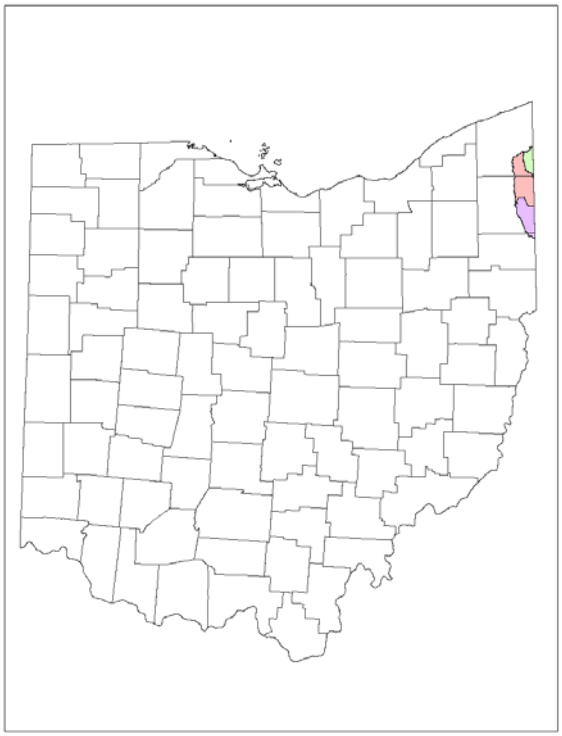
2008 Study Plan for the Pymatuning/Yankee/Little Yankee Watersheds

HUCs 0503010201, 0503010203, and 0503010206

(Ashtabula and Trumbull Counties, Ohio)



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INTRODUCTION

As part of the five-year basin approach for NPDES permitting and the TMDL process, an intensive ambient assessment will be conducted during the 2008 field sampling season within Hydrologic Unit Codes (HUCs) 0503010201, 0503010203, and 0503010206; corresponding to Pymatuning Reservoir tributaries, Pymatuning Creek, and Yankee/Little Yankee Run, respectively. The Pymatuning Creek and Yankee/Little Yankee Run watersheds have not been assessed since 1994. Much of the sampling effort in this survey will be dedicated to revisiting historical sampling stations in order to initiate a trends assessment. A list of sampling stations can be found in Table 2 and Table 3.

The 2008 survey will be the first time that any monitoring will be conducted on direct tributaries to the Pymatuning Reservoir, as well as Stratton Creek and the South Branch of Yankee Creek. Many of the Aquatic Life Use (ALU) designations for these waters were made prior to standardized approaches to the collection of instream biological data or numerical biological criteria. Ohio EPA is obligated to review, evaluate, or recommend (where appropriate) beneficial uses prior to basing any permitting actions on existing, unverified designations, or entirely unclassified water bodies. Therefore, some of the sampling effort for this survey is allocated to fulfill this obligation.

All information collected as part of this survey will support TMDL development for the study areas. The objectives of the TMDL process are to estimate pollutant loads from the various sources within the basin, define or characterize allowable loads to support the various beneficial uses, and to allocate pollutant loads among different pollutant sources through appropriate controls (e.g., NPDES permitting, storm water management, 319 proposals, NPS controls or other abatement strategies). The components of the TMDL process supported by this survey are primarily the identification of impaired waters, verification (and redesignating if necessary) of beneficial use designations, and sources of use impairment. These data are necessary precursors to the development of effective control or abatement strategies.

Sampling Objectives:

- Monitor and assess the chemical, physical, and biological integrity of the principal drainage networks of HUCs 0503010201 (Pymatuning Reservoir Tributaries), 0503010203 (Pymatuning Creek), and 0503010206 (Yankee/Little Yankee Creek) in support of the TMDL process;
- Assess physical habitat influences on stream biotic integrity;
- Determine recreational water quality;
- Evaluate the appropriateness of existing use designations and assign uses to undesignated streams;
- Characterize the amount of resource degradation attributable to various land uses, including agricultural practices and urbanization;
- Determine any aquatic impacts from known potential sources, including point source dischargers and unsewered communities;
- Collect fish samples for the Ohio Sport Fish Tissue Monitoring Program; and
- Document any changes in the biological, chemical, and physical conditions of the study areas where historical information exists.

ISSUES TO BE EVALUATED

Nonpoint Sources

Aging septic systems in the unsewered city of Kinsman, as well as in parks and vacation homes near the Pymatuning Reservoir, are expected to affect recreational attainment. Much of the soil in the watershed contains a high clay content that, when combined with low land relief, can exacerbate the rate of septic system failures due to poor absorption. Bacteriological sampling will be conducted in these areas of either potential or known septic system failures.

