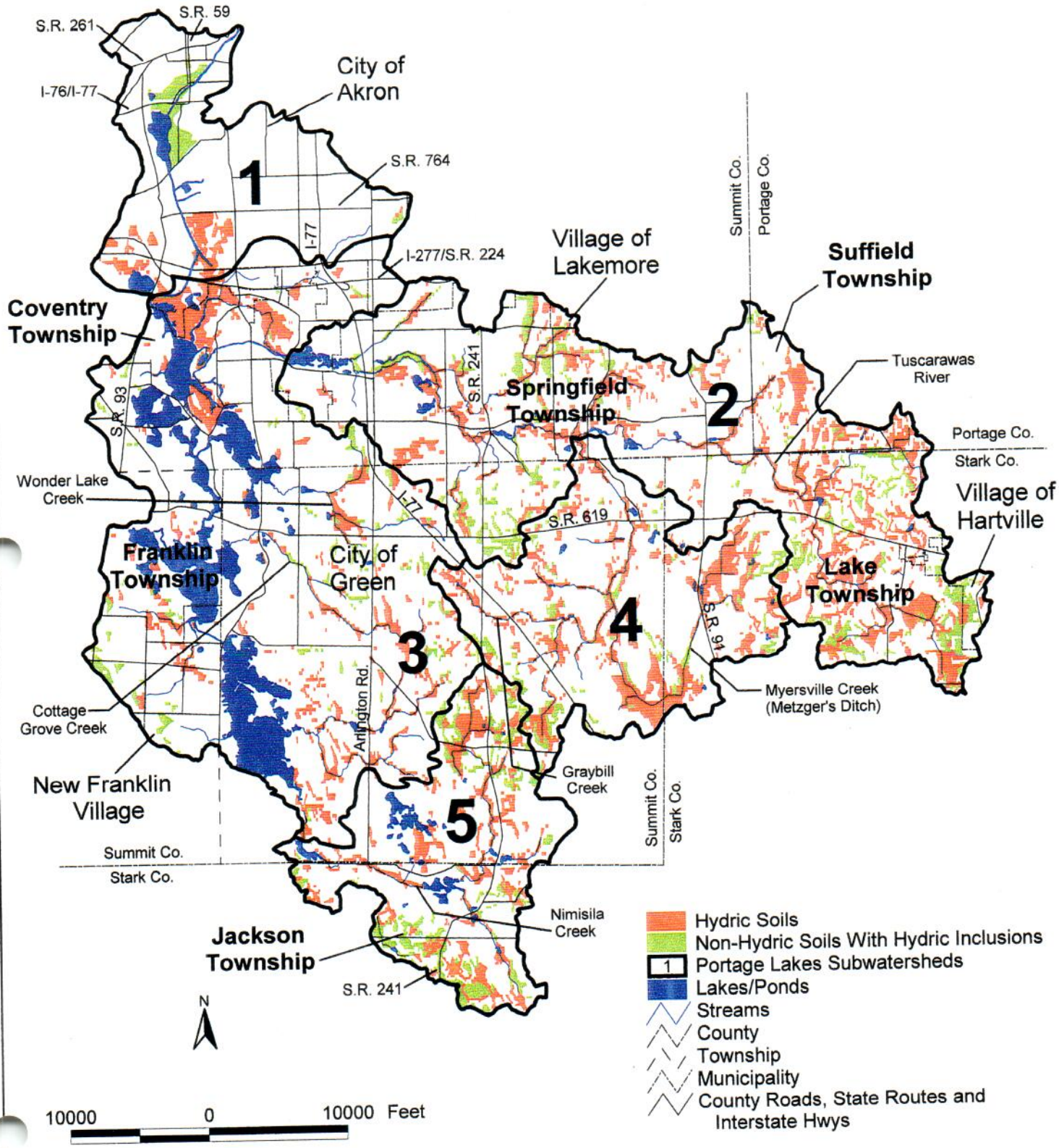
Wetlands, as defined by the OAC are "areas of land where the water table is at, near or above the land surface long enough each year to result in the formation of characteristically wet (hydric) soil types, and support the growth of water-dependent (hydrophytic) vegetation. Wetlands include, but are not limited to, marshes, swamps, bogs and other such low-lying areas." (OAC section 3745-1-02). Figure 12 depicts hydric soils and hydric soils with non-hydric inclusions in the watershed. Hydric soils do not necessarily represent wetland areas, but may help indicate where they are located.

Wetland areas serve very important functions that are generally overlooked, or not understood, by many watershed residents. Watershed residents benefit from wetlands in the following ways: flood prevention, as wetlands areas moderate water flow by detaining storm water which in turn reduces flood peaks during storm events; improving water quality; by retaining or transforming excess nutrients, trapping sediment and heavy metals; by acting as aquifer recharge areas; and by providing wildlife habitat as well as habitat for many threatened and endangered plant and animal species. However, as wetlands are generally beneficial, in some cases, water discharging from wetland areas may yield bacteriological loads and reduced dissolved oxygen levels.

NEFCO's identified biologically significant wetlands are those which contain a high degree of biodiversity and/or contain rare, endangered or threatened species. According to sections 3745-1-50(L) and 3745-1-50(LL) effective May 1, 1998, "endangered species" and "threatened species" mean a native Ohio plant species listed or designated by the ODNR as endangered or threatened with extirpation pursuant to section 1518.01 of the Revised Code; and animal species listed or designated as endangered or threatened with statewide extinction by the ODNR pursuant to section 1531.25 of the Revised Code; or a species that appears on the threatened species registry, as defined in rule 3745-1-05 of the OAC; or any plant or animal species that is native to Ohio or that migrates or is otherwise reasonable likely to occur within the state and which has been listed as threatened pursuant to section 4 of the Endangered Species Act, 16 U.S.C.A. 1531 et seq., as amended.

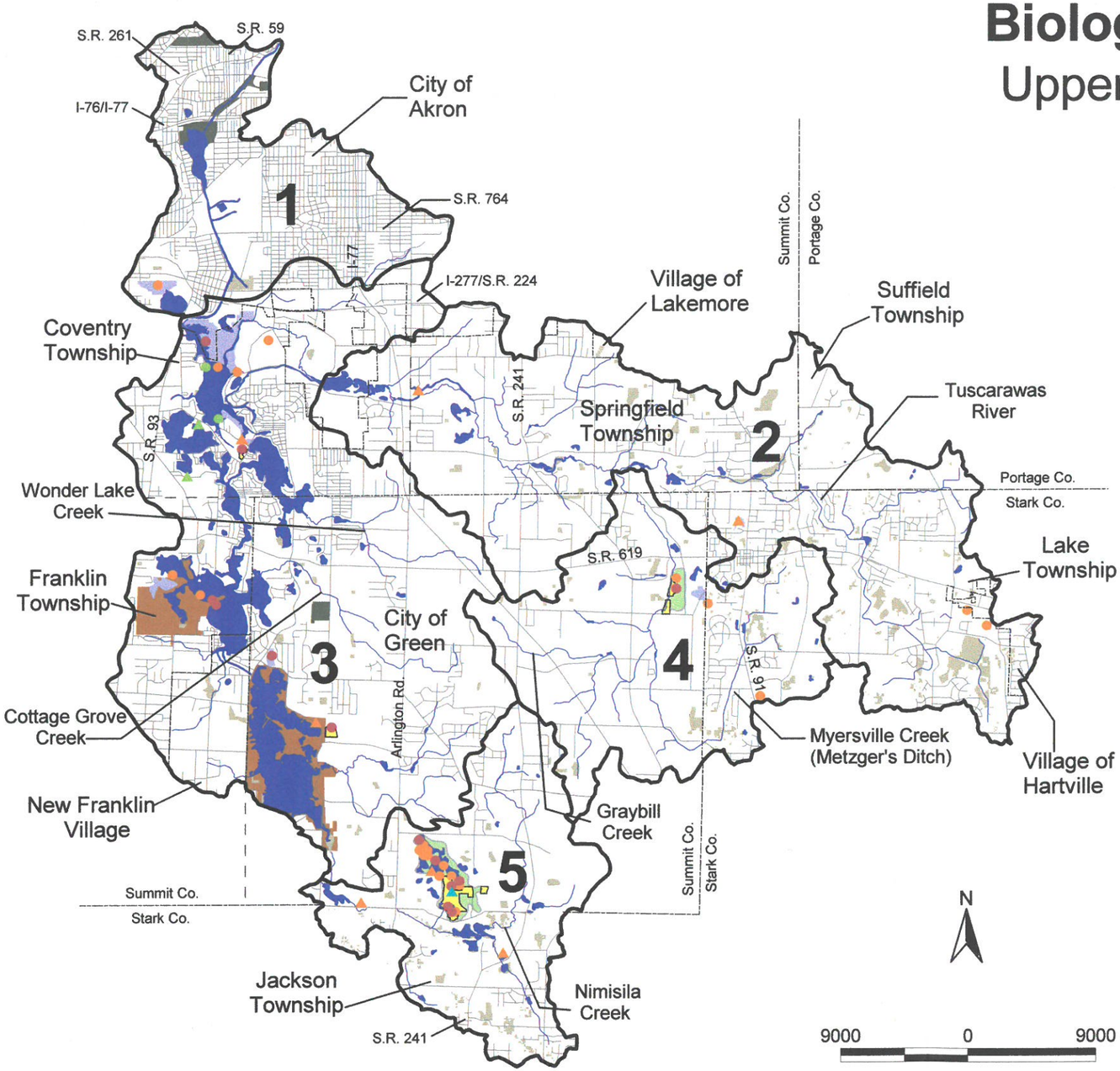
Shown in Figure 13 are the biologically significant wetlands that are located within the Upper Tuscarawas Watershed study area. The locations of biologically significant wetlands were obtained through the use of the National Wetland Inventory (for wetlands with areas greater than 5 acres) developed by the Department of the Interior, the Ohio Wetland Inventory produced from May 1987 Landsat (satellite) Thematic Mapper data, cross-referenced with U.S.G.S. Quads and overlaid with the ODNR Department of Natural Heritage's list of Ohio's's rare and endangered special plant and/or animal species. In order to be considered a biologically significant wetland, at least one special plant or animal species must be located within the wetland. Fifteen

Figure 12
Hydric Soils and Non-Hydric Soils With Hydric Inclusions
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: ODNR, Division of Natural Resources, Division of Real Estate and Land Management; Soil Surveys of Summit, Stark and Portage Counties; USGS.

Figure 13
Biologically Significant Wetlands
Upper Tuscarawas River Watershed



- Biologically Significant Wetlands
- Biologically Significant Wetlands Which are Managed/Proposed Managed Areas by ODNR
- Other Wetland Areas
- Proposed Managed Areas by ODNR
- Portage Lakes State Park
- Parks
- 1 Portage Lakes Subwatersheds
- Lakes/Ponds
- Areas in Which Three or More Species are Located
- Exact Location Of Plant Species
- Location Of Plant Species Within One Mile
- Exact Location Of Animal Species
- Location Of Animal Species Within One Mile
- Location Of Other Species Within One Mile
- County
- Township
- Municipality
- Roads
- Streams

Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: Ohio Department of Natural Resources, Division of Real Estate and Land Management, Division of Natural Areas and Preserves, 1997; USGS.

(15) biologically significant wetlands were identified, three of which include biologically significant wetlands already managed by ODNR. Managed areas within the watershed include Portage Lakes Wetland, Karlo Fen State Nature preserve, and Portage Lakes State Park, appendices J, K and L, respectively. Proposed managed areas include Myersville Fen State Nature Preserve and Singer Lake. These two areas have been recommended on the basis of the Natural Heritage data, and botanists' and zoologists' field surveys. The proposed Myersville Fen State Nature Preserve, a 27.243 acre site, still needs to go through final approval procedures. The proposed Singer Lake Preserve is not currently managed by ODNR, however, the Division of Natural Areas and Preserves has recommended and identified the extent of the proposed managed area (330 acres). Singer Lake is in the top 10 list for proposed managed areas, 4 of the 10 are now being managed by ODNR. However, it is recommended that field verification of wetland areas should be conducted. Wetland areas shown do not necessarily correspond to the Army Corps of Engineers' jurisdictional definition of wetlands.

Inventory and Status of Unique Species and Features

The data from the Ohio Department of Natural Resources, Division of Natural Areas and Preserves, was received in two forms. One was in computer printouts containing the scientific name, common name, federal and state status, class code, latitude, longitude, accuracy, and manages areas. The second was in an ASCII file including the same data as the computer printouts, an endangerment/class code list, and a rare plant and animal list.

The data from ODNR listed significant natural areas, high quality plant communities, rare and endangered plants and animals, and managed areas within the study area. As a result, a total of 135 records were discovered in the study area, shown by point symbols, that indicate the location, accuracy, type and occurrence of each incident. The location of unique plant and animal species, along with one other class category, are also shown in Figure 13. Each point location symbol and color indicate whether it is a plant (orange), animal (green), or other (blue). The symbol shape indicates the accuracy of the point data; a circle - exact location and a triangle - within one square mile. Gazettes shown in red indicate where three or more species are located at the same location.

Appendix M is a computer printout of the Natural Heritage records per county obtained from the Ohio Department of Natural Resources, Division of Natural Areas and Preserves. Appendix N shows the number of records within the study area, the fields, location accuracy codes, class codes, status codes for unique species and features found within the study area.

Conclusion

The importance of the Upper Tuscarawas River Watershed Critical Resource Areas Study is that it builds upon previous and current NEFCO studies for the development and implementation of an action plan. It is NEFCO's intent that the Critical Resource Area Study will help provide a sound technical and ecological base for effective management, use and protection of natural resources important to watershed residents while minimizing adverse impacts to environmental and ecological systems that are key to maintaining environmental quality.

Currently, there are no streams in the watershed designated as "state resource waters," although the following thirteen (13) publicly-owned lakes and/or reservoirs are designated as state resource waters: Nimisila Reservoir, Turkeyfoot Lake, Rex Lake, Mud Lake, West Reservoir, East Reservoir, Miller Lake, Hower Lake, North Reservoir, and Long Lake, which are located in subwatershed 3, Lake Nesmith and Summit Lake, which are located in subwatershed 1, and the Tuscarawas Diversion Dam, which is located in subwatershed 2.

Headwaters consisting of intermittent and perennial (first order) streams were prevalent throughout the watershed. The identification of headwaters was important in that they are more likely to have higher quality biological and aquatic life which are susceptible to point and nonpoint sources of pollution.

