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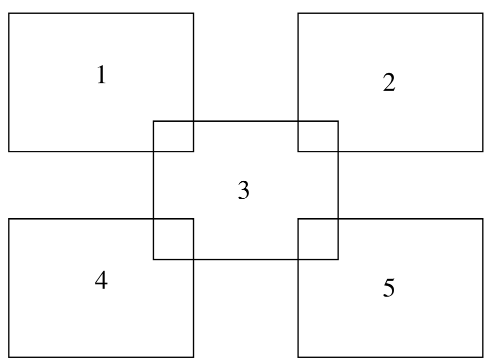
Surface-Water Quantity and Quality, Aquatic Biology, Stream Geomorphology, and Groundwater-Flow Simulation for National Guard Training Center at Fort Indiantown Gap, Pennsylvania, 2002–05

Scientific Investigations Series 2010–5155

U.S. Department of the Interior
U.S. Geological Survey



Cover.

Activities at Fort Indiantown Gap, where military training and environmental stewardship coexist. Photographs 1 and 2 by M.J. Langland, U.S. Geological Survey. Photographs 3, 4, and 5 by J. Hovis, Pennsylvania Department of Military and Veterans Affairs.

Back cover:

View of the Fort Indiantown Gap Training Center overlooking the training corridor. Photograph by J. Hovis, Pennsylvania Department of Military and Veterans Affairs.

Surface-Water Quantity and Quality, Aquatic Biology, Stream Geomorphology, and Groundwater-Flow Simulation for National Guard Training Center at Fort Indiantown Gap, Pennsylvania, 2002–05

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Conversion Factors and Datum

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square foot (ft^2)	929.0	square centimeter (cm^2)
square foot (ft^2)	0.09290	square meter (m^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
foot per second (ft/s)	0.3048	meter per second (m/s)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer [$(m^3/s)/km^2$]
million gallons per day per square mile [$(Mgal/d)/mi^2$]	1,461	cubic meter per day per square kilometer [$(m^3/d)/km^2$]
inch per hour (in/h)	0.0254	meter per hour (m/h)
inch per year (in/yr)	25.4	millimeter per year (mm/yr)
mile per hour (mi/h)	1.609	kilometer per hour (km/h)
	Mass	
pound, avoirdupois (lb)	0.4536	kilogram (kg)
ton, short (2,000 lb)	0.9072	megagram (Mg)
ton per day (ton/d)	0.9072	metric ton per day
ton per day (ton/d)	0.9072	megagram per day (Mg/d)
ton per day per square mile [$(ton/d)/mi^2$]	0.3503	megagram per day per square kilometer [$(Mg/d)/km^2$]
ton per year (ton/yr)	0.9072	megagram per year (Mg/yr)
ton per year (ton/yr)	0.9072	metric ton per year
	Hydraulic conductivity	
foot per day (ft/d)	0.3048	meter per day (m/d)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

°F=(1.8×°C)+32

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

°C=(°F-32)/1.8

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929.

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Surface-Water Quantity and Quality, Aquatic Biology, Stream Geomorphology, and Groundwater-Flow Simulation for National Guard Training Center at Fort Indiantown Gap, Pennsylvania, 2002–05

By Michael J. Langland, Peter J. Cinotto, Douglas C. Chichester, Michael D. Bilger, and Robin A. Brightbill