The Valley Mould Dam on Little Yankee Creek, RM 4.96, impounds nearly a mile of the stream. The dam, originally built as a water source for industrial processing, has become obsolete as the current owner has switched to municipal water. The presence of this structure has also been frequently cited as causing flooding in the city of Hubbard. As such, biological and chemical monitoring, including sediment sampling, will be conducted downstream from and within the dam pool in order to assess the dam's removal potential. Biological sampling will only include quantitative macroinvertebrate sampling as part of the 2008 survey. Assessment of the fish community was conducted in this reach by DERR (Division of Emergency and Remedial Response) in 2007. Results from that sampling effort will be incorporated into the 2008 assessment.

Point Sources

The Kraft Dairy Group on Pymatuning Creek near Kinsman has closed since the last survey in 1994. Wastewater from this operation was produced from backwash water from potable water treatment and washings of cheese curd and equipment. The wastewater was eventually discharged to a ditch and entered Pymatuning Creek at RM 17.31. The 1994 survey sampling results showed increases in total phosphorus, TKN, ammonia-N and nitrate-nitrite downstream from the discharge point. It is expected that the 2008 survey would see decreases in these parameters downstream from Kinsman as a result of the dairy's closing.

Brookfield and Hubbard represent the largest urban areas serviced by sanitary sewers in the survey area (Table 1). Both municipal wastewater facilities completed their last upgrades in 1989, five years before OEPA last survey in 1994. The 1994 survey noted improved water quality conditions in Yankee Creek downstream from the Brookfield facility, with dissolved oxygen levels increasing and ammonia-N and TKN concentration being consistently near or below minimum detection limits. The Hubbard WWTP showed similar improvements in Little Yankee Creek; however, there was an increase in TKN and total phosphorus downstream of the WWTP. It has been noted that annual flows since the 1989 upgrade has been rising steadily. These facilities, along with the Andover WWTP (discharging into Wade Creek), will be monitored for chemical, biological, and bacteriological parameters at points upstream and downstream of their discharge.

Small Stream Evaluation

Several very small streams are listed in Ohio Administrative Code (OAC) 3745-1-25 as possessing beneficial uses based on 1978 water quality standards (Berry Creek, Clear Creek, Maple Creek, Mill Creek, Big Run, and McCullough Run). Due to resource constraints of the Ecological Assessment staff, these streams will not be evaluated biologically as part of the 2008 TMDL survey. However, Northeast District Office (NEDO) staff will visit each of these streams as indicated in tables 2 and 3 to conduct a QHEI assessment. The information from these visits will be used to assign priority to future sampling efforts of these streams, if warranted. A habitat assessment can NOT be used to recommend an aquatic life use.

CONSERVATION

The federally endangered northern clubshell mussel (*Pleurobema clava*) has been collected historically in Pymatuning Creek. This species inhabits only three other streams in Ohio - St. Josephs River, Fish Creek, and Little Darby Creek. In 1994, a small population consisting of 10 live and 11 dead individuals was collected in Pymatuning Creek in the reach south of Woodworth Road to the Ashtabula County line (Huehner and Corr 1994). While seemingly small, this population is nonetheless significant for a stream the size of Pymatuning Creek. Presently, channelization and livestock access to the stream are viewed as significant threats to their continued survival. The data collected as part of the 2008 sampling effort can be unequivocally applied toward efforts aimed at the conservation of *Pleurobema clava* in Pymatuning Creek.

CONTACTS

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St Joseph Riverside Hospital – 1300 Tod Ave. NW, Warren, OH 44485
330.841.4195
St. Joseph Emergency and Diagnostic – 476 S. Main St., Andover, OH 44003
330.293.6111

SAMPLING ACTIVITIES

Chemical/Physical Water and Sediment
Chemical sampling locations within the study area are listed in Tables 2 and 3. Conventional chemical/physical water quality samples will be collected at least 5 times at each designated location. Sediment samples will be collected at 1 location. Datasonde© continuous recorders will be deployed at 11 locations. Chemical parameters to be tested are listed in Table 2. Nutrient sampling (bicarbonate and chlorophyll a) will be conducted during one low flow sampling event in August or September at locations indicated in Table 2.

Bacteriological Sampling
Water samples will be collected at 36 sites for bacteriological analyses to determine the attainment status of the Primary Contact Recreational (PCR) use of Pymatuning Creek, Yankee Creek, Little Yankee Creek and associated tributaries. Testing will include *Escherichia coli* (*E. coli*) bacteria. **Each site will be sampled at least 5 times during the recreation season.** Sampling events should be conducted under normal flow regimes in order to assess ambient bacteria levels when recreation is most likely to occur. USGS gaging stations may be consulted in order to determine appropriate flow regimes in which to schedule sampling events.

Macroinvertebrate and Fish Assemblages
Macroinvertebrate sampling methods will be used as listed in Table 2. Fish assemblages will be sampled as listed in Table 2. QHEI scores will be calculated for the habitat at all fish sampling locations.

Fish Tissue
Fish tissue samples will be collected from 4 locations as part of the Ohio Fish Tissue Consumption Monitoring Program. Fillet samples of edible size sport fish will be tested for organochlorinated pesticides, PCBs, mercury, lead, cadmium, arsenic, and selenium. Results will be used in the Ohio Sport Fish Consumption Advisory Program.