Ground water resources are one of the watershed's most important resources that warrant protection. Major ground water resource areas with yields of more than 100 gallons per minute were identified and mapped. The location of the major ground water resources were located along the Tuscarawas River mainstem in subwatershed 2, from the west side of West Reservoir in subwatershed 3, and north along the Ohio & Erie Canal in subwatershed 1. Some areas are capable of yielding 500 to 1,000 gallons per minute. However, the area outlined in red, south of Summit Lake, contains saline ground water unfit for human consumption.

Fifteen biologically significant wetlands were identified within the watershed. The location of these areas was determined by downloading wetland information from NHI, OWI, and U.S.G.S. wetland sites. At least one special plant or animal species must have been located at the site. NEFCO discovered that of the fifteen, three biologically significant wetlands, Portage Lakes Wetland, Karlo Fen State Nature Preserve, and Portage Lakes State Park, are currently under ODNR's management. Two proposed managed areas include Myersville Fen State Nature Preserve, currently going through final approval procedures, and Singer Lake, which is in the top ten for proposed natural areas recommended by ODNR staff to by managed by ODNR.

A total of 135 unique plant and animal sites were identified within the watershed. The most significant area was Singer Lake, located in subwatershed 5, with 25 unique species located within the proposed boundary recommended by ODNR staff. The Singer Lake area warrants serious consideration for protection due to its biodiversity and wetland areas.

IV. Riparian Zone Analysis

Summary

The purpose of this Upper Tuscarawas River Watershed Riparian Habitat Inventory was to evaluate the condition of the riparian corridor along the Tuscarawas River mainstem; Myersville Creek (a tributary of the Tuscarawas River); Graybill Creek (a tributary to Myersville Creek); Wonder Lake Creek (a tributary to Cottage Grove Lake (East Reservoir)); Cottage Grove Creek (a tributary to Mud Lake); and Nimisila Creek. The riparian evaluation revealed that overall 34.5 percent of the six waterways were of high quality riparian habitat (i.e. forest, swamp, shrub, old field).

NEFCO believes that streams are important components of the environment, and that such natural areas are subject to adverse impact caused by commercial and residential development, which is exacerbated by habitat and hydrologic modifications. Action should be taken to restore/protect/preserve riparian corridor habitat may be augmented by guidance from an analysis and mapping of conditions in the watershed.

Introduction

The intent of this project is to update an existing riparian inventory (from 1990 aerial photographs) of the Tuscarawas River and selected tributaries that flow into the Portage Lakes system. The updated assessment was conducted through the use of 1995 aerial photos, supplied by the Akron Metropolitan Area Transportation Study (AMATS) and 1997 aerial photos supplied by the Stark County Regional Planning Commission, of the Tuscarawas River Watershed. A comparison of the 1990 and 1995 riparian inventory results was made to characterize trends that may be occurring in the watershed. The criteria with which to evaluate the habitat are from the Ohio EPA Qualitative Habitat Evaluation Index (QHEI) matrix for Riparian Zone and Bank Erosion. However, the extent of stream bank erosion could not be evaluated from the aerial photos (Appendix N). Additionally, the riparian evaluation will help NEFCO identify and prioritize low, moderate and high quality riparian habitat that could be used to target streams or stream segments in need of protection and/or restoration efforts.

It is also the intent of this study that the results of the Upper Tuscarawas River Watershed Riparian Inventory raise public awareness and help guide land use decisions by key stakeholders in order to protect the integrity of stream segments that are threatened by urbanization, thereby protecting water quality standards within the watershed.

Riparian Habitat Inventory and Evaluation

The integrity of the riparian habitat is just one component of the Upper Tuscarawas River Watershed's Strategic Action Plan because an intact riparian corridor helps the stream resist erosion and protects water quality from inflows of pollutants, sediment and over-land runoff. These factors help maintain important chemical and physical characteristics needed to support biodiversity in the streams. The biodiversity preserves the stream's ability to assimilate pollution and prevent development of nuisance and health threatening algal blooms.

The intent of the riparian habitat inventory and evaluation of the Tuscarawas River mainstem and other tributaries is to examine current conditions of the riparian habitat quality through the use of aerial photos and Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) matrix for Riparian Zone and Bank Erosion. This was accomplished by delineating each evaluated watercourse into a series of 400 foot wide by 600 foot long segments which were scored according to riparian habitat width and quality. The data will then be tabulated for the purpose of prioritizing either a specific stream, subwatershed, or stream segment that is of low, moderate, or high riparian habitat quality that may then be targeted for outreach efforts for either protection or restoration.

Once impaired stream(s), subwatershed(s), minor subwatershed(s) and/or stream segments were determined, the data results were be compared with previous riparian habitat evaluations to characterize possible trends. The results may facilitate the development of goals and objectives dedicated toward habitat restoration. However, high quality stream(s), subwatershed(s), and/or stream segments may be viewed as worthy of preservation and/or protection by implementing Best Management Practices (BMPs) to prevent degradation of these stream segment habitats.

Source Materials

The source materials used include the following:

1. Department of the Interior, United States Geological Survey (U.S.G.S.) 7.5 Minute Series Topographic maps at a scale of 1:24,000 as follows:

    a. 4765 IV NW, North Canton Quadrangle
    b. 4665 I NE, Canal Fulton Quadrangle
    c. 4766 III SW, Akron East Quadrangle
    d. 4666 II SE, Akron West Quadrangle
    e. 4765 IV NE, Hartville Quadrangle

2. Twenty one (21) blue line aerial photos, at a scale of 1":400', produced in March 1997, obtained from the Stark County Regional Planning Commission; and forty-eight (48) blue line aerial photos, also at a scale of 1":400', produced in April 1995 received from the AMATS.

Methodology

To prepare a comprehensive evaluation of the Upper Tuscarawas River Watershed, NEFCO examined streams that were spatially distributed throughout the watershed to gain insight of the overall existing riparian habitat condition.

NEFCO evaluated and scored six (6) waterways, for a total of 42.61 river miles, which included the following: Tuscarawas River, located in subwatersheds 1 and 2; Myersville Creek, a tributary of the Tuscarawas River, located in subwatershed 4; Graybill Creek, a tributary of Myersville Creek, also located in subwatershed 4; Cottage Grove Creek, a tributary to Mud Lake, located in subwatershed 3; Wonder Lake Creek, a tributary to East Reservoir, located in subwatershed 3; and Nimisila Creek, a tributary to Nimisila Lake, located in subwatershed 5.

Each watercourse on the blue line aerial photos was marked off into 600 by 400 foot segments from intersection points, labeled, and numbered consecutively. Using a template corresponding to the study area scale, the first 400 feet of each 600 foot segment was evaluated, while the remaining 200 feet was assumed to be similar to the first 400 feet in each segment. However, if the remaining 200 feet was significantly different from the first 400 feet, then the entire segment was evaluated. Each stream bank was analyzed for both riparian width and quality and scored numerically. Riparian width is evaluated as the width of high quality habitat (forest, swamp, shrub, and old field) from the center of the stream.

The scoring criteria are found in paragraph 4 of the Ohio EPA Qualitative Habitat Evaluation Index Field Sheet (EPA Form 4520) (Appendix O contains a copy of the entire field sheet) as follows:

Riparian Width (per bank) [total max score]	Flood Plain Quality (Most Predominant, Per Bank) [total max score]
L R	L R
__ __ Wide >50m [4pts.]	__ __ Forest, Swamp [3 pts.]
__ __ Moderate 10-50m [3 pts.]	__ __ Shrub or Old Field [2 pts.]
__ __ Narrow 5-10m [2 pts.]	__ __ Fenced Pasture [1 pt.]
__ __ Very Narrow <5m [1 pt.]	__ __ Residential, Park, New Field [1 pt.]
__ __ None	__ __ Conservation Tillage [1 pt.]
	__ __ Open Pasture, Rowcrop [0]
	__ __ Urban or Industrial [0]
	__ __ Mining/Construction [0]

Once the analysis was completed for each 600 foot segment, a chart was prepared for each watercourse segment where the right and left bank values were added together to give each segment a single numerical value.

An example of the data is illustrated in Table 21. Stream segment #Tusc-1 of the Tuscarawas River, located in Coventry Township in Summit County, north of Long Lake exhibited a riparian width of greater than 50 meters, with the flood plain quality consistency of swamp. Consequently, this stream segment received the maximum score of 7.0. In comparison, stream segment #Gray-9 (Graybill Creek), a tributary of Myersville Creek, located in the City of Green in Summit County exhibited "habitat modifications" such as streambank modifications, stream burial and removal of riparian vegetation. This stream segment had no riparian width, and the flood plain quality fell into the residential/park/new field category. The total score for this stream segment was 1.0.

Table 21
Sample Riparian Habitat Data Entry From the Riparian Width and Quality

	Riparian Width			Flood Plain Quality			Total Habitat Score
Segment #	Right Bank	Left Bank	Total	Right Bank	Left Bank	Total	
Tusc-1	2.0	2.0	4.0	1.5	1.5	3.0	7.0
Gray-9	0.0	0.0	0.0	0.5	0.5	1.0	1.0

Results

A total of 375 stream segments within the Upper Tuscarawas River Watershed were evaluated for riparian width and predominant vegetation cover. This represents approximately 225,000 feet, or 42.61 miles, of stream length, about two thirds of which, 150,000 feet, or 28.42 miles, were actually evaluated. Again, this methodology assumed that the remaining 200 feet of the 600 foot stream segment was similar to the first 400 feet. The tabulated data of the streams can be found in Appendix O.

Table 22 provides a summary of the frequency of the total scores for the Upper Tuscarawas River, tributary and other streams that were included in this study. Again, a score of 7.0 suggests that a high quality (HQ) riparian corridor and vegetative cover exist along a stream segment, while a low score indicates a poor riparian and vegetative cover.

Table 22
Frequency of Habitat Scores Along the Tuscarawas River and Other Streams

	Tusacarawas River Mainstem		Myersville Creek		Graybill Creek		Wonder Lake Creek		Cottage Grove Creek		Nimisila Creek	
Habitat Score	Frequency	(%)	Frequency	(%)	Frequency	(%)	Frequency	(%)	Frequency	(%)	Frequency	(%)
7.0	31.0	20.80	10.0	13.70	1.0	3.57	7.0	23.33	4.0	11.76	9.0	14.75
6.5	6.0	4.07	7.0	9.59	1.0	3.57	1.0	3.33	3.0	8.82	2.0	3.28
6.0	14.0	9.40	12.0	16.44	1.0	3.57	1.0	3.33	5.0	14.71	5.0	8.20
5.5	7.0	4.70	3.0	4.11	0.0	0.00	0.0	0.00	1.0	2.94	6.0	9.84
5.0	20.0	13.42	7.0	9.59	5.0	17.86	7.0	23.33	1.0	2.94	10.0	16.39
4.5	4.0	2.68	4.0	5.48	0.0	0.00	0.0	0.00	0.0	0.00	2.0	3.28
4.0	7.0	4.70	6.0	8.22	1.0	3.57	3.0	10.00	4.0	11.76	1.0	1.64
3.5	4.0	2.68	8.0	10.96	1.0	3.57	0.0	0.00	1.0	2.94	4.0	6.56
3.0	11.0	7.38	3.0	4.11	4.0	14.29	3.0	10.00	5.0	14.71	8.0	13.11
2.5	4.0	2.68	3.0	4.11	1.0	3.57	0.0	0.00	2.0	5.88	2.0	3.28
2.0	12.0	8.05	3.0	4.11	4.0	14.29	2.0	6.67	5.0	14.71	4.0	6.56
1.5	8.0	5.37	1.0	1.37	0.0	0.00	0.0	0.00	0.0	0.00	3.0	4.92
1.0	19.0	12.75	5.0	6.85	4.0	14.29	3.0	10.00	3.0	8.82	4.0	6.56
0.5	2.0	1.34	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
0.0	0.0	0.00	1.0	1.37	5.0	17.86	3.0	10.00	0.0	0.00	1.0	1.64
Total Segments	149		73		28		30		34		61	
Total Points	630.5		338		78.5		124.5		140.5		261.5	
Avg. Score	4.23		4.63		2.80		4.15		4.13		4.29	

Table 23 shows the average total score for each selected waterway. In an effort to prioritize streams, NEFCO established three categories consisting of low, moderate, and high riparian quality with scores of 0-2.0, 2.5-4.5, and 5.0-7.0, respectively. The average riparian habitat score is calculated by dividing the total points by the total number of stream segments found in Table 23. Additionally, the ranking was based on Average Riparian Habitat Score.

Table 23
Percentage of Low, Moderate and High Quality Riparian Habitat

Stream Name	Average Percentage Score			Avg. Riparian Habitat Score	Ranking based on Avg. Riparian Habitat Score
	Low	Moderate	High		
Tuscarawas River Mainstem	27.51	20.12	52.39	4.23	3
Myersville Creek	13.70	32.88	53.43	4.63	1
Graybill Creek	46.44	25.00	28.57	2.80	6
Wonder Lake Creek	26.67	20.00	53.32	4.15	4
Cottage Grove Creek	23.53	35.29	41.17	4.13	5
Nimisila Creek	19.68	27.87	52.46	4.29	2

Table 24 provides an approximation of acreage of high quality habitat identified along the evaluated riparian corridors. The high quality habitat only includes flood plain quality consisting of either forest, swamp, shrub or old field. Table 24 also shows the maximum acres evaluated, the total stream corridor area (acres) and the percentage of stream corridor as high quality habitat.

Figure 14 is a generalized map of the distribution of riparian habitat scores as calculated from the total habitat evaluation results found in Appendix P. Scores that ranged between 0.0 - 2.0 are shown in red, 2.5 - 4.5 are shown in yellow, and 5.0 - 7.0 are shown in green. A 200 foot effort for each side of the watercourse corresponds with the evaluation procedures during the habitat evaluation scoring process.

Figures 15 through 20 are graphs that reflect the total score of the riparian width and flood plain quality scores. Again, a stream segment score between 0-2.0 is of low quality, a score of 2.5-4.5 is considered to be moderate, and a score of 5.0-7.0 is recognized as a segment that is of high quality. The graphs also indicate the current overall riparian health of the Upper Tuscarawas River Watershed.