Abstract

Base-line and long-term monitoring of water resources of the National Guard Training Center at Fort Indiantown Gap in south-central Pennsylvania began in 2002. Results of continuous monitoring of streamflow and turbidity and monthly and stormflow water-quality samples from two continuous-record long-term stream sites, periodic collection of water-quality samples from five miscellaneous stream sites, and annual collection of biological data from 2002 to 2005 at 27 sites are discussed. In addition, results from a stream-geomorphic analysis and classification and a regional groundwater-flow model are included. Streamflow at the facility was above normal for the 2003 through 2005 water years and extremely high-flow events occurred in 2003 and in 2004. Water-quality samples were analyzed for nutrients, sediments, metals, major ions, pesticides, volatile and semi-volatile organic compounds, and explosives. Results indicated no exceedances for any constituent (except iron) above the primary and secondary drinking-water standards or health-advisory levels set by the U.S. Environmental Protection Agency. Iron concentrations were naturally elevated in the groundwater within the watershed because of bedrock lithology. The majority of the constituents were at or below the method detection limit. Sediment loads were dominated by precipitation due to the remnants of Hurricane Ivan in September 2004. More than 60 percent of the sediment load measured during the entire study was transported past the streamgage in just 2 days during that event. Habitat and aquatic-invertebrate data were collected in the summers of 2002–05, and fish data were collected in 2004. Although 2002 was a drought year, 2003–05 were above-normal flow years. Results indicated a wide diversity in invertebrates, good numbers of taxa (distinct organisms), and on the basis of a combination of metrics, the majority of the 27 sites indicated no or slight impairment. Fish-metric data from 25 sites indicated results similar to the invertebrate data. Stream classification based on evolution of the stream channels indicates about 94 percent of the channels were considered to be in equilibrium (type B or C channels), neither aggrading nor eroding. A regional, uncalibrated groundwater-flow model indicated the surface-water and groundwater-flow divides coincided. Because of folding of rock layers, groundwater was under confined conditions and nearly all the water leaves the facility via the streams.

Introduction

The National Guard Training Center at Fort Indiantown Gap (hereafter referred to as the FIG facility) is a 27-mi^2 military facility in Dauphin and Lebanon Counties, Pa. (fig. 1), that has been in use since 1931 as a training and mobilization facility by the U.S. Army and National Guard. Major training facilities at the FIG facility include a bombing range, artillery ranges, and maneuver areas for tanks and other tracked vehicles. Training activities, as well as general operations (vehicle maintenance, petroleum storage, and waste storage and disposal), have the potential to affect water and biological resources on the FIG facility and adjacent lands.

The Pennsylvania Department of Military and Veterans Affairs (PADMVA) is responsible for managing lands at the FIG facility. As part of their management program, PADMVA recently completed an Integrated Training Area Management Program and Integrated Natural Resources Management Plan to protect the environment while ensuring that the military training mission is achieved. The U.S. Geological Survey (USGS) and the PADMVA entered into an agreement in x year to conduct baseline and long-term monitoring of water resources on the FIG facility to allow assessments of current and future water-quality and biological conditions.

Purpose and Scope

This report presents results of a preliminary assessment conducted for the PADMVA at the FIG facility. The primary objectives of this study are to provide a baseline of current water-quality and biological conditions of the stream