QUALITY ASSURANCE/SAMPLING METHODS

Ohio EPA Manuals
All biological, chemical, EPA laboratory, data processing, and data analysis methods and procedures adhere to those specified in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2006), Biological Criteria for the Protection of Aquatic Life, Volumes II - III (Ohio Environmental Protection Agency 1987, 1989a, 1989b), The Qualitative Habitat Evaluation Index (QHEI); Rationale, Methods, and Application (Rankin 1989) for habitat assessment, Ohio EPA Sediment Sampling Guide and Methodologies (Ohio EPA 2001), and Ohio EPA Fish Collection Guidance Manual (Ohio EPA 2004) .

Quality Control
Ten percent of the sediment, water, and bacteria samples will be submitted to the lab as field duplicates. One Datasonde© recorder site will have two instruments placed in the river as field duplicates. Field blanks will occur at a minimum of 5 percent of the water samples. Equipment blanks for sediment samples will occur at a minimum of 5 percent. Field instruments will be calibrated daily, using manufacturer guidelines and requirements noted in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2006). An acid blank will be run on new lots of acid ampules. Matrix spike duplicates will be collected for organic water samples at a minimum of 5 percent.

Use Attainment
Attainment/non-attainment of aquatic life uses will be determined by using biological criteria codified in Ohio Administrative Code (OAC) 3745-1-07, Table 7-17. Numerical biological criteria are based on multimetric biological indices including the Index of Biotic Integrity (IBI) and modified Index of Well-Being (MIwb), indices measuring the response of the fish community, and the Invertebrate Community Index (ICI), which indicates the response of the macroinvertebrate community.

Performance expectations for the basic aquatic life uses (Warmwater Habitat [WWH], Exceptional Warmwater Habitat [EWH], and Modified Warmwater Habitat [MWH] were developed using the regional reference site approach (Hughes et al. 1986; Omernik 1987). This fits the practical definition of biological integrity as the biological performance of the natural habitats within a region (Karr and Dudley 1981). Attainment of an aquatic life use is FULL if all three indices (or those available) meet the applicable criteria, PARTIAL if at least one of the indices did not attain and performance did not fall below the fair category, and NON if all indices either fail to attain or any index indicates poor or very poor performance. The results will be compared to WWH biocriteria for the Erie Ontario Lake Plain (EOLP) ecoregion.

Recreational use attainment will be determined using *E. coli* bacteria. This organism is an indicator organism for the potential presence of pathogens in surface water resulting from the presence of untreated human or animal wastes, and is the basis for recreational use water quality criteria in Rule 3745-1-07 of the Ohio Administrative Code (OAC).

Stream Habitat Evaluation
Physical habitat is evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989). Various attributes of the available habitat are scored based on their overall importance to the establishment of viable, diverse aquatic faunas. Evaluations of type and quality of substrate, amount of instream cover, channel

morphology, extent of riparian canopy, pool and riffle development and quality, and stream gradient are among the metrics used to evaluate the characteristics of a stream segment, not just the characteristics of a single sampling site. As such, individual sites may have much poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of segments around the state have indicated that values higher than 60 were generally conducive to the establishment of warmwater faunas while those which scored in excess of 75-80 often typify habitat conditions which have the ability to support exceptional faunas.

Biological Community Assessment

Macroinvertebrates will be collected from artificial substrates and from the natural habitats. Quantitative sampling will be conducted at reference sites and/or at sites with drainage areas in excess of 20 mi^2. Qualitative sampling will be conducted in headwater sites with drainages smaller than 20 mi^2. The artificial substrate collection provides quantitative data and consists of a composite sample of 5 modified Hester-Dendy (HD) multiple-plate samplers colonized for six weeks. At the time of the artificial substrate collection, a qualitative multihabitat composite sample is also collected. This sampling effort consists of an inventory of all observed macroinvertebrate taxa from the natural habitats at each site with no attempt to quantify populations other than notations on the predominance of specific taxa or taxa groups within major macrohabitat types (e.g., riffle, run, pool, margin). Fish will be sampled at each sampling location with pulsed DC current. Two passes will be conducted at sites larger than 20 mi^2 and at reference sites. Detailed biological sampling protocols are documented in the Ohio EPA manual Biological Criteria for the Protection of Aquatic Life, Volume III (1989).

Sediment

Fine grained multi-incremental sediment samples will be collected in the upper 4 inches of bottom material using either decontaminated stainless steel scoops or Ekman dredges. Collected sediment will be placed into glass jars with teflon lined lids, placed on ice (to maintain 4^oC) and delivered to the Ohio EPA lab. Sampling and decontamination protocols will follow those listed in the Ohio EPA Sediment Sampling Guide and Methodologies, November, 2001.