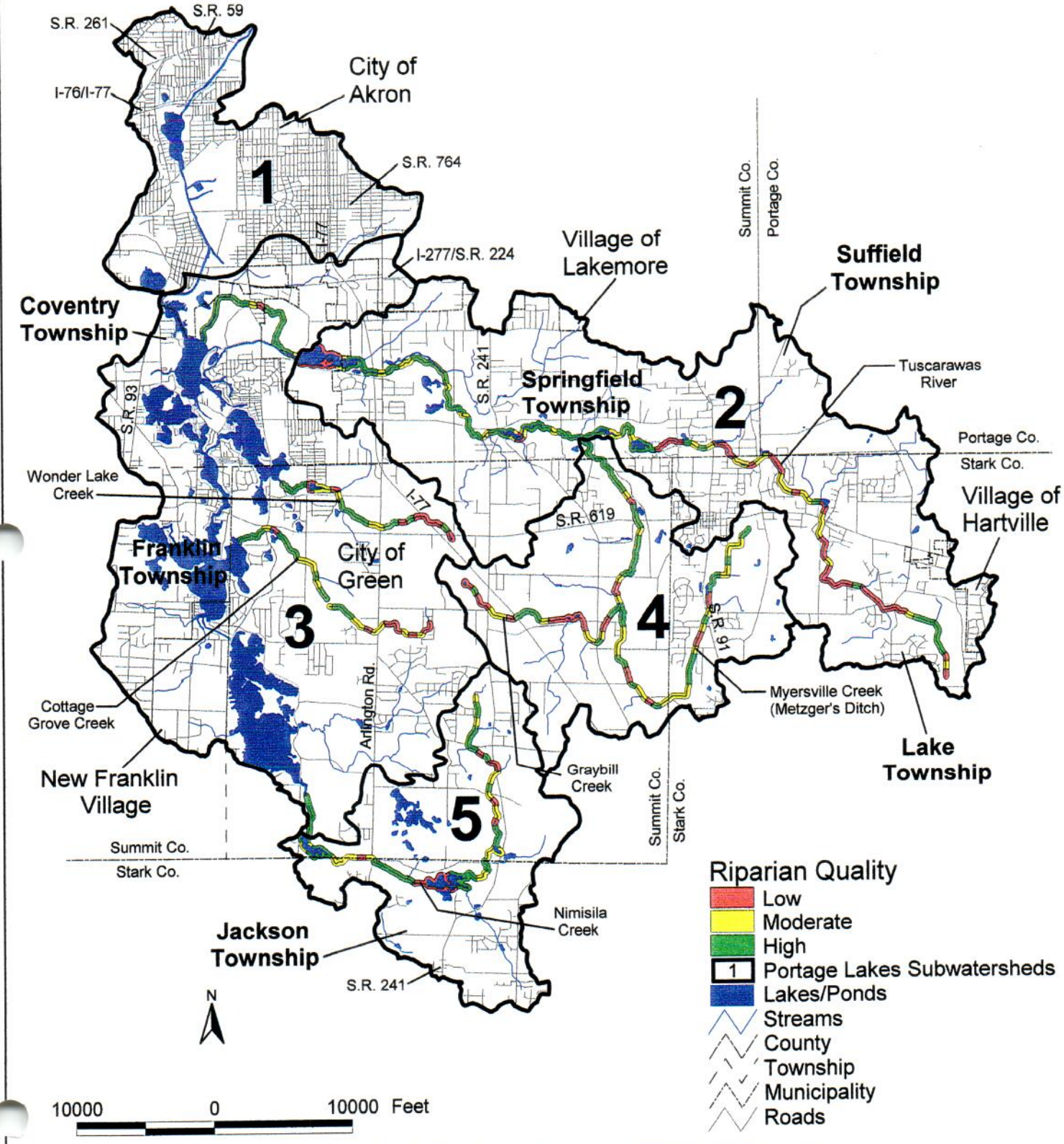
Table 24
Estimates of acreage of forest, swamp, shrub and old fields habitat along segments of the Tuscarawas River and other streams

Stream Name	Riparian Corridor (Acres)			Max. Acres (Evaluated acres)	Total Stream Corridor Area* (acres)	Percent of Stream Corridor as H.Q. Habitat**
	Left Bank	Right Bank	Total			
Tuscarawas River Mainstem	114.69	101.45	216.14	547.29	820.94	40
Myersville Creek	62.13	56.75	118.88	268.14	402.20	44
Graybill Creek	10.83	8.72	19.55	102.85	154.27	19
Wonder Lake Creek	22.16	20.49	42.65	110.19	165.29	39
Cottage Grove Creek	20.64	18.31	39.95	124.89	187.33	31
Nimisila Creek	34.71	42.05	76.76	224.06	336.09	34

* Total stream corridor is equivalent to the length of evaluated area and 200' on either side of the stream times the total number of segments.

** This percentage represents the amount of acreage relative to maximum obtainable, then extrapolated out to the total riparian area segment (400' x 600'). Note this High Quality (HQ) habitat is described as forest, swamp, shrub and old field.

Figure 14
Riparian Habitat Quality
Upper Tuscarawas River Watershed



Northeast Ohio Four County Regional Planning and Development Organization, 1998.
Source Material: ODNR, Division of Real Estate and Land Management; Stark County Regional Planning Commission; Akron Metropolitan Area Transportation Study; USGS.

Figure 15

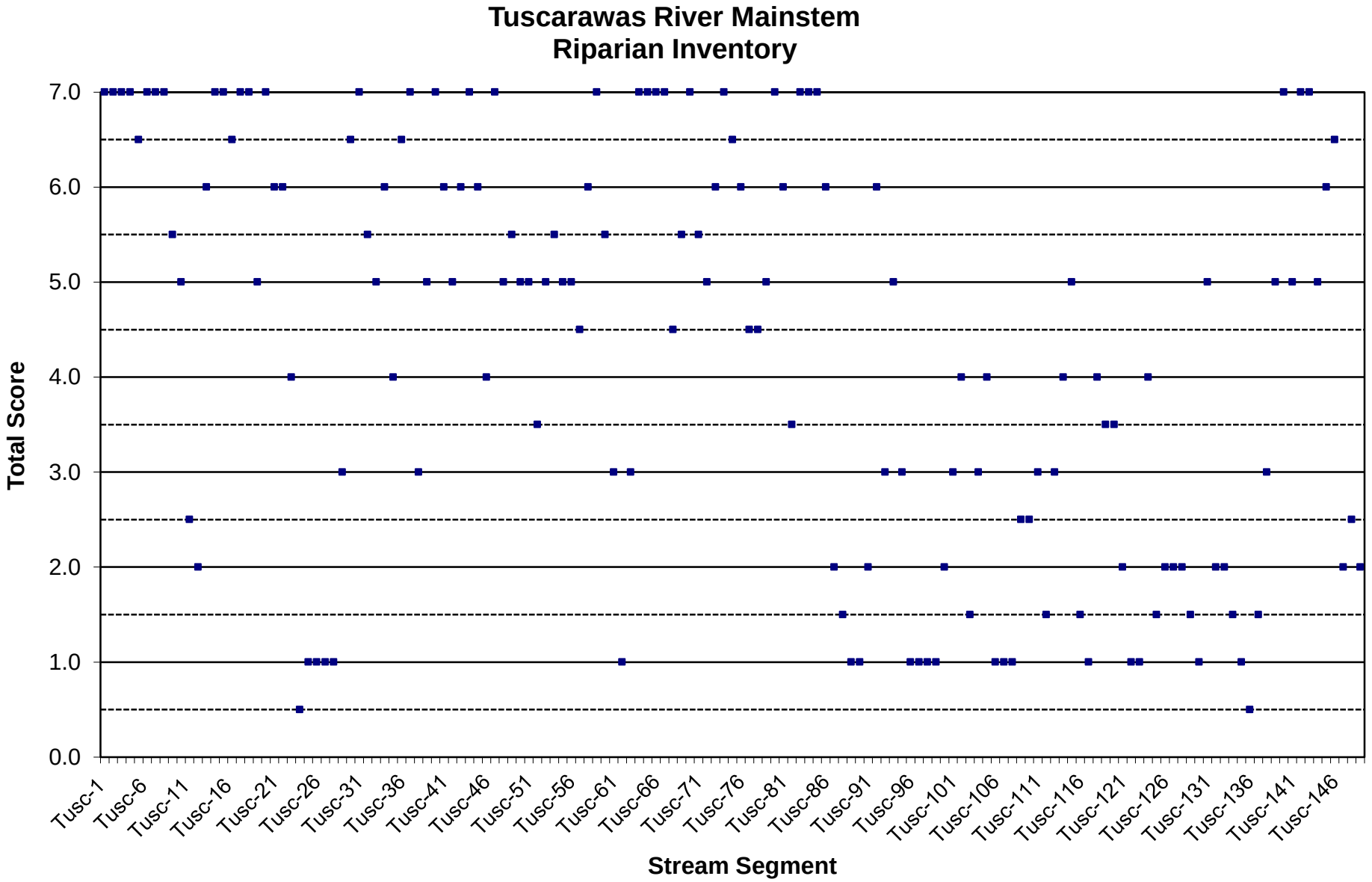

Tuscarawas River Mainstem
Riparian Inventory
Total Score
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Tusc-1
Tusc-6
Tusc-11
Tusc-16
Tusc-21
Tusc-26
Tusc-31
Tusc-36
Tusc-41
Tusc-46
Tusc-51
Tusc-56
Tusc-61
Tusc-66
Tusc-71
Tusc-76
Tusc-81
Tusc-86
Tusc-91
Tusc-96
Tusc-101
Tusc-106
Tusc-111
Tusc-116
Tusc-121
Tusc-126
Tusc-131
Tusc-136
Tusc-141
Tusc-146
Stream Segment