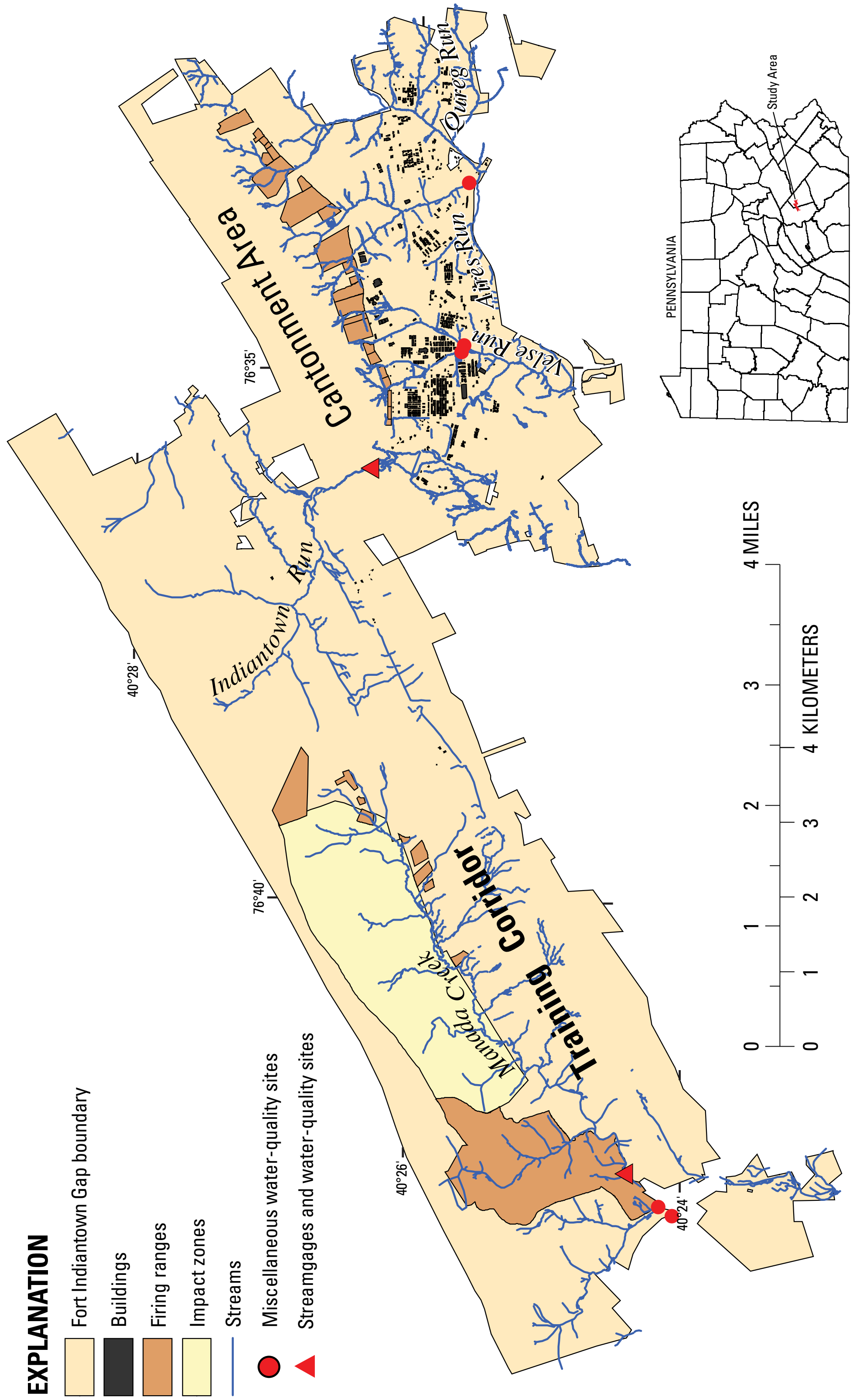


Figure 1. Location of study area, streamgages and water-quality sites, and major features in Fort Indiantown Gap (FIG), Lebanon and Dauphin Counties, Pa.

environment and implement a water-quality monitoring and biological-assessment network for the FIG facility. This report presents the results of the five specific goals from 2002 to 2005.

Specific goals are:

- Determine the baseline occurrence and distribution of contaminants in surface water and sediment,
- Assess the biological community by collecting, quantifying, and identifying benthic macroinvertebrates, fish data, and habitat information,
- Implement a long-term monitoring network to measure seasonal and episodic water-quality changes, quantify contaminant and sediment loads, and evaluate the quality of water leaving the FIG facility,
- Assess the geomorphological condition of streams on the FIG facility and classify them,
- Assess the potential for groundwater transport of contaminants on and off the FIG facility.

Description of Study Area

The FIG facility is in south-central Pennsylvania; the majority of the facility is in Lebanon County, and the remainder is in Dauphin County (fig. 1). The facility is divided into two major sections, training and cantonment. The major training areas are in the central and western areas of the facility, confined mainly between the Blue and Second Mountain. Training includes both ground (field and live fire) and air (fixed and rotary wing, airborne and assault, and air-to-ground fire) activities. Two predominantly forested watersheds drain the majority of the area within the Training Corridor (fig. 1)—Manada Creek and the upper reaches of Indiantown Run. Continuous streamflow and turbidity, along with periodic water quality, were measured at two sites near the facility boundary. Within the Training Corridor, a previous study (Ogden Environmental and Energy Services Co., Inc, 2000) suggested sediment erosion (siltation) was the leading water-quality impairment. Historically, baseline stream-water quality, including the effects of spent ammunition and explosive material, had not been previously characterized spatially or temporally.