Fish Tissue

Tissue fillet samples will be collected from fish of edible size, and species preferred for analysis include spotted bass, largemouth bass, smallmouth bass, flathead catfish, walleye, saugeye, white bass, common carp, freshwater drum, and channel catfish. When possible, composite samples (by species) will be collected using a minimum of three fish and a minimum of 150 grams of material. At each sampling location, an attempt will be made to collect five fish species for fillet tissue analysis. Fish will be sampled using electrofishing boat methods. Sampling locations are listed in Table 2.

Fish used for tissue analysis will be filleted in the field using decontaminated stainless steel fillet knives. Filleted samples will be wrapped in aluminum foil, placed in a sealed plastic bag, and placed on dry ice. Sampling and decontamination protocols will follow those listed in the Ohio EPA Fish Collection Guidance Manual (2004); however, it is not necessary to clean aluminum foil which is used directly from the roll. Fish tissue samples will be stored in chest freezers at the Ohio EPA Groveport Field Facility prior to delivery to Division of Environmental Services (DES).

Surface Water

Surface water grab samples will be collected from the upper 12 inches of river water and sampled into appropriate containers. Collected water will be preserved using appropriate methods, as outlined in Parts II and III of the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 2006) and delivered to the Ohio EPA lab for analysis. Datasonde© continuous recorders will be placed at select locations to evaluate diurnal measurements of dissolved oxygen, pH, temperature, and conductivity.

Bacteria
Water samples will be collected into sterilized polyethylene containers, cooled to 4°C, and transported to Adams Water Laboratory, 912 E. Tallmadge Ave., Akron, OH 44310 within 6 hours of sample collection. All samples will be analyzed for *E. coli* bacteria using U.S.EPA approved methods (STORET Parameter Code 31633).

Table 1. Municipal facilities regulated by the National Pollution Discharge Elimination System in the Pymatuning/Yankee/Little Yankee watershed.

Facility	Permit #	Receiving Stream	River Mile	Design Flow (MGD)
Andover WWTP	21Y00013	Wade Creek	2.73	0.5
Hubbard WWTP	3PD00028	Little Yankee Run	4.59	2.1
Brookfield WWTP	3PJ00001	Yankee Run	0.42	1.3

Table 2. Sampling locations with associated sampling protocols and issues, by HUC-12, for the Pymatuning/Yankee/Little Yankee watershed survey, 2008.

RIVER	RIVER MILE	DRAIN. AREA	LOCATION	ISSUE	SAMPLE TYPE	STORET
HUC 05030102 01 04 – Frontal Pymatuning Reservoir						
Black Creek	1.43	5.2	Pymatuning Lake Rd.	Geometric	C,B,F,M	N04K01
Gravel Run	1.27	5.3	Pymatuning Lake Rd.	Geometric	C,B,F,M	N04K02
McMichael Creek	1.26	6.3	Pymatuning Lake Rd.	Geometric	C,B,F,M	N04K03
Trib. to Shenango River at RM 71.46 (Wade Creek)*	2.8	2.8	U.S. Rt. 6	Ust. Andover WWTP	C*,B,M,N	N04K04
Trib. to Shenango River at RM 71.46 (Wade Creek)	2.73	3.0	Andover WWTP Effluent	Andover WWTP Effluent	C*,B	N04K05
Trib. to Shenango River at RM 71.46 (Wade Creek)	1.82	3.1	U.S. Rt. 6	Geometric, Dst Andover WWTP	C*,B,F,M,D,N	N04K06
HUC 05030102 03 01 – Headwaters Pymatuning Creek						
Pymatuning Creek	30.38	11.8	U.S. Rt. 6	Geometric	C,B,F,M,T	N04S27
Pymatuning Creek	29.10	15.9	Dodgeville Rd.	Geometric	C,B,F,M	N04Q07
Pymatuning Creek	24.50	35.0	U.S. Rt. 322	Geometric	C,B,F2,MT	N04S02
Pymatuning Creek	22.70	43.0	Underwood Rd.	Reference, Geometric	C,B,F2,MT,D	N04Q06
HUC 05030102 03 02 – Sugar Creek-Pymatuning Creek						
Pymatuning Creek	17.78	66.0	St. Rt. 87	Geometric	C,B,F2,MT,D	N04S26
Sugar Creek	5.72	9.0	St. Rt. 88	Geometric	C,B,F,M	N04K07
Sugar Creek	0.92	19.9	Burnett Rd.	Geometric	C,B,F2,MT	N04S28
Berry Creek	0.32	2.8	Sodom-Hutchings Road	Site visit (NEDO staff)	Q	N04K17
Clear Creek	2.5	1.5	Stoddard-Hayes Road	Site visit (NEDO staff)	Q	N04K18
HUC 05030102 03 03 – Stratton Creek-Pymatuning Creek						
Pymatuning Creek	15.80	96.0	Dst Storm Sewer #2/SR 7	Sentinel	C,B,F2,MT,D,T	N04S23
Pymatuning Creek	15.70	96.0	Dst septic outfalls/SR 7	Chemical evaluation of several private septic outfalls	C,B	N04S23
Pymatuning Creek	15.20	97.0	S. of Kinsman, Adj. SR 7	Recovery from Kinsman	C,B,D	N04S22
Stratton Creek	4.21	9.1	Webber Rd.	Geometric	C,B,F,M	N04K08
Stratton Creek	0.70	17.1	Kinsman-Nickerson Rd.	Geometric	C,B,F,M	N04K09