Figure 16
Myersville Creek
Riparian Inventory

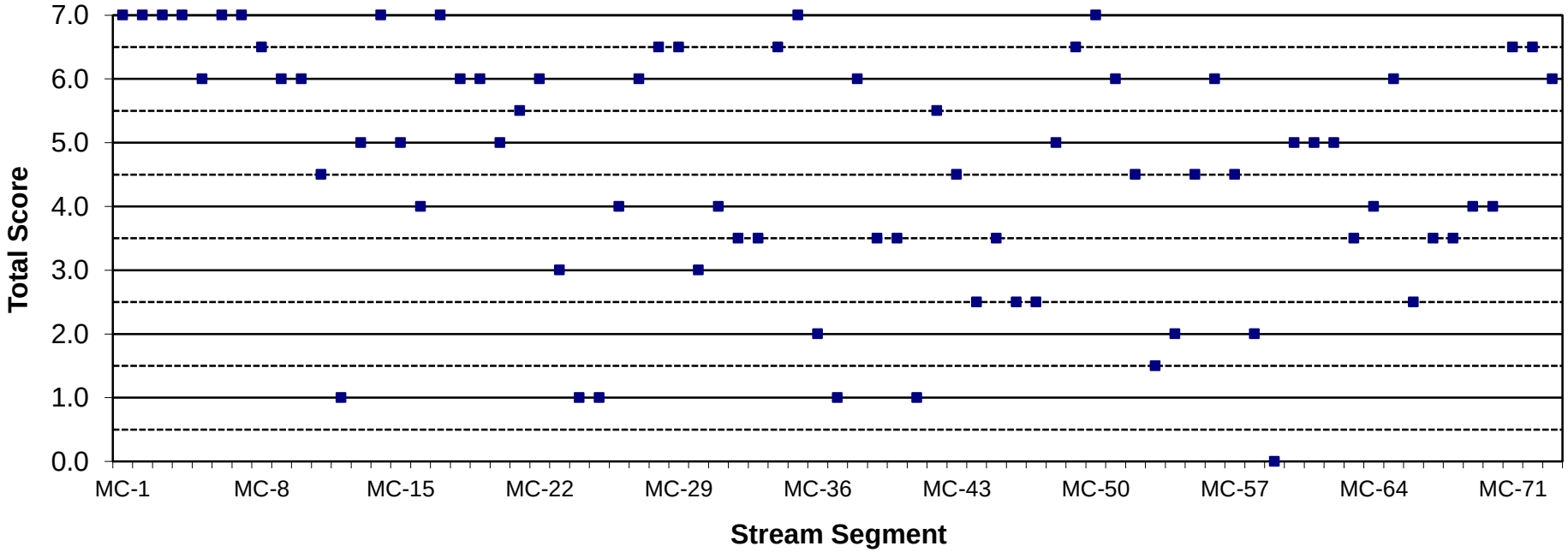


Figure 17
Graybill Creek
Riparian Inventory

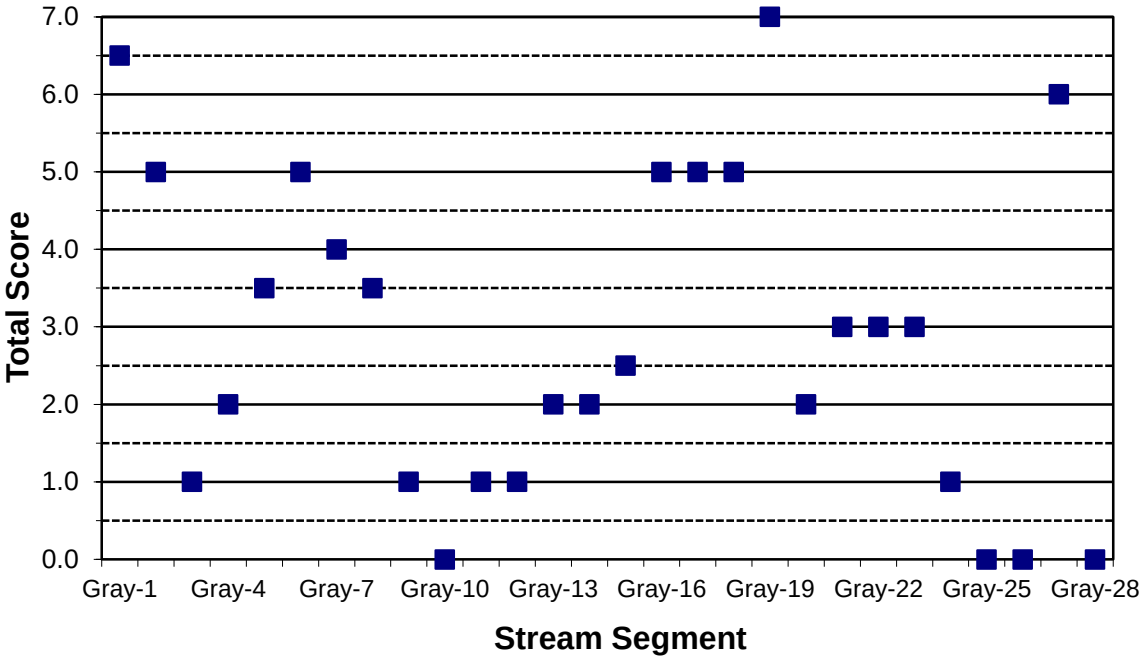


Figure 18
Wonder Lake Creek
Riparian Inventory

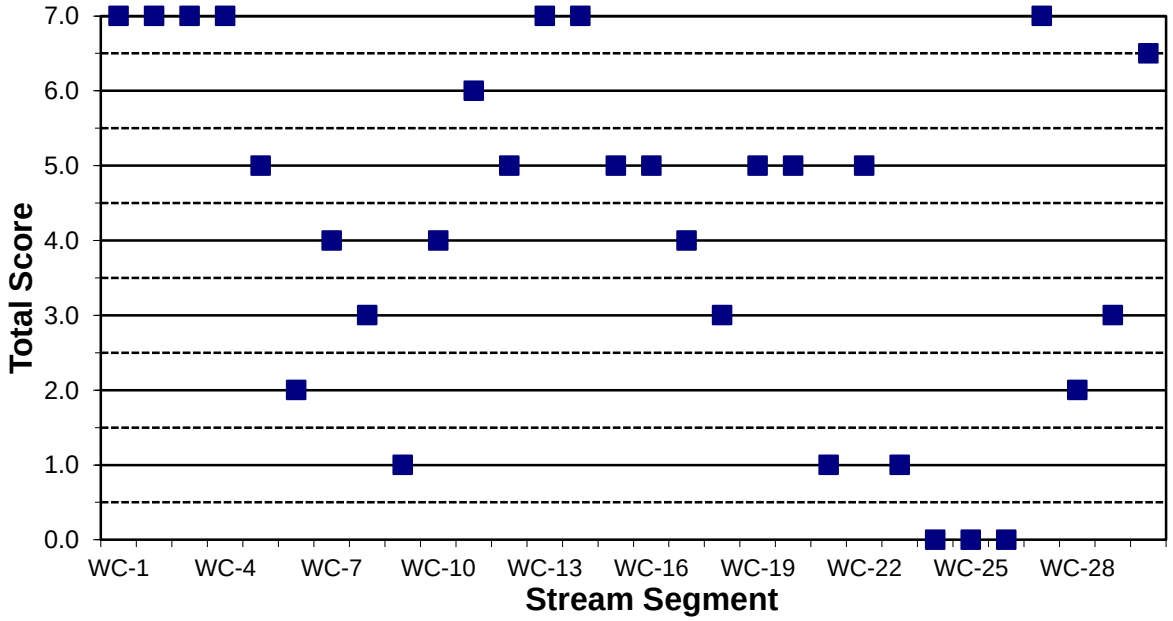


Figure 19
Cottage Grove Creek
Ripaian Inventory

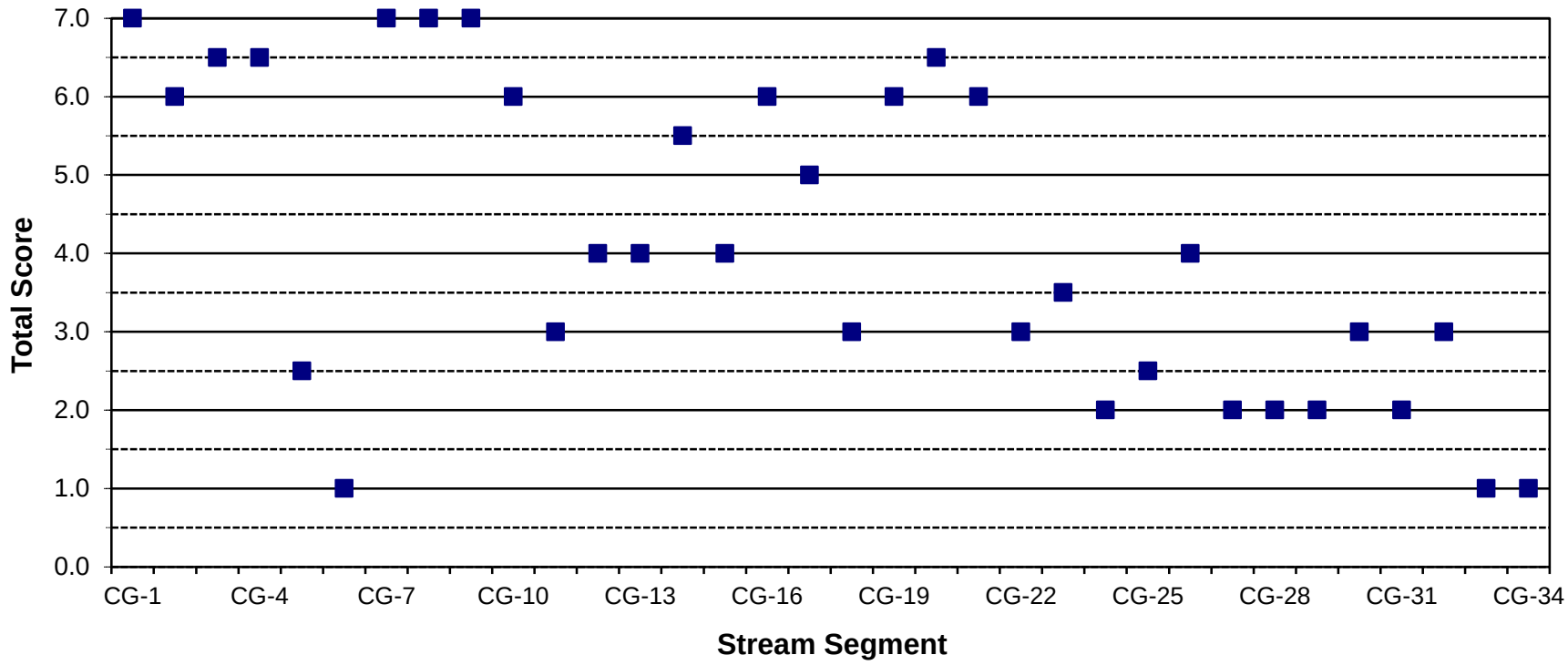
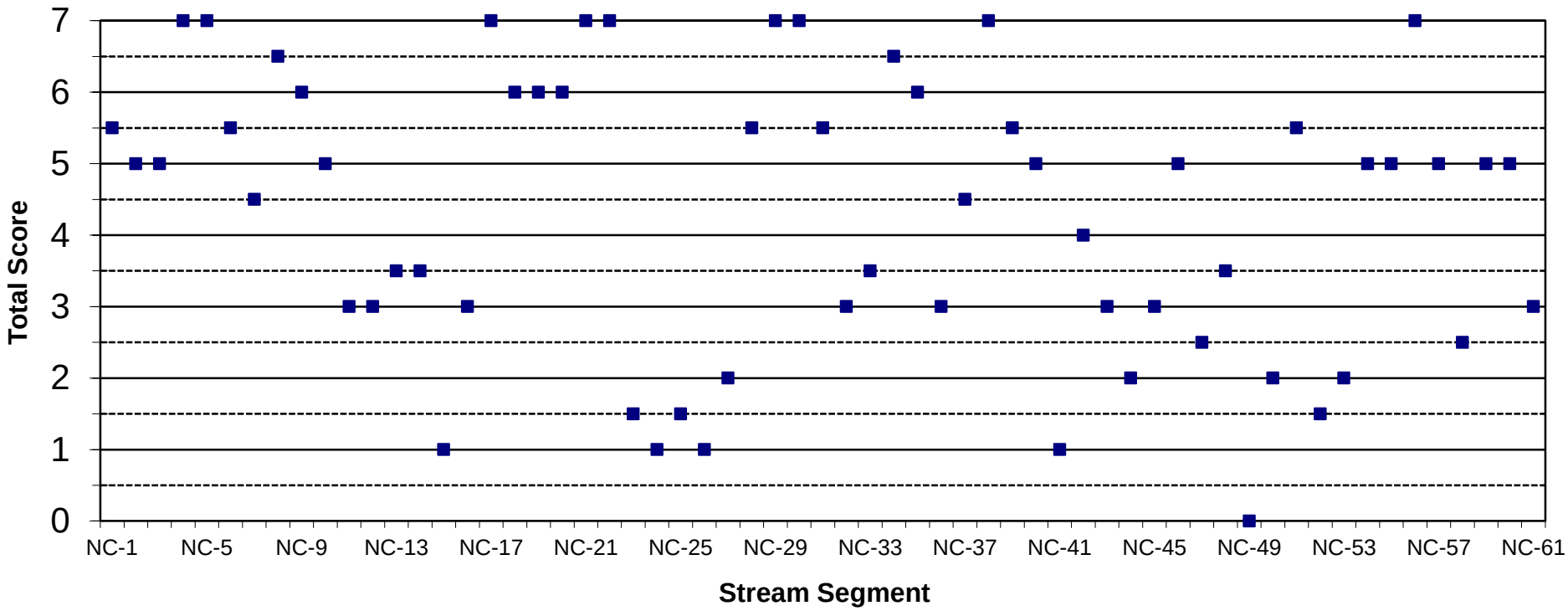


Figure 20
Nimisila Creek
Riparian Inventory



Stream Gradient and Riparian Description

The following stream gradient (Figure 21) helps characterize streams by offering a cross-sectional representation of stream fall from its source to its mouth for each evaluated stream in the Upper Tuscarawas River Watershed. Typically, streams with a steep gradient have more energy available for stream flow, which increases its capacity to headwardly erode transporting sediment loads and debris downstream, depositing its stream load as the stream gradient diminishes as it approaches the convergence with the mainstem or higher order stream or local base level.

The following description of each evaluated watercourse is based on aerial photo interpretations of the Upper Tuscarawas River Watershed, and is provided so the reader will have a better understanding of the existing conditions of the riparian corridor within the watershed.

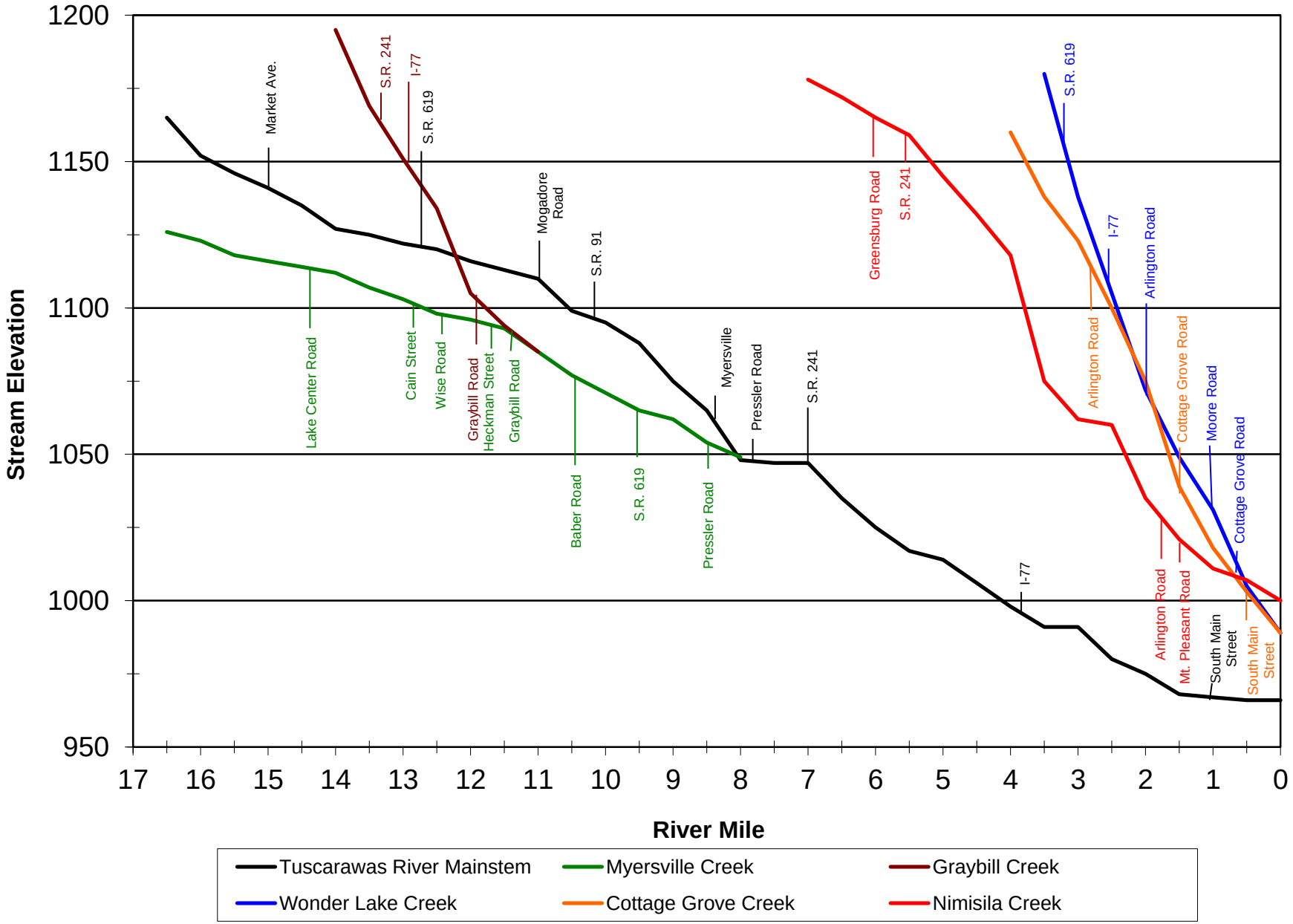
The Tuscarawas River headwaters begin in Lake Township of Stark County, flowing northwesterly through Springfield Township, Coventry Township and a portion of the City of Akron. Its average stream gradient is approximately 11.75 feet/mile (Figure 21) with 0.22 percent slope (Table 25). The aerial photos show that the Tuscarawas River riparian habitat is fragmented and is being pressured by increasing urbanization. Much of the Tuscarawas River in the Stark County portion appears to have been modified by channelization and diminished riparian width and cover. The Ohio EPA 305b report (Appendix A) identified removal of riparian vegetation as a souce of impairment to assessed segments of the Tuscarawas River. However, even though the Tuscarawas River is pressured by development, three sections possess high quality habitat. These sections include stream segments along the area known as the Rubber City Wildlife Area between Pickle and Arlington Roads, the Firestone Metro Park (Warren Road to South Main Street) and from just west of South Main Street to the confluence of Long Lake.