The developed area of the FIG facility, commonly known as the Cantonment Area (fig. 1), is drained by the lower reaches of Indiantown Run, the upper reaches of Qureg Run, Aires Run, a tributary to Qureg Run, and the headwaters of Forge Creek, all located entirely in the Lebanon Valley. Most of this area is categorized as residential/light industrial and it consists of recreational areas, maintenance buildings, and a storage yard. The potential for additional water-quality problems as a result of past practices has been suggested by Ogden Environmental and Energy Services Co., Inc. (2000). Past practices included continual construction/destruction of buildings, vehicle storage and maintenance areas, fuel spills and leaks, and landfill hazards. However, the headwaters area of Qureg Run also was impacted to some extent by the track-vehicle training maneuvers that occasionally occur. No continuous streamgages or water-quality monitors were located in this eastern area of the FIG facility. Infrequent water-quality samples were collected at several of the stream sites in the Cantonment Area.

Physiography and Geology

The FIG facility is in the Valley and Ridge Physiographic Province (VRPP). The VRPP consists of complexly folded and faulted sedimentary rocks generally of Paleozoic age (Berg and Dodge, 1981). The training areas of the FIG facility are predominantly in the Appalachian Mountain Section of the VRPP, which consists mainly of sandstone (ridges tops) and shale (valley). The cantonment area is predominantly in the Great Valley Section of the VRPP, which consists primarily of limestone, shale, and dolomite. Based on mapping by Berg and others (1981), the FIG facility is underlain by a total of 10 geologic units, 7 of which are formations (Catskill, Trimmers Rock, Spechty Kopf, Pocono, Martinsburg, Bloomsburg, and Tuscarora), 2 groups (Hamilton and Clinton), and 1 sequence (Hamburg) (fig. 2).

Study Approach and Design

Approach—The specific surface-water goals of the study were accomplished by (1) synoptic sampling of streams at high and low base-flow conditions, (2) synoptic sampling during a storm event, (3) sampling of suspended and bed sediments, and (4) long-term monitoring of water quality in streams leaving the FIG facility. Baseline groundwater conditions were characterized by (1) base-flow sampling of stream-water quality, and (2) applying a groundwater-flow model to evaluate groundwater-flow paths. Additional information was collected for evaluation of aquatic biology (macroinvertebrates and fish habitat) and stream geomorphology (assessments and classification).

Design—A network of synoptic, biological, and long-term monitoring sites was designed on the basis of reconnaissance baseline sampling, data from previous studies, evaluation of possible contaminant transport pathways, and logistical considerations. Sampling frequencies and major constituents sampled for are provided in table 1. Additional information on laboratory-method codes and detection limits for major ions, nutrients, metals, pesticides, polychlorinated biphenyls, volatile and semi-volatile organics, and explosives residue is presented in the appendixes.

The long-term monitoring plan involved streamgaging and water-quality sample collection at two continuous-record sites (Indiantown Run and Manada Creek, fig. 1), and additional water-quality sample collection and streamflow measurements at five miscellaneous sites (table 1). The long-term