RIVER	RIVER MILE	DRAIN. AREA	LOCATION	ISSUE	SAMPLE TYPE	STORET
Maple Creek	0.1	3.8	Private Driveway (Kinsman Lake community)	Site visit (NEDO staff)	Q	N04K10
HUC 05030102 03 04 –-Booth Run-Pymatuning Creek						
Pymatuning Creek	8.40	135.0	St. Rt. 88	Geometric	C,B,F2,MT,T,D	N04S01
Pymatuning Creek	1.94	148.0	PA state line at Orangeville	Sentinel	C,B,F2,MT,D,T	N04S20
Mill Creek	0.91	4.4	SR 7	Site visit (NEDO staff)	Q	N04K11
HUC 05030102 06 01 – Yankee Creek						
Yankee Creek	11.34	14.8	SR 305, W of Hartford	Geometric	C,B,F,M	N04S34
Yankee Creek	6.50	33.0	Co. Rd. 361A	Geometric	C,B,F2,MT	N04Q03
Yankee Creek	1.23	44.0	Ust Brookfield WWTP @ CR 1017	Sentinel	C*,F2,MT,D,N	N04S35
Yankee Creek	0.42	45.5	Dst. Brookfield WWTP/US 62	Brookfield WWTP Effluent	C*,B	N04S04
Yankee Creek	0.3	45.7	Dst. Brookfield WWTP/US 62	Dst. Brookfield WWTP	C*,B,F2,MT,D,N	N04S33
South Br. Yankee Creek	1.54	9.0	Warner Rd.	Geometric	C,B,F,M	N04K12
HUC 05030102 06 02 – Little Yankee Creek						
Little Yankee Creek	10.99	8.0	Albright-McKay Rd.	Geometric	C,B,F,M	N04K13
Little Yankee Creek	9.56	11.0	Stewart Sharon Rd.	Reference, Geometric	C,B,F2,MT	N04S12
Little Yankee Creek	7.95	15.6	Chestnut Ridge Rd.	Geometric	C,B,F,M	N04K14
Little Yankee Creek	5.0	29.8	Access via 4-wheeler path adjacent to RR tracks	Dam pool effect (Fish sampled in 2007)	C,B,O,S,MT,T	N04Q01
Little Yankee Creek	4.70	30.8	Ust Hubbard WWTP @ Mill St.	Sentinel, Ust Hubbard WWTP	C*,B,F2,MT,D,N	N04S10
Little Yankee Creek	4.59	30.8	Hubbard WWTP Effluent	Hubbard WWTP Effluent	C*,B	N04S09
Little Yankee Creek	4.4	30.9	Dst. Hubbard WWTP @ 1st RR Bridge	Dst. Hubbard WWTP	C*,B,F2,MT,N	N04S08
Little Yankee Creek	1.58	41.2	Chestnut Ridge Road	Longitudinal coverage, historical	C,B,F2,MT,D	N04W06
Little Deer Creek	0.40	7.6	St. Rt. 304	Reference, Geometric	C,B,F2,MT	N04S13
Mud Run	0.07	8.1	North Main St.	Geometric	C,B,F,M	N04S14
HUC 05030102 06 03 – McCullough Run						
McCullough Run	1.9	1.9	Brockway-Sharon Road (at PA state line)	Site visit (NEDO staff)	Q	N04K15

RIVER	RIVER MILE	DRAIN. AREA	LOCATION	ISSUE	SAMPLE TYPE	STORET
Big Run	1.3	2.5	Brockway-Sharon Road (at PA state line)	Site visit (NEDO staff)	Q	N04K16

C – Chemistry site
C* - Chemistry site including one low flow pass for bicarbonate (alkalinity)
B – Bacteria site
F – Fish Site
F2 – Two-pass fish site (for reference sites and/or drainage area 20 sq. miles or greater)
M – Macroinvertebrate site
MT – Macroinvertebrate quantitative site (for reference sites and/or drainage area 20 sq. miles or greater)
S – Sediment site
D – Datasonde site
T – Fish Tissue
Q – QHEI evaluation
N- Chlorophyll a

Type	Number of Sites
Total	41
Water chemistry	36
Bacteria	36
Fish (2-pass/total passes)	29 (15/44)
Macroinvertebrate	31 (16 Quantitative)
Fish Tissue	5
Sediment	1
Datasonde©	11

Table 3. Sampling locations with geographical coordinates, by stream, for the Pymatuning/Yankee/Little Yankee watershed survey, 2008.