Myersville Creek enters the Tuscarawas River near river mile (R.M.) 8.2. Its average stream gradient is approximately 9.28 feet/mile (Figure 21) with 0.18 percent slope (Table 25). Myersville Creek flows south, originally from the southwest corner of the 619 and Mogadore Road intersection. The creek appears to be channelized or modified along its entire course within Stark County, flowing through fragmented habitat in mix of residential, shrub, old field and wooded areas. As Myersville Creek enters Summit County, it turns north, initially flowing through an agricultural zone until it reaches Hickman Road where housing density increases up to Raber Road. Once north of Raber Road, the riparian habitat, up to the confluence with the Tuscarawas River, greatly improves, flowing through primarily forested/swamp areas interspersed with a few segments affected by residential areas and mining activity.

Graybill Creek enters Myersville Creek at approximately R.M. 3.0. Its average stream gradient is approximately 34.59 feet/mile (Figure 21) with 0.65 percent slope (Table 25). Graybill Creek begins at the Akron/Canton Industrial Park and flows east through an urbanized area for the first five segments. East of Massillon Road, the stream flows

Figure 21

Stream Gradients for the Upper Tuscarawas River Watershed



Subwatersheds 2, 3, 4 and 5

primarily through agricultural areas with limited riparian cover and width. Graybill Creek habitat appears to have been directly affected by increased housing, development and golf courses. Numerous segments have little to no riparian cover or riparian width due to riparian corridor destruction, and in fact two segments of Graybill Creek have been culverted or piped.

Table 25
Average Stream Gradient and Percent of Slope

Stream Name	Average Stream Gradient	Percent of Slope
	height/length = avg. stream gradient	vertical distance/horizontal distance x 100 = % of slope
Tuscarawas River Mainstem	199'/16.93 mi. = 11.75'/mi	199'/89,400' X 100 = .22% of slope
Myersville Creek	77'/8.30 mi. = 9.28'/mi	77'/43,800' X 100 = .18% of slope
Graybill Creek	110'/3.18 mi. = 34.59'/mi	110'/16,800' X 100 = .65% of slope
Wonder Lake Creek	191'/3.41 mi. = 56.01'/mi	191'/18,000' X 100 = 1.06% of slope
Cottage Grove Creek	171'/3.86 mi. = 44.30'/mi	171'/20,400' X 100 = .84% of slope
Nimisila Creek	178'/6.93 mi. = 25.69'/mi	178'/36,600' X 100 = .49% of slope

Cottage Grove Creek is a tributary of Mud Lake. Its average stream gradient is approximately 44.30 feet/mile (Figure 21) with 0.84 percent slope (Table 25). Cottage Grove Creek begins east of Arlington Road where the first seven segments show riparian habitat modification. However, once west of Arlington Road, the stream flows through fragmented riparian habitat dominated by agricultural land use and high quality habitat to Mud Lake, with the exception of two commercialized segments near the intersection of State Route 619 and Main Street.

Wonder Lake Creek is a tributary to a bay of East Reservoir known as Cottage Grove Lake. Its average stream gradient is 56.01 feet/mile (Figure 21) with 0.84 percent slope (Table 25). Wonder Lake Creek begins just south of the intersection of 619 and Pickle Road and north of I-77. The headwaters portion of the stream has been severely altered by housing and commercial development to Arlington Road. However, east of Arlington Road the stream enters high quality habitat, with only a few segments affected by residential areas.

Nimisila Creek is a tributary to Nimisila Lake. Its average stream gradient is 25.69 feet/mile (Figure 21) with 0.49 percent slope (Table 25). Nimisila Creek begins west of the Massillon Road and Wise Road intersection flowing south through fragmented habitat to Koons Road where the riparian habitat improves without being fragmented. The stream then flows west through Singer Lake, which is surrounded by housing.

Once the stream exits Singer Lake, the riparian habitat consists mostly of wide to moderate riparian width consisting of forest/swamp and shrub/old field flood plain quality prior to entering Lake Noah where the stream may continue toward either Comet Lake or to Nimisila Lake, retaining its high quality riparian habitat to the confluence of Nimisila Lake.

Conclusion

Based on the results of the riparian habitat evaluation for the watershed, and in comparison to a 1996 NEFCO Upper Tuscarawas River riparian evaluation that used 1990 aerial photos, NEFCO has been able to conclude that residential and commercial development within the watershed continue to threaten riparian habitat as they had in the previous study. Furthermore, the evaluation determined that residential and commercial development pressures in the watershed continue to exacerbate the loss of riparian habitat through habitat modification caused by channelization, streambank alteration, stream burial, removal of riparian vegetation, and an increase in impervious surfaces. Such impacts contribute to the instability of riparian corridor ecosystems, and raise serious concerns regarding water quality issues by increasing the amount of storm water runoff, streambank erosion, sedimentation, loss of shading, and the inability to serve as filter areas to trap sediment. If the trend continues, serious problems may also develop from storm water runoff, i.e. pollutant loading, increased peak flows, and velocity of water in streams caused by storm events. Further, flooding from exacerbated storm water runoff is likely to be problematic to downstream homeowners who live along the affected watercourse.

The riparian habitat evaluation revealed that overall 34.5 percent of the six waterways were of high quality habitat. The 34.5 percent of high quality habitat is a decrease from the 1990 data set in which 55 percent (NEFCO, 1996, p. 39) of the riparian corridor consisted of high quality habitat. One should be cautious with regard to the significant drop of high quality habitat because interpretation of the blue line aerial photos is subjective even when one follows a specific methodology. Table 24 indicates that Myersville Creek had the highest percentage of high quality habitat (39.50 percent) while Graybill Creek, unquestionably the stream that is the most impacted by development pressure, received the lowest percentage of high quality riparian habitat with only 19.01 percent.

Table 22 indicates that the following streams received average riparian habitat scores: Tuscarawas River - 4.23; Myersville Creek - 4.63; Graybill Creek - 2.80; Wonder Lake Creek - 4.15; Cottage Grove Creek - 4.13; and Nimisila Creek - 4.29. Consequently, Graybill Creek's 2.80 average riparian habitat score, coupled with its 19.01 percent of high quality habitat, should be regarded as a "priority" stream for restoration efforts. However, one must consider whether it is reasonable and logical to target a stream that has already been so adversely impacted by development because such a stream may be too far gone to make a difference. Figure 14, a distribution of riparian habitat

scores, could be used to target severely altered riparian segments for remediation activities or target areas with intact riparian habitat for protection/preservation efforts.

V. Portage Lakes Task Force

Summary

The Portage Lakes Task Force (PLTF) was formed to assist with efforts to protect and/or restore water quality in the Upper Tuscarawas River Watershed. The PLTF includes representatives from state and local governments, citizens groups, and members of the community. Members of the PLTF meet as needed to review watershed projects and provide feedback to improve the effectiveness of such projects. Two sets of PLTF Meetings were held in 1998 to evaluate existing threats to water quality and review the initial watershed action plan. This report provides an overview of the meetings, materials from the meetings, and a discussion of the results.

Each set of meetings contained an afternoon and an evening meeting. The first set of meetings identified potential pollution sources in the watershed and participants discussed their possible effects on surface and/or ground water quality. The second set of meetings focused on a review of the initial watershed action plan. These meetings assisted in summarizing information from previous meetings and reports in addition to new information.

Introduction

A multi-faceted approach is necessary to protect and restore healthy water quality in the Upper Tuscarawas River Watershed. Participation by several agencies responsible for land stewardship would be a cost effective activity to undertake as a component to a successful action plan. This would capitalize on the expertise and resources from a variety of agencies. The action plan needs to coordinate tasks and work elements wherever possible to maximize the benefits of protecting and restoring water quality.

Discussion

A variety of agencies and organizations are included in the PLTF in an attempt to achieve a balance of perspective and to identify all possible resources for future work. Organizations and agencies identified include the local Home Builders Association, local health departments, SWCDs, local planning departments, Ohio EPA, ODNR and concerned citizen groups. A list of the individuals and agencies is included in Appendix Q.

The first set of meetings took place on June 22 and August 18, 1998. The purpose was to introduce new comers to the watershed, review previous meetings and reports, provide an overview of the work plan, and evaluate potential pollution sources within the watershed. Copies of the news release, meeting announcement, agenda, sign-in sheet, and meeting materials are included in Appendix F. The June 22 meeting

participants felt that an additional potential pollution source should be included on the list - Giant Canada Geese.

Two home owners who attended the August 18 meeting expressed concern regarding an exposed Marathon pipeline in subwatershed 2. Meeting participants felt that sod farms should be included in the potential pollution sources. The president and members of the grassroots group Concerned Citizens of Lake Township (CCLT) voiced concerns regarding the Industrial Excess Landfill (IEL) and its potential to impair surface and/or ground water quality.

The second set of meetings took place on October 14 and October 21, 1998. The result of the Pollution Potential Ratings and an overview of the Critical Resources and Riparian Zone Analysis were presented. The primary focus of these meetings was to evaluate the initial Watershed Action Plan. Copies of the news release, meeting announcement, agenda, sign-in sheet, and meeting materials are included in Appendix G. A representative of the Portage Lakes Advisory Council (PLAC) voiced concerns pertaining to a future area of development known as the "Dollar Lake Project." Other meeting participants recommended that establishing local/area household hazardous waste drop-off facilities or pick-up days should be included in the Watershed Action Plan. Other action plan recommendations included encouraging proper authorities to create an appropriate life-span for underground storage tanks (USTs) and requiring replacement of tanks after this determined life-span, and locating future water line extensions to assist in determining the potential for well abandonment.

Conclusion

The PLTF can serve as a key ingredient to the success of the Watershed Action Plan as it orchestrates the team approach to solving the water quality problems in the watershed. However; the PLTF Meetings in 1998, which were open to the public, revealed the need for greater participation at such meetings.

There appeared to be good support during PLTF Meetings held in 1996 for initiating a management committee with local leaders using NEFCO, PLAC, SWCD, and other agencies as the base. The committee would be refined to involve the public and formalize their organization as a working coalition from this base of agencies. The coalition could obtain funding for projects and coordinate intercommunity actions. NEFCO's role would be to facilitate and support the coalition; however, a grassroots organization would be the best group to accomplish the actions.

VI. Watershed Action Plan

Summary

NEFCO utilized the results from the public meetings and the ratings of the Potential Pollution Sources to guide the formation of the Upper Tuscarawas River Watershed Action Plan. Previous reports and additional information, pertaining to nonpoint and point source pollution, also aided in the creation of this plan.

First, problems were identified, which lead to the development of goals, objectives, actions and priority areas. After each objective was determined, they were assigned one or more actions to achieve the desired goal. Possible funding sources, estimated time frames, expected improvements, and evaluations for each action were included during the final stages of the plan.

Introduction

A watershed action plan is simply a strategic action plan focusing on watershed issues. The ultimate goal for a watershed action plan is the restoration or preservation of beneficial uses within the watershed. These include unrestricted consumption of fish and wildlife and drinking water, restoration of aquatic and terrestrial biotic communities and their habitats, and unrestricted recreational and commercial uses (C.R.R.A.P., 1992, pp. 2-19). Every watershed is unique and strategies to protect and/or restore them should reflect this. Each watershed has specific characteristics and problems related to a variety of factors, such as geography, geology, population density, economics, and present water quality. To assist in the plan's effectiveness, an inventory of possible sources of pollution in the watershed were identified from previous reports and recent research, and evaluated based on their relative contribution of pollutants. This is important since the water quality at any point in a stream is the product of all natural and human activities in the drainage area above that point (Ohio EPA 1997, pp.2-3).

The development of a watershed action plan for the Upper Tuscarawas River Watershed involves an itemization of the problems, priorities and activities the PLTF and other local organizations would like to address. It provides guidance by outlining a strategy to address water quality concerns. The process of developing a watershed action plan elicits a comprehensive understanding of water resources and the various interests involved. As a result of this plan, NEFCO hopes to promote a better perception of pollution sources and attainable solutions. This will pave the way for the next phase--feasibility and implementation; once additional funding is available.

Discussion

Properly managing urban, suburban and rural land uses along the Tuscarawas River, its tributaries and the Portage Lakes will improve the quality and productivity of this valuable natural resource. The Upper Tuscarawas River Watershed Action Plan is intended to guide the PLTF and other local organizations in their efforts to assist residents, developers, business owners, farmers, government officials, property owners and others in meeting this challenge. After existing water quality and possible pollution sources were evaluated, seven goals were identified. These are listed below:

Please note: These numbers do not necessarily refer to the order which goals should be addressed. However; goals 1-3 directly reflect the identified potential pollution sources with the highest potential to impair surface and/or ground water quality (Table 19 and Appendix I).

1. Reduce nutrient and bacteria loads, from fecal contamination, in lakes and streams
2. Decrease levels of toxic substances (heavy metals, oil/petroleum products, etc.) entering surface and/or ground water
3. Reduce impacts from sediment/siltation in lakes and streams
4. Protect and/or restore shorelines and riparian corridors in selected wetlands, lakes and streams
5. Reduce fertilizer, herbicide and pesticide runoff into the watershed
6. Reduce levels of salinity impacting surface and/or ground water quality, which will decrease levels of dissolved solids
7. Acquire stronger understanding, cooperation and participation regarding water quality issues

Objectives and priority areas have been identified to meet the goals of this plan. NEFCO and the PLTF have identified a series of actions to assist in realizing these objectives. Suggested responsible parties, possible funding sources, estimated time frames, expected improvements, and evaluations for each action have also been assigned. When funding becomes available, work plans will identify which actions will be undertaken as priorities and resources allow. Table 26 contains the action plan developed for the watershed. Appendix R contains a list of abbreviations/acronyms used in the plan.

In addition to the objectives listed in the plan, it was also recommended by Keith Riley (Ohio EPA-NEDO, DSW) that a 201/208 update process be conducted to put a Water Quality Managment Plan in place to protect the watershed by prescribing protective wastewater disposal options for new development in each subwatershed. Also, development of a “cradle to grave” approach was encouraged by Mr. Riley to ensure that HSDSs and SPSDSs do not impact surface water quality. This approach would include installer licensing and testing, inspection of system installation, a long term

operation inspection program, mandatory pumping program, system owner education, countywide septage disposal plans and facility upgrades. These could be facilitated by the Link Deposit and Rural Hardship Grant Program and supported by annual fees to pay for inspections, tracking, watershed surveys, and education programs. The establishment of county-wide septage disposal plans is an essential part of the successful implementation of the above proposed BMPs. Enforcement of Federal 503 Septage Regulations may result in an end to operations by septage land application haulers, making it essential to establish a grid of publicly-owned treatment works (POTWs) with septage receiving capabilities to accept septage generated by each county. The Water Pollution Control Loan Fund (WPCLF) is a feasible funding source for the installation of septage facilities at POTWs.