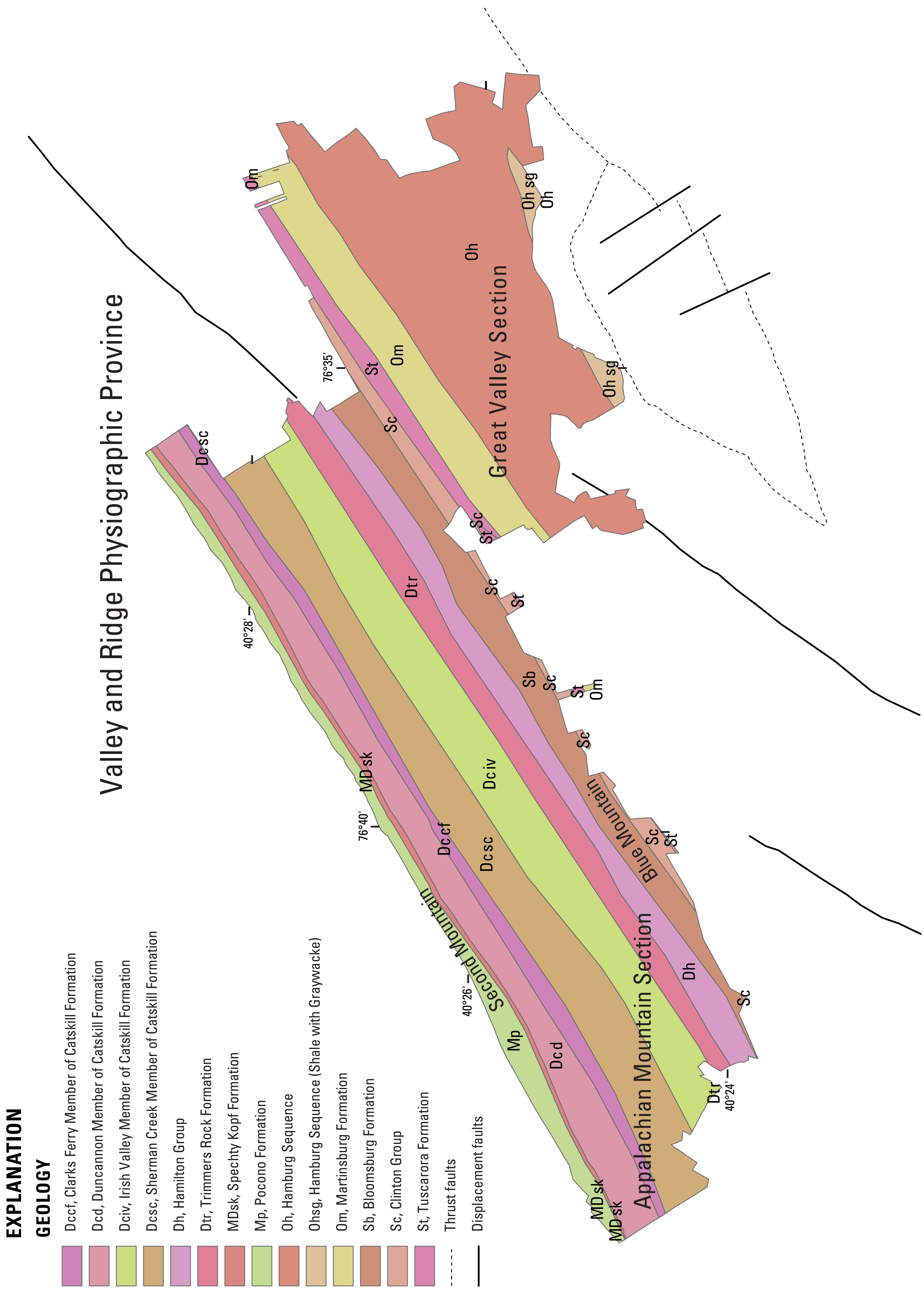


Figure 2. Major geologic units identified at the Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa.

Table 1. Summary of surface-water sampling activities.