RIVER	RIVER MILE	DRAIN. AREA	LOCATION	LATITUDE	LONGITUDE	USGS QUAD
Black Creek	1.43	5.2	Pymatuning Lake Rd.	41.5861	-80.5417	Andover
Gravel Run	1.27	5.3	Pymatuning Lake Rd.	41.6235	-80.5419	Andover
McMichael Creek	1.26	6.3	Pymatuning Lake Rd.	41.5402	-80.5333	Andover
Trib. to Shenango River at RM 71.46 (Wade Creek)	2.80	2.8	U.S. Rt. 6	41.6078	-80.5622	Andover
Trib. to Shenango River at RM 71.46 (Wade Creek)	2.73	3.0	Andover WWTP Effluent	41.3030	-80.5567	Andover
Trib. to Shenango River at RM 71.46 (Wade Creek)	1.82	3.1	U.S. Rt. 6	41.6072	-80.5509	Andover
Pymatuning Creek	30.38	11.8	U.S. Rt. 6	41.6069	-80.6297	Cherry Valley
Pymatuning Creek	29.10	15.9	Dodgeville Rd.	41.5908	-80.6308	Cherry Valley
Pymatuning Creek	24.50	35.0	U.S. Rt. 322	41.5339	-80.6342	Cherry Valley
Pymatuning Creek	22.70	43.0	Underwood Rd.	41.5106	-80.6344	Cherry Valley
Pymatuning Creek	17.78	66.0	St. Rt. 87	41.4553	-80.6125	Kinsman
Pymatuning Creek	15.80	96.0	Dst Storm Sewer #2/SR 7	41.4431	-80.5869	Kinsman
Pymatuning Creek	15.70	96.0	Dst Septic outfalls/SR 7	41.4430	-80.5853	Kinsman
Pymatuning Creek	15.20	96.0	Dst. Kinsman, Adj. SR 7	41.4384	-80.5884	Kinsman
Pymatuning Creek	8.40	135.0	St. Rt. 88	41.3869	-80.5575	Kinsman
Pymatuning Creek	1.94	148.0	PA state line at Orangeville	41.3400	-80.5194	Orangeville
Sugar Creek	5.72	9.0	St. Rt. 88	41.3886	-80.6318	Gustavus
Sugar Creek	0.92	19.9	Burnett Rd.	41.4375	-80.6036	Kinsman
Berry Creek	0.32	2.8	Sodom-Hutchings Road	41.3852	-80.6393	Gustavus
Clear Creek	2.5	1.5	Stoddard-Hayes Road	41.4509	-80.6470	Gustavus
Stratton Creek	4.21	9.1	Webber Rd.	41.4828	-80.5613	Kinsman
Stratton Creek	0.70	17.1	Kinsman-Nickerson Rd.	41.4436	-80.5779	Kinsman
Maple Creek	0.10	3.8	Private Driveway (Kinsman Lake)	41.4489	-80.5779	Kinsman
Mill Creek	0.91	4.4	SR 7	41.3935	-80.5688	Kinsman
Yankee Creek	11.34	14.8	SR 305, W of Hartford	41.3125	-80.6097	Orangeville
Yankee Creek	6.50	33.0	Co. Rd. 361A	41.2758	-80.5719	Orangeville

RIVER	RIVER MILE	DRAIN. AREA	LOCATION	LATITUDE	LONGITUDE	USGS QUAD
Yankee Creek	1.23	44.0	Ust Brookfield WWTP @ CR 1017	41.2206	-80.5344	Sharon West
Yankee Creek	0.42	45.5	Brookfield WWTP Effluent	41.2155	-80.5270	Sharon West
Yankee Creek	0.3	45.7	Dst. Brookfield WWTP/US 62	41.2142	-80.5250	Sharon West
South Br. Yankee Creek	1.54	9.0	Warner Rd.	41.2916	-80.6173	Orangeville
Little Yankee Creek	10.99	8.0	Albright-McKay Rd.	41.2300	-80.6010	Sharon West
Little Yankee Creek	9.56	11.0	Stewart Sharon Rd.	41.2136	-80.5922	Sharon West
Little Yankee Creek	7.95	15.6	Chestnut Ridge Rd.	41.1929	-80.5844	Sharon West
Little Yankee Creek	5.0	29.8	Access via 4-wheeler path by RR tracks	41.1699	-80.5602	Sharon West
Little Yankee Creek	4.70	30.8	Ust Hubbard WWTP @ Mill St.	41.1711	-80.5550	Sharon West
Little Yankee Creek	4.59	30.9	Hubbard WWTP Effluent	41.1705	-80.5534	Sharon West
Little Yankee Creek	4.4	30.9	Dst. Hubbard WWTP @ 1st RR Bridge	41.1703	-80.5500	Sharon West
Little Yankee Creek	1.58	41.2	Chestnut Ridge Road	41.1934	-80.5344	Sharon West
Mud Run	0.07	8.1	North Main St.	41.1697	-80.5692	Sharon West
Little Deer Creek	0.40	7.6	St. Rt. 304	41.1636	-80.5417	Sharon West
McCullough Run	1.9	1.9	Brockway-Sharon Road	41.2672	-80.5194	Sharon West
Big Run	1.3	2.5	Brockway-Sharon Road	41.3054	-80.5195	Sharon West

Figure 1. Survey area map showing sampling type and location within the Pymatuning/ Yankee/ Little Yankee Creek watersheds.