Table 27 lists specific stream segments for Objective 4.1--protecting or restoring riparian corridors. Table 28 lists specific areas for Objective 4.2--protecting or restoring shorelines of wetlands. These areas were identified using the results of the Riparian Zone Analysis and the Critical Resources Study, in addition to close observation of 1997 orthophotos. Field verification is recommended before planning specific activities in these areas.

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Goal 1: Reduce nutrient and bacteria loads, from fecal contamination, in lakes and streams						
Objective 1.1: Decrease potential nutrient and bacteria loads from **discharging off-lot**, i.e., point source, home/semi-public sewage disposal systems (HSDSs) and (SPSDSs)						
Priority Areas: Subwatersheds 2 and 3; especially along SR. 619, S.R. 241 and to the east of S.R. 93						
a. Establish a permit system to facilitate HSDS and SPSDS inspection and maintenance	State and Local Health Departments OEPA	Local Property/Home Owner Operation & Maintenance Fee	3 years	Lower number of malfunctioning/failing HSDSs and SPSDs	Number of systems inspected, pumped, and/or repaired	
b. Seek funding assistance and repair or replace faulty HSDSs and SPSDSs	Local Health Departments	NPS Program (ODNR) WPCLF WPCLF (Linked Deposit) PL-566 CWA Section 319 NPS (OEPA)	3 years	Lower number of malfunctioning/failing HSDSs and SPSDSs	Number of systems repaired or replaced	
c. Provide support to research cost effective and environmentally-sound alternatives to control water pollution from HSDSs and SPSDSs, e.g., constructed wetlands	Local Health Departments NEFCO	WPCLF WPCLF (Linked Deposit) PL-566 R&D Grant	3 years	Viable alternatives to control water pollution from HSDSs and SPSDSs, especially where current technology is limited, e.g. poor soils	Types of research conducted, data collected, and results	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
d. Establish education efforts to increase public awareness on faulty HSDSs and SPSDSs 1) Door-to-door survey 2) Distribute information materials where needed, e.g., video "Dollars Down the Drain", soil pipe sticker to remind homeowners when to pump septic tanks 3) Hold public meetings 4) Set up information booths at county/local fairs	Local Health Departments NEFCO	NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Increased awareness of water quality impacts associated with malfunctioning/failing HSDSs and SPSDSs	1) Number surveys completed 2) Number of information materials distributed 3) Number of public meetings held 4) Number of fairs with information booths	
e. Promote the extension of sewers in the watershed, especially where high concentrations of HSDSs and SPSDSs are located on poor soils for septic systems	State and Local Governments County Sanitary Engineer State and Local Health Departments	WPCLF Local Property/Home Owners (through assessments) County/Local Government	3 years	Lower number of Malfunctioning/failing HSDSs and SPSDSs	Level of interest in extending existing sewered areas and future plans/projects	
Objective 1.2: Decrease potential nutrient and bacteria loads from **failing on-lot (non-discharging)** home/semi-public sewage disposal systems (HSDSs) and (SPSDSs)						
Priority Areas: Subwatersheds 2 and 3, especially along SR. 619, S.R. 241 and to the east of S.R. 93						
a. Establish a permit system to facilitate HSDS and SPSDS inspection and maintenance	State and Local Health Departments OEPA	Local Property/Home Owner Operation & Maintenance Fee	Once every 3 years	Lower number of malfunctioning/failing HSDSs and SPSDs	Number of systems inspected, pumped, and/or repaired	
b. Seek funding assistance and repair or replace faulty HSDSs and SPSDSs	Local Health Departments	NPSProgram (319 Grants) WPCLF WPCLF (Linked Deposit) PL-566 CWA Section 319 NPS	3 years	Lower number of malfunctioning/failing HSDSs and SPSDSs	Number of systems repaired or replaced	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
c. Provide support to research cost effective and environmentally-sound alternatives to control water pollution from HSDSs and SPSDSs, e.g., constructed wetlands	Local Health Departments NEFCO	NatureWorks NPS Program (ODNR) WPCLF WPCLF (Linked Deposit) PL-566 R&D Grant CWA Section 319 NPS (OEPA)	3 years	Viable alternatives to control water pollution from HSDSs and SPSDSs, especially where current technology is limited, e.g. poor soils	Types of research conducted, data collected, and results	
d. Establish education efforts to increase public awareness on faulty HSDSs and SPSDSs 1) Door-to-door surveys 2) Distribute information materials where needed, e.g., video "Dollars Down the Drain", soil pipe sticker to remind homeowners when to pump septic tanks 3) Hold public meetings 4) Set up information booths at county/local fairs	Local Health Departments NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Increased awareness of water quality impacts associated with malfunctioning/failing HSDSs and SPSDSs	1) Number of surveys completed 2) Number of information materials distributed 3) Number of public meetings held 4) Number of fairs with information booths	
e. Promote the extension of sewers in the watershed, especially where high concentrations of HSDSs and SPSDSs are located on poor soils for septic systems	State and Local Governments County Sanitary Engineer State and Local Health Departments	WPCLF Local Property/Home Owners (through assessments) County/Local Government	3 years	Lower number of Malfunctioning/failing HSDSs and SPSDSs	Level of interest in extending existing sewered areas and future plans/projects	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Objective 1.3: Reduce nutrient and bacteria loads from livestock						
Priority Areas: To be determined						
a. Identify and assess all livestock operations in the watershed and map target areas	USDA/NRCS ODA OSU Extension NEFCO County SWCDs	NatureWorks CWA Section 319 NPS (OEPA)	3 months	Stronger understanding of where potential sources of pollution are located and their severity	Map and list of all livestock operations in the watershed with target areas	
b. Plan and implement manure management plans on agricultural operations	USDA/NRCS ODNR/DSWC County SWCDs	EQIP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit) PL-566 R&D Grant	1 year	Reduced levels of nutrient and bacteria contamination	Number of manure management plans implemented and degree of success	
c. Establish settling, grass filtration or soil infiltration systems around animal feeding and containment areas, e.g., buffer strips	USDA/NRCS ODNR/DSWC County SWCDs	EQIP CRP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit) PL-566 CWA Section 319 Grant (OEPA)	1 year	Reduced agricultural runoff into lakes and streams	Number of buffer strips established and maintained	
d. Implement fencing and development of off-stream watering facilities to limit or exclude livestock from stream areas	ODNR/DSWC County SWCDs	EQIP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit) PL-566 CWA Section 319 Grant (OEPA) SIP	1 year	Reduce point source pollution by livestock	Number of off-stream watering facilities developed and length of fencing around lakes and streams	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
e. Fund alternative technology for farm waste treatment, e.g., constructed wetlands	ODA ODNR/DSWC County SWCDs	EQIP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit) PL-566 R&D Grant CWA Section 319 Grant (OEPA)	3 years	Viable alternatives to treat manure effectively	Types of research conducted, data collected, and results	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Objective 1.4: Reduce excess (those over MCLs and MCL goals) nutrient and bacteria loads from wastewater treatment plants (WWTPs)						
Priority Areas: Subwatersheds 2 and 3, especially along S.R. 93						
a. Require stricter final effluent self-monitoring requirements for WWTPs under 0.25 mgd 1) Add monitoring of nitrate and nitrites to the list of parameters to be tested for WWTPs under NPDES permits with design flows <0.25 mgd 2) Add monitoring of phosphorus to the list of parameters to be tested for WWTPs under NPDES permits with design flows <0.1 mgd b. Support Ohio EPA's statewide general permit to regulate treated wastewater discharges from small systems (≤0.025 mgd)	OEPA/DSW Local Health Departments NEFCO		1 year	Better understanding and control of pollutants from WWTPs with design flows less than .25 mgd	Additional nutrient parameters added and statewide general permit recognized by local government and residents	
Objective 1.5: Reduce excess nutrients and bacteria from natural sources						
Priority Area: Subwatershed 3, with an emphasis on landowners with riparian or shoreline property						
a. Educate shoreline and riparian landowners on ways to deter waterfowl from grazing on their property 1) Distribute information pamphlets	OEPA ODNR/Div. of Wildlife County SWCDs NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Reduced nutrients and bacteria from waterfowl	1) Number of information pamphlets distributed	
b. Educate pet owners about proper disposal of pet wastes 1) Distribute information pamphlets	County SWCDs NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Reduced nonpoint source pollution from domestic animal waste	1) Number of information pamphlets distributed	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Goal 2: Decrease levels of toxic substances (heavy metals, oil and petroleum products, etc.) entering surface and/or ground water						
Objective 2.1: Decrease contributions of toxic substances from landfills and dumps						
Priority Area: Subwatershed 4						
a. Identify priority sites for additional investigation and remediation efforts 1) Conduct adequate monitoring to determine the sources(s), pollutant(s) and severity of water quality degradation 2) Promote appropriate reuse of contaminated sites	OEPA/DERR State and Local Health Departments Private Sector	WPCLF CWA Section 319 NPS (OEPA) Private Sector	1 year	1) Acquire a defensible base of information for future action 2) Decreased health hazards from contaminated sites	1) Number of water samples collected, results and conclusion(s) 2) Number and types of actions taken to ensure appropriate reuse of contaminated sites	
b. Initiate volunteer clean-up days for illegal dumping areas	OEPA Local Health Departments Grassroots/citizen-based Groups	NPS Education Grant NPS Program (ODNR) OEEF WPCLF CWA Section 319 NPS (OEPA)	2 months per clean-up day	Lower number of illegal dumps	Number of clean-up days organized and amount of refuse collected and hauled to appropriate facilities	
c. Enforce stricter penalties against illegal dumping	Local Governments		1 year	Decrease illegal dumping	Stricter penalties imposed	
d. Establish hazardous waste drop-off facilities; where needed, for local communities and/or hazardous waste pick-up days	Solid Waste Districts State and Local Health Departments Private Sector	NatureWorks NPS Program (319 Grants) WPCLF PL-566 CWA Section 319 NPS Private Sector	1 year	Decrease illegal dumping	Number of drop-off facilities established or pick-up days held	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Objective 2.2: Decrease levels of toxic substances from industrial land use areas						
Priority Areas: Subwatersheds 1 and 2						
a. Identify by-products of industrial processes taking place in the watershed and educate owners/operators about the hazards of negligent management of such substances	OEPA State and Local Health Departments Private Sector	NatureWorks NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Lower releases of toxic substances from industrial operations	A listing of identified by-products from industrial processes and names and numbers of owners/operators educated about the hazards of negligent management	
b. Educate owners/operators of industrial facilities about the benefits of implementing preventive and control measures (BMPs) to reduce pollutants	Local Governments OEPA NEFCO	NatureWorks NPS Education Grant NPS Program (ODNR) OEEF WPCLF (Linked Deposit) PL-566 CWA Section 319 NPS (OEPA)	6 months to 1 year	Increased awareness about the benefits of BMPs and reduced levels of pollutants from industrial land use areas	List of contacts and number of operations that have implemented BMPs to reduce pollutants	
Objective 2.3: Decrease levels of toxic substances from storm water runoff						
Priority Areas: Subwatersheds 1 and 3						
a. Implement a regional/ watershed-based storm water management plan	ODNR/DSWC County SWCDs County Engineer NEFCO	EQIP NatureWorks NPS Program (ODNR) WPCLF PL-566 CWA Section 319 NPS (OEPA) Storm water utility	3 years	Improved water quality and moderated peak storm water flows	Completion of the plan and level of participation	
b. Implement NPDES Phase II Storm Water Program	Local Governments	WPCLF Storm water utility		Improved water quality and moderated peak storm water flows	Implementation of program	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
c. Implement preventative measures to reduce storm water runoff 1) Educate homeowners on proper use and disposal of household hazardous waste and the importance of proper operation and maintenance of stormwater control devices, e.g., debris and sediment removal from channels, pipes and pumps 2) Begin a storm drain stenciling program 3) Limit the amount of impervious areas for commercial establishments 4) Organize hazardous waste drop-off facilities; where needed, for local communities and/or hazardous waste pick-up days	1) Local Health Departments County SWCDs NEFCO Solid Waste Districts Private Sector 2) County SWCDs NEFCO 3) Local and County Planning and Zoning Boards 4) Solid Waste Districts State and Local Health Departments Private Sector	NatureWorks NPS Education Grant NPS Program (ODNR) OEEF WPCLF CWA Section 319 NPS (OEPA) Private Sector	2 years	Lower levels of toxic substances entering the environment from storm water runoff	1) Education efforts conducted 2) Development of and participation in a storm drain stenciling program 3) Permits or ordinances in effect 4) Number of drop-off facilities or pick-up days organized	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
d. Implement control measures to reduce storm water runoff and/or improve water quality 1) Research first flush or end-of-pipe treatment requirements, e.g., stormceptor vortex 2) Require catch basins for parking lots over a specified size 3) Install detention and/or retention ponds and treatment systems for water quality improvement 4) Route drainage from impervious surfaces to pervious areas (as soils allow) 5) Routine/scheduled street sweeping	1) OEPA/DWPC County Engineer Private Sector 2) Local and County Planning and Zoning Boards County Engineer 3) ODNR/DSWC County SWCDs County Engineer Private Sector 4) ODNR/DSWC County SWCDs County Engineer Private Sector 5) ODOT	EQIP NatureWorks NPS Program (ODNR) WPCLF WPCLF (Linked Deposit) PL-566 R&D Grant CWA Section 319 NPS (OEPA) Private Sector	2 years	Lower levels of toxic substances entering the environment from storm water runoff	1) Requirements established and enacted 2) Requirements established and enacted 3) Number of ponds and treatment systems installed 4) Number of drainage areas diverted from impervious surfaces to pervious areas 5) Number of communities participating in routine/scheduled street sweeping	
e. Locate historical spills and accidental release sites in the watershed	OEPA/DERR NEFCO	NatureWorks CWA Section 319 NPS (OEPA)	3 months	Insight regarding locations where there is a higher risk for polluted storm water runoff	Up-to-date list and map of spills and accidental releases in the watershed	
Objective 2.4: Decrease releases of toxic substances from underground storage tanks (USTs) and oil and gas pipelines						
Priority Areas: Subwatersheds 2, 3, 4 and 5						
a. Encourage regulations requiring USTs, over a certain age, to be replaced by new tanks	SFM/BUSTR Local Government Lobbying Groups Private Sector		1 year	Decrease releases from old USTs	Regulations developed and enacted	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
b. Identify UST problem areas and ensure that these areas are monitored adequately	SFM/BUSTR NEFCO Private Sector	NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit) CWA Section 319 NPS (OEPA)	1 year	Insight regarding areas with a high potential for releases of pollutants and decreasing the risk	Number of problem areas identified and appropriate person(s) contacted to ensure adequate monitoring	
c. Encourage consumers to purchase gasoline/diesel from service stations that equip USTs with leak detectors or other protective mechanisms and identify these by a decal on the pump, such as the Buckeye Leaf Symbol	NEFCO Private Sector	NPS Education Grant NPS Program (ODNR) CWA Section 319 NPS (OEPA) Private Sector	1 year	Increase in service stations which equip USTs with protective mechanisms through consumer demand	Level of increased business for service stations with decals associated with protective mechanisms	
Objective 2.5: Increase awareness regarding the location and pollution potential of oil and gas pipelines in relation to drinking water wells						
Priority Areas: Subwatersheds 3 and 5						