Sampling activity	Location	Number of samples	Constituents
Synoptic sediment	Training area Cantonment Off-facility	4 sites/2 samples 8 sites/2 samples 4 sites/2 samples	**Training and off-facility sites**—Nutrients, metals, polychlorinated biphenyls, explosives, sand/silt/clay **Cantonment sites**—Nutrients, metals, polychlorinated biphenyls, volatile organic compounds, semi-volatile organic compounds, pesticides, phenols, major ions, sand/silt/clay fraction, oil and grease
Long-term surface-water quality monitoring	2 sites near facility perimeter	Non-storm (monthly, quarterly, bi-annual) Storm 3 samples per storm/ 4 storms per year	**Monthly**—Nutrients, sediments, metals, ions **Quarterly**—Total organic carbon, explosives **Bi-annual**—Pesticides, polychlorinated biphenyls, semi-volatile and volatile organic compounds, oil and grease **Storm**—Sediments, nutrients, occasional metals, organic compounds, total organic carbon
Miscellaneous surface-water quality sites	5 sites within study area	Quarterly to bi-annual and selected storm sampling	**Quarterly**—total organic carbon, explosives **Bi-annual**—pesticides, polychlorinated biphenyls, semi-volatile and volatile organic compounds, oil and grease **Storm**—part of quarterly or bi-annual sampling

monitoring plan also included additional monitoring points to fully characterize other streams leaving the FIG facility.

A synoptic survey of stream sediments was conducted to help define the areal patterns of chemical quality of sediment. Sediment was collected and analyzed from stream depositional areas, selected sediment ponds, depositional wetland areas, and stream impoundments to help document sediment chemistry in the cantonment area.

Limited historical water-quality data from streams within the FIG facility were available. Most data were the result of one-time sampling events and were collected to accompany invertebrate community assessments in the late 1990s. Samples from periodic water-quality assessments of the Susquehanna River Basin by the Susquehanna River Basin Commission were collected near the mouth of Manada Creek about 8 mi downstream from the FIG facility boundary (Traver, 1997). Routine water-quality samples also were collected near the mouth of Manada Creek as a part of the Pennsylvania Department of Environmental Protection (PaDEP) Statewide Water-Quality Network (WQN).

Study Methods

Streamflow and water quality—Measurements of streamflow at all sites and computations of streamflow records for the long-term continuous sites were conducted in accordance with standard USGS methods (Rantz and others, Volumes I and II, 1982). Measurements of temperature, specific conductance, and turbidity were monitored continuously at the two long-term sites using instream probes. Field measurements were conducted routinely at all sites to monitor the performance of the probes and record actual conditions (Wilde and others, 1999; Wood, 1976). Water-quality samples were collected by automatic and manual means according to USGS methods (Wilde and others, 1999). The structures built at both continuous monitoring sites house automatic samplers that can collect samples remotely on the basis of a change in flow or a change in turbidity.

Sampling procedures and quality assurance—Some physical and water-quality constituents were measured in the field at the time of sample collection. Temperature, pH, and specific conductance of all surface-water samples were determined on site using standard USGS methods (Wilde and others, 1999; Wood, 1976). In streams, discharge was recorded continuously, and a stage/discharge rating was developed for the two continuous-record long-term monitoring locations;

measurements of streamflow were conducted at the time of all sampling for the five miscellaneous sites.

Water and sediment samples were prepared in the field or at the office according to the specific processing, filtering, and preservation techniques required by the USGS (Wilde and others, 1999) or contract laboratories. Samples were analyzed by the USGS National Water-Quality Laboratory and Severn Trent Laboratory for the chemical constituents and physical properties listed in appendix 1.

Quality-assurance (QA) samples were collected to evaluate the integrity of the sampling and analytical procedures (table showing QA samples is shown below). A minimum of 5 to 10 percent of all samples collected were blanks, replicates, or spikes obtained for QA purposes. Blanks were samples of water known to be free of any dissolved constituents. Blanks (both field and equipment) were submitted to the laboratory to help evaluate if samples were being contaminated from the sampling process. Replicates were split aliquots of the same water sample that were submitted to the laboratory for duplicate analysis. Replicates helped evaluate the precision inherent in the sampling and analysis process. Spikes were samples of known concentration that were submitted to the laboratory. Spikes helped evaluate the accuracy of the sampling and analysis process.

Types and percentages of quality-assurance samples by constituent.