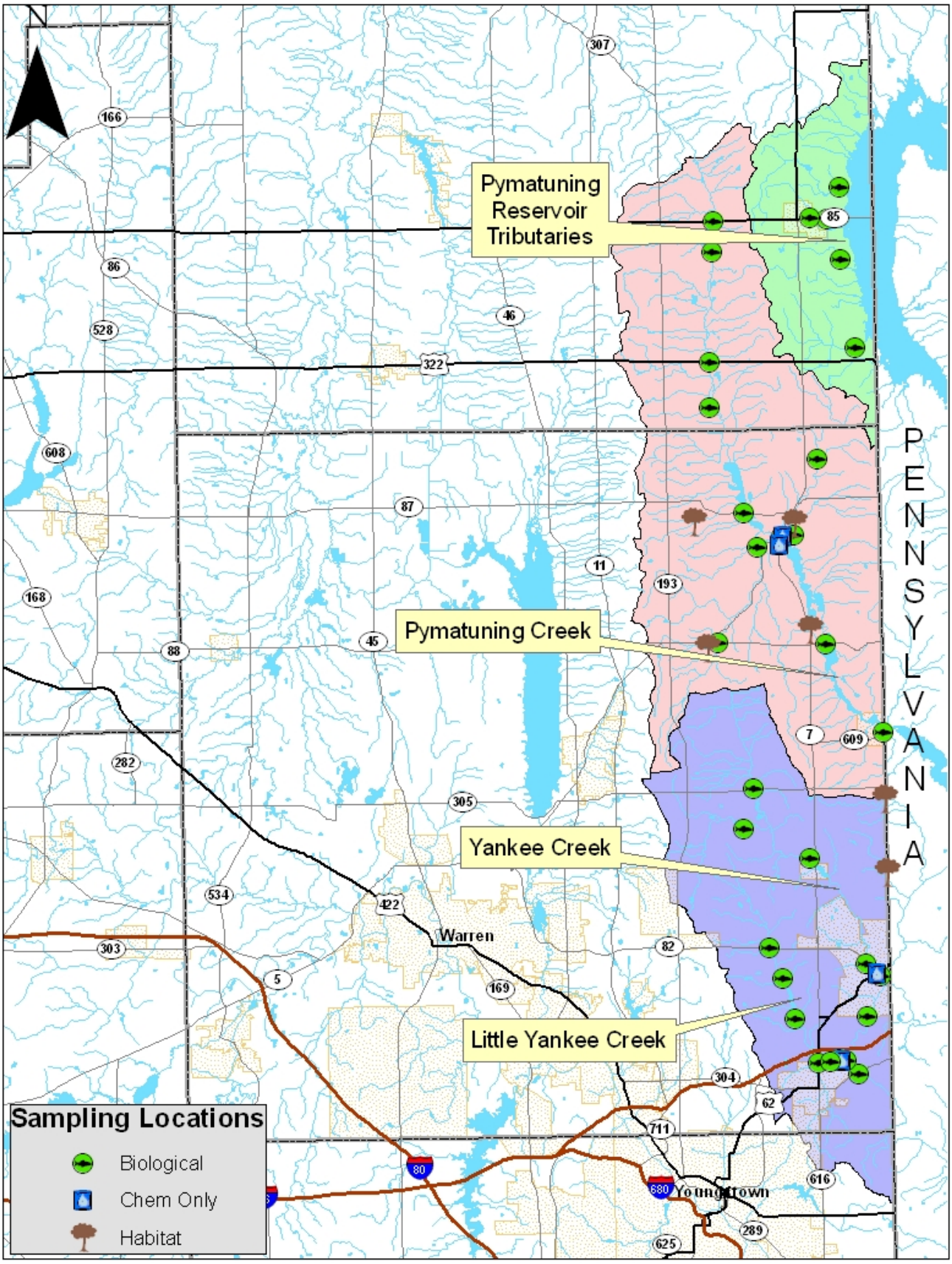

Table 4. List of chemical/physical water quality parameters to be analyzed/measured in surface water, sediment, and fish tissue from the Pymatuning/Yankee/Little Yankee watershed survey, 2008. Water samples will be collected 5 times (organics twice), sediment once. Bacteria samples will be collected 5 - 10 times, with at least 5 samples in a thirty-day period to determine the recreational use. Select sampling locations will be monitored for dissolved oxygen, pH, temperature, and conductivity using Datasonde© continuous recorders (Table 2).