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
a. Identify all drinking water wells located within a prescribed distance of oil and gas transmission lines 1) Sample a percentage of all drinking water wells for the presence or absence of petroleum hydrocarbons representative of oil and gas and/or their byproducts 2) Provide pipeline and drinking water well location information to community planning and zoning officials and planning commissions 3) Recommend disclosure of pipeline locations to any person(s) purchasing property located within a prescribed distance of the known pipeline(s) 4) Recommend the use of treated public water supply to service residences within a prescribed distance of a known pipeline	ODNR/Div. of Oil and Gas Community Planning and Zoning Officials Planning Commission NEFCO	NatureWorks NPS Program (ODNR) PL-566 CWA Section 319 NPS (OEPA)	3 years	More precise locations of oil and gas pipelines, detection of leaks or ruptures in pipelines, increased knowledge regarding pipeline location and potential to pollute drinking water wells, and availability of other water resources	Detailed maps of oil and gas pipeline locations in relation to drinking water wells, number of wells monitored each year and results, and information regarding pipeline locations and proximity to wells available	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Objective: 2.6: Decrease ground water contamination from improperly constructed and/or abandoned drinking water wells						
Priority Areas: No specific areas identified at this time						
a. Identify wells abandoned prior to sealing requirements 1) Determine if wells were sealed properly 2) Properly abandon wells if needed	OEPA/DDAGW ODNR/DOW NEFCO State and Local Health Departments	NatureWorks NPS Program (ODNR) PL-566 CWA Section 319 NPS (OEPA)	3 years	Decrease ground water contamination from abandoned wells	List and map of all abandoned wells prior to sealing requirements 1) Number of these wells inspected for proper abandonment 2) Number of wells properly abandoned	
b. Seek proactive and consistent enforcement of well construction, maintenance and abandonment standards	OEPA/DDAGW ODNR/DOW State and Local Health Departments Private Sector		1 year	Decrease ground water contamination from wells	Level of enforcement and effectiveness of present standards	
c. Educate public and private well owners the hazards of ground water contamination and preventative measures 1) Distribute information pamphlets	OEPA/DDAGW ODNR/DOW State and Local Health Departments NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Increased awareness of ground water contamination associated with active or abandoned wells	1) Number of pamphlets distributed	
d. Identify critical NPS pollution areas in close proximity to abandoned wells and implement BMPs to reduce contamination risks	OEPA/DDAGW ODNR/DOW State and Local Health Departments NEFCO Private Sector	EQIP CRP NatureWorks NPS Program (ODNR) WPCLF WPCLF (Linked Deposit) CWA Section 319 NPS (OEPA)	1 year	Decrease ground water contamination from abandoned wells	Critical areas identified and number and location of BMPs implemented to reduce contamination risks	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Goal 3: Reduce impacts from sedimentation/siltation in lakes and streams						
Objective 3.1: Reduce soil erosion, transport, and deposition of sediment associated with construction sites						
Priority Areas: Subwatersheds 2, 3, 4 and 5; in close proximity to lakes and streams						

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
a. Support preventative measures to reduce impacts from construction sites 1) Encourage phasing of construction sites over a specified size 2) Develop and enforce zoning ordinances that restrict or require additional protective measures for development in sensitive areas, e.g., slopes >6%, wetlands, and slopes with high sediment yield 3) Initiate vegetative stabilization (seeding) of disturbed areas over a certain size and/or exposed for a specified length of time 4) Work with local communities to promote development that minimizes the percentage of impervious surfaces, such as open space zoning and cluster development 5) Assist communities with the development of township or municipal ordinances requiring construction sites to leave easements of a specified distance near shorelines of targeted wetlands and lakes and flood plains of targeted streams	1) County SWCDs Building Inspectors HBA 2) OEPA Local and County Planning and Zoning Boards Building Inspectors County Engineer Local Unit of Government 3) County SWCDs USDA/NRCS Building Inspectors 4) Local Planning and Zoning Boards County Engineer USDA/NRCS 5) Local Planning and Zoning Boards USDA/NRCS	State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit)	3 years	Reduce potential for sediment erosion, transport and deposition from construction sites	1) Number of construction sites phasing development 2) Zoning ordinances established and enacted 3) Locations with vegetative stabilization initiated 4) List of communities participating in promoting such development 5) List of townships or municipalities with ordinances established and enforced	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
b. Implement control measures to reduce impacts from construction sites 1) Conduct frequent inspection of construction site erosion and sediment control BMPs and approved plans, i.e., SWPPPs 2) Require building controls for individual lots 3) Maintain vegetated buffer strips and riparian zones near construction sites 4) Promote the design of post-construction BMPs at construction sites, i.e., water quantity/water quality basins, constructed wetlands, planting and preserving trees, etc.	1) County SWCDs County Engineer 2) Local and County Planning and Zoning Boards County SWCDs County Engineer 3) County SWCDs Local Government Private Sector 4) County SWCDs, County Engineer USDA/NRCS	EQIP CRP NatureWorks NPS Program (ODNR) WPCLF WPCLF (Linked Deposit) CWA Section 319 NPS (OEPA) SIP	3 years	Reduce potential for sediment erosion, transport and deposition from construction sites	1) How often control plans are inspected 2) Requirements established and enacted 3) Number of buffer strips and riparian zones maintained 4) Number of post-construction BMPs implemented	
c. Work with SWCDs and building associations to identify pilot demonstration that utilize innovative erosion control and management practices	County SWCDs HBA County Engineer USDA/NRCS	EQIP CRP NatureWorks NPS Program (ODNR) WPCLF R&D Grant CWA Section 319 NPS (OEPA)	3 years	Viable alternatives to control water pollution from construction site	Number of pilot demonstrations tested and results	
d. Offer additional education for builders, developers, and contractors, i.e., new techniques, post-construction BMPs, etc. 1) Hold seminars/ workshops 2) Distribute information packets	County SWCDs ODNR/DSWC USDA/NRCS	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA) Private Sector	1 year	Increased awareness of present and future practices to reduce construction site water quality impacts	1) Number of seminars/work shops held 2) Number of information packets distributed	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Objective 3.2: Reduce soil erosion transport, and deposition of sediment associated with agricultural areas						
Priority Areas: Subwatersheds 2, 4 and 5; in close proximity to lakes and streams						
a. Educate farmers about the benefits of implementing appropriate vegetative and tillage BMPs, especially with fields adjacent to headwater streams, to reduce the impacts associated with sediment, e.g., conservation tillage, conservation cropping sequence, contour strip cropping, and contour farming	ODNR/DSWC County SWCDs ODA USDA/NRCS	EQIP CRP State Cost Share Program NatureWorks NPS Program (ODNR) OEEF WPCLF (Linked Deposit) PL-566 CWA Section 319 NPS (OEPA)	6 months to 1 year	Reduced sediment loads entering waterways from agricultural areas	Level of participation in vegetative and tillage BMPs	
b. Implement appropriate structural BMPs to alleviate soil-related pollution 1) fencing and development of off-stream watering facilities to exclude livestock from lakes and streams 2) Establish grassed and forested buffer strips on farm croplands, especially adjacent to streams 3) Construct water and sediment control basins equipped with treatment systems for water quality improvement	ODNR/DSWC County SWCDs ODA USDA/NRCS	EQIP CRP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit) PL-566 R&D Grant CWA Section 319 NPS (OEPA) SIP	3 years	Lower soil-related pollution from agricultural areas	1) Number of off-stream watering facilities fenced and developed 2) Number of feet with grassed and forested buffer strips established 3) Number of water and sediment control basins, with treatment systems, constructed	
Objective 3.3: Reduce sediment/siltation and airborne pollutants from sand and gravel mining activities						
Priority Areas: Active mining operation in the northern portion of Subwatershed 4 along Myersville Creek on Myersville Road and an active operation in the southern half of Subwatershed 5 near S.R. 241 (Wales Avenue).						

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
a. Ensure that implemented storm water control measures are frequently inspected	County SWCDs OEPA	NPS Program (ODNR)	6 months to 1 year	Reduced pollution from abandoned mines	Number of abandoned mines inspected for implemented storm water control measures	
b. Ensure dust control strategies are performed, such as periodic water spraying	County SWCDs OEPA	NPS Program (ODNR)	6 months to 1 year	Reduce airborne pollutants, which could eventually reach waterways	Number of active mines inspected and level of participation in dust control measures	
Goal 4: Protect and/or restore shorelines and riparian corridors in selected wetlands, lakes and streams						
Objective 4.1: Protect shoreline and riparian corridor in selected wetlands, lakes and streams						
Priority Areas: High Quality Riparian Corridors within the watershed and Biologically Significant Wetlands and other wetland areas adjacent to streams or lakes. Refer to Tables 28 and 29 for specific areas identified for protection efforts						
a. Encourage city and county park districts to purchase selected areas to protect and/or increase intact shoreline and riparian corridor	City and County Park Districts ODNR/ Div. of Wildlife and Div. of Parks and Recreation	WPCLF PL-566 CWA Section 319 NPS (OEPA) WRP	1 year	Increased shoreline and riparian corridor in selected areas	Number of selected areas purchased	
b. Provide incentives for landowners to protect shoreline or riparian corridor with long-term protection or permanent conservation easements	Local and County Planning and Zoning Boards	NatureWorks PL-566 CWA Section 319 NPS (OEPA) WRP	3 years	Increased shoreline and riparian corridor	Number of feet set aside for long-term protection or permanent conservation easements	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
c. Assist communities with the development of township or municipal ordinances requiring new construction sites to leave easements, of a specified distance, near shorelines of targeted wetlands and lakes and flood plains of targeted streams	Local and County Planning and Zoning Boards	NPS Education Grant NPS Program (ODNR) OEEF	3 years	Protection of shoreline and riparian corridor	Townships or municipal ordinances established and enforced	
d. Identify shoreline and riparian landowners and educate them about shoreline or riparian zone protection and importance 1) Distribute information pamphlets	NEFCO	NPS Education Grant NPS Program (ODNR) OEEF WPCLF CWA Section 319 NPS (OEPA)	6 months to 1 year	Increased protection of shoreline and riparian corridor	List of riparian landowners 1) Number of information pamphlets distributed	
Objective 4.2: Restore shoreline and riparian corridor in selected wetlands, lakes and streams						
Priority Areas: Low Quality Riparian Corridors and former wetland areas which would aid in improving water quality. Refer to Tables 28 and 29 for specific areas identified for restoration efforts						
a. Assist shoreline and riparian landowners to replant shoreline and riparian corridor in selected wetlands, lakes and streams using appropriate BMPs	OEPA ODNR/DSWC County SWCDs NEFCO USDA/NRCS Grassroots/Citizen-Based Groups ODNR/Div. of Wildlife	EQIP CRP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF WPCLF (Linked Deposit) PL-566 CWA Section 319 NPS (OEPA) SIP	3 years	Restoration of shoreline and riparian corridor	Number of feet replanted	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
b. Assist shoreline and riparian landowners to restabilize shoreline and riparian corridor in selected wetlands, lakes and streams using appropriate BMPs	ODNR/DSWC USDA/NRCS County SWCDs NEFCO ODNR/Div. of Wildlife	EQIP CRP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF WPCLF (Linked Deposit) PL-566 CWA Section 319 NPS (OEPA) SIP	3 years	Restabilization of shoreline and riparian corridor	Number of feet restabilized	
c. Assist riparian landowners to restore in-stream habitat using appropriate BMPs	ODNR/DSWC USDA/NRCS County SWCDs NEFCO ODNR/Div. of Wildlife	EQIP CRP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF WPCLF (Linked Deposit) PL-566 CWA Section 319 NPS (OEPA) SIP	3 years	Restoration of in-stream habitat	Number of feet restored	
Goal 5: Reduce fertilizer, herbicide and pesticide runoff into the watershed						
Objective 5.1: Reduce fertilizer, herbicide and pesticide runoff from agricultural areas						
Priority Areas: To be determined						
a. Identify all agricultural areas within the watershed	ODA OSU Extension County SWCDs NEFCO USDA/NRCS	EQIP State Cost Share Program NatureWorks NPS Education Grant NPS Program (ODNR) OEEF WPCLF (Linked Deposit) CWA Section 319 NPS (OEPA)	1 year	Knowledge of number and type of current agricultural operations in the watershed	Watershed map containing different types of agricultural operations	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
b. Inform local farmers about the benefits and principles of integrated pesticide management (IPM) and precision farming 1) Distribute information packets 2) Hold seminars/ workshops 3) Develop nutrient management plans for local farms	ODA OSU Extension County SWCDs NEFCO USDA/NRCS	EQIP State Cost Share Program NatureWorks NPS Education Grant NPS Program (ODNR) OEEF WPCLF (Linked Deposit) CWA Section 319 NPS (OEPA)	1 year	Greater awareness and involvement regarding IPM and precision farming	1) Number of packets distributed 2) Number of seminars/ workshops held and level of participation 3) Level of participation in nutrient management plans	
c. Provide assistance to farms willing to participate in IPM and precision farming	ODA OSU Extension County SWCDs NEFCO	EQIP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit) R&D Grant CWA Section 319 NPS (OEPA)	1 year	Reduced contribution of fertilizer, herbicide and pesticide from agricultural areas	Assistance available and number of farms participating in IPM and precision farming	
d. Ensure farmers are implementing BMPs, e.g., chemical management and disposal and calibration and maintenance of spray equipment through education	ODA OSU Extension County SWCDs NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Reduced levels of fertilizers, pesticides and herbicides from agricultural areas	Number of farmers using such BMPs on a regular basis	
e. Provide assistance to farms willing to implement appropriate BMPs to reduce agricultural runoff into lakes and streams	ODA OSU Extension County SWCDs USDA/NRCS	EQIP CRP State Cost Share Program NatureWorks NPS Program (ODNR) WPCLF (Linked Deposit) CWA Section 319 NPS (OEPA)	1 year	Reduced levels of fertilizers, pesticides and herbicides from agricultural areas	Number of farms given assistance to implement BMPs	
Objective 5.2: Reduce fertilizer, herbicide and pesticide runoff from golf courses, nurseries, greenhouses, landscaping operations, and sod-farms						
Priority Areas: Subwatersheds 2, 3, 4 and 5						