Parameters	Test Method	Water	Sediment	Fish Tissue
Acidity	USEPA 305.1	X		
Alkalinity (carbonate/bicarbonate)	USEPA 310.1	X		
BOD, 5-DAY	SM 5210B	X		
SOLIDS, DISSOLVED (TDS)	USEPA 160.1	X		
SOLIDS, SUSPENDED (TSS)	USEPA 160.2	X		
AMMONIA	USEPA 350.1/ SM 4500	X	X	
TKN	USEPA 351.2	X		
NITRATE-NITRITE	USEPA 353.1	X		
Nitrite	USEPA 354.1	X		
Chloride	USEPA 325.1	X		
COD	USEPA 410.4	X		
Sulfate	USEPA 375.4	X		
TOTAL PHOSPHORUS	USEPA 365.4/ USEPA 365.4	X	X	
DISSOLVED PHOSPHORUS	USEPA 365.4	X		
ICP 1 (Al,Ba,Ca,Cr,Cu,Fe, Mg, Mn, Na, Ni, K, Sr, Zn, Hardness)	USEPA 200.7	X		
ICP 3 (Al,Ba,Ca,Cr,Cu,Fe,Mg,Mn,Na,Ni,K,Sr,Zn,Pb)	USEPA 200.7		X	
SIMA 1 (As,Cd,Pb,Se)	USEPA 200.9, SM 3113B	X		X
SIMA 2 (As, Cd, Se)	USEPA 200.9, SM 3113B		X	
MERCURY, TOTAL	USEPA 245.1,7470A,7471A	X	X	X (245.1)
pH - grab	Hanna HI9811 meter	X - field		
Conductivity - grab	Hanna HI9811 meter/ USEPA 120.1	X - field / lab		
Dissolved Oxygen - grab	YSI 55 meter	X - field		
Temperature - grab	YSI 55 meter	X - field		
VOCs	-	NOT RECOMMENDED	X	
SVOCs	USEPA 625/ USEPA 8270C	X	X	
Pesticides/PCBs/ Chlordane	USEPA 608/ USEPA 8081A, 8082	X	X	X (OEPA 590.1)
E.coli	USEPA 1103.1/ 640.1	X		
Chlorophyll a	USEPA 445.1	X		
Percent Solids	SM 2540G		X	X

REFERENCES

Huehner, M.K. and C.L. Corr. 1994. The Unionid Mussel Fauna of Pymatuning Creek in Ashtabula County, Ohio, Including the Federally Endangered Clubshell (*Pleurobema clava*). Ohio J. Sci. 94 (5): 147-150.

Hughes, R. M., D. P. Larsen, and J. M. Omernik. 1986. Regional reference sites: a method for assessing stream pollution. Env. Mgmt. 10(5): 629-635.

Karr, J.R. and D.R. Dudley. 1981. Ecological perspective on water quality goals. Env. Mgmt. 5(1): 55-68.

Ohio EPA. 1987a. Biological criteria for the protection of aquatic life: Volume I. The role of biological data in water quality assessment. Division of Water Quality Monitoring and Assessment, Surface Water Section, Columbus, Ohio.
http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html

Ohio EPA. 1987b. Biological criteria for the protection of aquatic life: Volume II. Users manual for biological field assessment of Ohio surface waters. Division of Water Quality Monitoring and Assessment, Surface Water Section, Columbus, Ohio
http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html

Ohio EPA. 1989a. Addendum to biological criteria for the protection of aquatic life: Users manual for biological field assessment of Ohio surface waters. Division of Water Quality Planning and Assessment, Surface Water Section, Columbus, Ohio.
http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html

Ohio EPA. 1989b. Biological criteria for the protection of aquatic life: Volume III. Standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrate communities. Division of Water Quality Planning and Assessment, Columbus, Ohio.
http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html

Ohio EPA. 1997. Draft. Biological Criteria for the Protection of Aquatic Life: Volume IV: Fish and Macroinvertebrate Indicies for Ohio's Lake Erie Nearshore Waters, Harbors, and Lacustuaries. Division of Surface Water, Ecological Assessment Unit, Ohio EPA, Columbus, Ohio, USA.

Ohio EPA. 2001. Sediment sampling guide and methodologies, 2nd edition. Nov. 2001. Division of Surface Water, Columbus, Ohio.
http://www.epa.state.oh.us/dsw/guidance/sedman2001.pdf

Ohio EPA. 2004. State of Ohio Cooperative Fish Tissue Monitoring Program, Fish Collection Guidance Manual Final.March 2004
http://www.epa.state.oh.us/dsw/fishadvisory/FishCollectionGuidanceManual05.pdf

Ohio Environmental Protection Agency. 2006. Ohio EPA manual of surveillance methods and quaity assurance practices, updated edition. Division of Environmental Services, Columbus, Ohio. http://www.epa.state.oh.us/dsw/documents/Field%20Manual%203-6-06%20revision.pdf

Omernik, J.M. 1987. Ecoregions of the conterminous United States. Ann. Assoc. Amer. Geogr. 77(1): 118-125.

Rankin, E.T. 1989. The qualitative habitat evaluation index (QHEI): rationale, methods, and application. Division of Water Quality Planning and Assessment, Columbus, Ohio.
http://www.epa.state.oh.us/dsw/bioassess/BioCriteriaProtAqLife.html