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
a. Identify how many operations are using IPM and their level of knowledge regarding IPM 1) Distribute surveys to all operations in the watershed	ODA OSU Extension County SWCDs USDA/NRCS NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months	Better understanding regarding where future education and promotion of IPM is needed	1) Number of surveys completed	
b. Inform owners/operations about the benefits of BMPs, such as: IPM, calibration and maintenance of spray equipment, and proper chemical management and disposal 1) Distribute information packets 2) Hold seminars/ workshops	ODA OCES County SWCDs NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Increased awareness of the benefits of BMPs	1) Number of pamphlets distributed 2) Number of seminars/ workshops held and level of participation	
Objective 5.3: Reduce fertilizer, herbicide and pesticide runoff from lawns						
Priority Area: Subwatershed 3						
a. Educate property/home owners about the importance of lawn fertilizer and herbicide management 1) Distribute information pamphlets 2) Hold backyard stream stewardship programs which introduce alternative lawn and garden care	1) OEPA/DSW County SWCDs NEFCO 2) OEPA/DSW County SWCDs OSU Extension ODNR/Div. of Wildlife NEFCO	NatureWorks NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA) Private Sector	6 months to 1 year	Increased awareness concerning the importance of lawn fertilizer and herbicide management	1) Number of information pamphlets distributed 2) Number of backyard stream stewardship programs held and list of participants	
Goal 6: Reduce levels of salinity impacting surface and/or ground water quality, which will decrease levels of dissolved solids						
Objective 6.1: Decrease runoff from salt storage sites and seasonal spreading of salt						
Priority Area: Entire watershed						

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
a. Ensure that proper application, covered storage, cleanup of spills, and cleaning of sewers and ditches is implemented when using deicing materials	County SWCDS Local Government NEFCO Private Sector	NPS Education Grant NPS Program (ODNR) OEEF WPCLF CWA Section 319 NPS (OEPA)	3 years	Lower levels of water contamination from de-icing salts	Number of individuals or facilities contacted and level of management regarding de-icing materials	
b. Introduce BMPs to absorb runoff from impervious areas such as porous pavement and installing grass swales rather than storm sewers	County SWCDs County Engineer USDA/NRCS NEFCO	CRP NatureWorks NPS Program (ODNR) WPCLF CWA Section 319 NPS (OEPA)	3 years	Decrease runoff, which may contain dissolved solids, from impervious surfaces	Number of BMPs introduced and installed	
c. Explore the use of environmentally-friendly de-icing materials	County Engineer Private Sector	NatureWorks NPS Program (ODNR) WPCLF R&D Grant CWA Section 319 NPS (OEPA) Private Sector	3 years	Feasible alternatives to current de-icing materials	Results of alternative de-icing material research	
Objective 6.2: Decrease releases of brine from oil exploration and drilling activity						
Priority Area: Subwatershed 3						
a. Distribute flyers informing watershed residents on how to identify suspicious activities related to illegal dumping of brine and phone numbers of proper authorities to contact	OEPA/DERR NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	6 months to 1 year	Decreased illegal dumping of brine	Number of flyers distributed	
Goal 7: Acquire stronger understanding, cooperation and participation regarding water quality issues						
Objective 7.1: Strengthen awareness of and involvement in watershed issues						
Priority Area: Entire watershed						

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
a. Create stronger partnerships between all stakeholders in the watershed, including government agencies, private businesses and property owners	NEFCO	NatureWorks PL-566 CWA Section 319 NPS (OEPA)	3 years	Greater cooperation and participation to protect/improve water quality	Level of interest and feedback at events pertaining to the watershed	
b. Educate residents about watershed issues, through regularly scheduled events/activities that are recognized by the public 1) Distribute surveys 2) Present information at local organizations, e.g., Kiwanis, Audubon Society, and Nature Conservancy 3) Set up information booths at County/Local Fairs 4) Distribute information pamphlets 5) Organize field days 6) Hold public meetings	County SWCDs NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	1 year	Greater awareness regarding watershed issues	1) Number of surveys distributed and returned 2) Number of presentations given 3) Number of fairs with information booths 4) Number of information pamphlets distributed 5) Number of field days held 6) Number of public meetings held	
c. Organize volunteer action groups to address water quality concerns	County SWCDs NEFCO	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA) Citizen Action Mini-Grant	6 months to 1 year	Increased local involvement to improve water quality	Number of volunteers action groups formed	
d. Implement a watershed protection and awareness program in local schools	OEPA/DSW County SWCDs Local Boards of Education Local Schools Career Centers	NPS Education Grant NPS Program (ODNR) OEEF CWA Section 319 NPS (OEPA)	1 year	Stronger knowledge of future generations regarding the importance of watershed protection	Number of local schools implementing program	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
Objective 7.2: Monitor and evaluate water quality of lakes and streams						
Priority Area: Entire watershed						
a. Continue the NEFCO Volunteer Lake Monitoring Program (VLMP)	NEFCO	NPS Education Grant CWA Section 319 NPS (OEPA) Citizen Action Mini-Grant	3 years	Increased database to draw more accurate conclusions regarding water quality of lakes in the watershed	Data collected and results	
b. Monitor and establish baseline levels for macroinvertebrates, bacteria and water chemistry through volunteer monitoring programs 1) Identify representative monitoring locations 2) Organize volunteer monitoring programs 3) Summarize monitoring results into written reports	ODNR/DSWC County SWCDs OEPA/DSW NEFCO Izzak Walton League Rivers Unlimited	CWA Section 319 NPS (OEPA) Citizen Action Mini-Grant	3 years	Greater involvement and knowledge regarding water quality of streams and lakes, and additional data to monitor future results of remedial efforts	1) Number of critical monitoring locations identified 2) Number of volunteers and programs established 3) Written reports with results	
Objective 7.3: Conduct further research regarding point and nonpoint source pollution						
Priority Area: Entire watershed						
a. Locate historical spills and accidental release sites in the watershed	OEPA/DERR NEFCO	R&D Grant CWA Section 319 NPS (OEPA) Citizen Action Mini-Grant	3 months	Insight regarding locations where there is a higher risk of pollutants from spills and accidental releases	List and map of spills and accidental release sites in the watershed	
b. Produce a map with soil limitations for HSDSs and SPSDSs	County SWCDs NEFCO Local Health Departments	NatureWorks CWA Section 319 NPS (OEPA)	3 months	Greater knowledge of where there is a high potential for HSDSs and SPSDSs failure	Map of soil limitations for HSDSs and SPSDSs	

Table 26 (cont.)
Goals, Objectives, Priority Areas and Actions in Addition to Suggested Responsible Parties, Possible Funding Sources, Estimated Time Frames, Expected Improvements, and Evaluations of the Upper Tuscarawas Watershed Action Plan

Action	*Suggested Coordinating Party(ies)	**Possible Funding Source(s)	***Est. Time Frame	Expected Improvement(s)	Evaluation	Cost Estimate ***
c. Generate a map with present soil survey information available, e.g., slopes and potential soil loss	County SWCDs NEFCO	NatureWorks CWA Section 319 NPS (OEPA)	3 months	Insight regarding areas with increased pollutant runoff and erosion	Map with slopes and potential soil loss	
d. Identify types and locations of agricultural operations in the watershed	ODA OSU Extension NEFCO	NatureWorks CWA Section 319 NPS (OEPA)	3 months	Insight regarding potential pollution sources in the watershed	List of agricultural operation in watershed	
e. Produce a map with the locations of registered underground storage tanks (RUSTs)	OEPA/DERR NEFCO	NatureWorks CWA Section 319 NPS (OEPA)	1 month	Insight regarding potential pollution sources in the watershed	Map with the locations of RUSTs in the watershed	
f. Identify and map future extensions of central water facilities	NEFCO County Sanitary Engineer Environmental Services Department	NatureWorks CWA Section 319 NPS (OEPA)	1 month	Insight regarding where ground water contamination is more likely to occur	Map with future extensions for central water facilities	
g. Plot locations of abandoned water wells	OEPA/DDAGW NEFCO	NatureWorks CWA Section 319 NPS (OEPA)	3 month	Insight regarding where ground water contamination is more likely to occur	Map with abandoned water wells in the watershed	
*Possible Lead Parties **Refer to Appendix R for a complete list of funding sources in Ohio. ***Estimated time frame refers to amount of time required once funding is obtained.						

Table 27
Stream Segments Identified for Riparian Zone Protection or Restoration Activities in the Upper Tuscarawas River Watershed

*Ranking	Stream Name	Location (by Subwatershed)	Political Jurisdiction	**Location	Additional Considerations
Stream Segments Identified for Protection Efforts					
1	Tuscarawas River	2	Springfield Twp.	Arlington Road to the intersection of Pine Lake Rd. and Shore Side Circle	There are a few segments within this area with low or moderate riparian quality--these segments would benefit from restoration activities.
2	Myersville Creek	4	City of Green	From the confluence to Raber Rd.	This area is particularly important due to the location of the proposed managed area through ODNR--Myersville Fen State Nature Preserve. Also, restoration activities should be targeted along both sides of the gravel pit
3	Wonder Lake Creek	3	City of Green	From East Reservoir to Cottage Grove Rd.	This area has a high quality riparian corridor, which is heavily wooded.
4	Nimisila Creek	5	Jackson Twp.	East and west of Willowdale Lake until Summit/Stark County Line	Residential areas around Willowdale Lake should be targeted for remediation efforts through activities such as education and stormwater control.
Stream Segments Identified for Restoration Efforts					
1	Tuscarawas River	2	Lake Twp.	From the intersection of Pine Lake Rd. and Shore Side Circle to the southwest portion of the watershed (where the headwaters begin)	This portion of the Tuscarawas River is surrounded by residential and commercial areas. Educating riparian landowners about the importance of riparian zone protection would be an appropriate action towards restoration.
2	Myersville Creek	4	City of Green/ Lake Twp.	Stream segment south of Heckman Rd.	Education of riparian landowners would be an important action to assist in restoring this segment.
3	Tributary to Nimisila Creek	5	City of Green	From the Summit/Stark County Line to Greensburg Rd.	Education of riparian landowners would be an appropriate action to assist in restoring this segment.
4	Cottage Grove Creek	3	City of Green	East of Arlington Rd. To Goldenwood	This portion of Cottage Grove Creek has been heavily channelized. Planting grasses, trees and shrubs is needed to restore the riparian vegetation.
5	Cottage Grove Creek	3	City of Green	Stream segment to the east and west of Cottage Grove Rd.	Education of riparian landowners would be an appropriate action to assist in restoring this segment.

*Ranking refers to the order of priority, assigned by NEFCO, for stream protection or restoration efforts
**Many of the roads included for locating stream segments are not labeled on maps presented in this report. Please refer to Summit and Stark County Road Maps when locating stream areas.

Table 28
Areas Identified for Increasing or Protecting Wetlands in the Upper Tuscarawas River Watershed

*Ranking	Location (by Subwatershed)	Political Jurisdiction	**Location	Action Needed	Additional Considerations
1	5	City of Green	Singer Lake Area--just north of Summit/Stark County Line and east of Arlington Rd.	Protection	This is the most biologically significant wetland in the watershed, with 25 unique plant and animal species identified
2	2	Lake Township	On both sides of the Tuscarawas River headwaters	Protection	
3	3	City of Akron/ Coventry Township	Just north of Long Lake	Protection	This wetland most likely serves as a natural element for flood control
4	1	City of Akron	Northwest of Nesmith Lake	Protection	This wetland may help alleviate the effects of storm water entering Nesmith Lake
5	3	City of Green	Between Cottage Grove Rd. and Arlington Rd. on Cottage Grove Creek	Protection	
6	4	City of Green	Just north of baseball fields on Kreighbaum Rd.	Protection	It may not be possible to protect this wetland, since it is being considered for future development.
7	3	City of Green	Former site of Wonder Lake on Wonder Lake Creek, northeast intersection of Cottage Grove Rd. and Moore Rd.	Increase wetlands	This may be a suitable site for constructing a water quantity/water quality sediment and flood control basin.
8	2	Springfield Township	Northeast and west of Kim-Tam Lake	Protection	

*Ranking refers to the order of priority, assigned by NEFCO, for protecting or increasing wetlands
**Many of the roads included for locating wetlands are not labeled on maps presented in this report. Please refer to Summit and Stark County Road Maps when locating wetland areas. Field verification is also recommended for wetland areas identified in this report.

Suggested responsible parties and members of the PLTF received draft copies of the Action Plan during the final stages of the plan's development. They were asked to complete and return a questionnaire regarding the effectiveness of the plan. Appendix T contains the completed questionnaires which were returned to NEFCO.

Recommendations for Future Work

The Watershed Action Plan can be a useful tool for gathering public support and funding for future efforts. Strong partnerships between regulatory agencies, planning organizations, local governments and others with an interest in the watershed is needed to assure success of the plan. As mentioned earlier in this report, previous meetings in the watershed suggested the need for the formation of a management committee with local leaders and agencies as the base. Member organizations on the committee, e.g., OEPA and ODNR, would be given direction regarding important issues to consider when developing projects involving the watershed. The management committee would be the foundation for a working coalition. This coalition would involve multiple stakeholders and would assist with obtaining funding for the plan, as well as promoting and coordinating intercommunty activities. It is important that this coalition is recognized by the public, as well as community leaders, as a group which brings people together to solve water quality issues. NEFCO would facilitate and support the coalition; however, volunteer and grassroots groups would be the best suited to increase community involvement and accomplish the actions.

Continuous monitoring, evaluation and improvement is needed for the Action Plan to keep it up-to-date and strategic. Down the road, as additional information is made available, the relevance of issues may need to be reconsidered, in addition to introducing new issues. It is important to identify any obstacles, which may be encountered with the various actions in the plan, before implementation begins. When deciding on which actions to accomplish first; it would be best to select actions which use minimum resources; yet provide the maximum benefit to the watershed. Therefore; it is strongly recommended that the next phase include an analysis of high priority areas and the cost effectiveness of various actons involved, in addition to a method of evaluating measureable performance standards to track progress. This approach would help attract additional funding and community support for future projects.

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