[—, no samples collected]

Constituent	Blanks (percent of total samples)	Replicates (percent of total samples)	Spikes (percent of total samples)
Major cations and metals	5	5	—
Anions	5	5	—
Nutrients	5	5	—
Radiochemicals	—	10	—
Semi-volatile/volatile organic compounds	10	5	10
Pesticides	10	5	10
Explosives	10	10	—

Biology—Habitat, aquatic invertebrates, and fish were studied at selected sites on and off the FIG facility. The habitat and invertebrates data were collected and sampled at 27 sites for 4 years (2002–05) during July and August each year. A qualitative survey of the stream habitat was completed at each site when the macroinvertebrates were sampled. The habitat assessment was conducted using a Rapid Bio-assessment Protocol approach for high-gradient streams (Barbour and others, 1999) that uses a score from 0 to 200, higher being better, to determine the condition of the stream reach sampled. Some scored categories were epifaunal substrate/available cover, embeddedness, flow, bank stability, and human impact. Categories were optimal, sub-optimal, marginal, and poor. The following were recorded as part of the assessment: basic water-quality characteristics (pH, specific conductance, and water temperature), weather conditions (present and past 24 hours), site location map, stream characteristics, watershed features, riparian vegetation, instream features, and substrate type.

Invertebrates were sampled according to the PaDEP sampling protocol (Commonwealth of Pennsylvania, 2004). Samples were preserved in buffered formalin and brought back to the USGS laboratory in New Cumberland, Pa. In the lab, the formalin was removed from the samples for hazardous-waste disposal; the samples were rinsed in tap water several times and gridded and picked according to PaDEP procedures of 100 animal subsamples. These subsamples were identified to the lowest taxonomic level possible. The results were tabled, and the metrics were calculated. Taxa richness, total number of individuals, total EPT (Ephemeroptera, mayflies; Plecoptera, stoneflies; and Trichoptera, caddisflies), the percentage of EPT individuals, the dominant species and their number of individuals, a Hilsenhoff Biotic Index (HBI), number of chironomid (midge) taxa, and percent chironomids were calculated for each site. These metrics (both individual and mean) were used to determine the health of a stream (Barbour and others, 1999; Klemm and others, 1990, Hilsenhoff, 1988, Eaton, 1997). However, because the metrics of taxa richness, EPT taxa richness (value), and HBI measured different aspects of the community, a unanimous assessment was not expected; therefore, a majority "score" of the metrics defined the impact present. Using the impact scheme of the New York State Department of Environmental Conservation (Bode and others, 2002), sites were categorized in a four-tiered classification system where the level of impact was assessed for each individual parameter and then averaged for consensus determination. The impact scheme was non-impacted, indicative of excellent water quality; slightly impacted, indicative of good water quality; moderately impacted, indicative of fair water quality, and severely impacted, indicative of poor water quality.

Fish were sampled in 2004 at 25 of the 27 invertebrate sites. A backpack electrofishing unit was used to shock all fish within a 100-m reach. The fish were collected, put in buckets, sorted by species, measured for total length, and weighed. Aerators and ice were used to keep the fish alive in the buckets while awaiting processing. When 30 individuals of a given species were measured and weighed, the other individuals of that species were batch weighed. The fish were then released back to the same stream reach. A Two-way Indicator Species Analysis (TWINSPAN) was used to show the relation of the sites to each other on the basis of communities at the sites. The TWINSPAN uses the relative abundance of fish species at all sites to show which sites are similar in community and which are not. This hierarchical classification program arranges similar samples together in a dendogram by using indicator species to separate the sites from each other (Gauch, 1982). By using this polythetic technique, some of the noise in community data is lost, and a more accurate picture of the community structures can be seen (Gauch, 1982). TWINSPAN uses reciprocal averaging focusing on different community gradients as important factors in partitioning the data sets for the sites in ordination space (Gauch, 1982).

Channel morphology—Fluvial geomorphic analysis at the two continuous-record long-term monitoring sites and the subsequent stream classification were based primarily on methods and theory developed by Rosgen (1996, 1998, 2002), Simon (1989), and Cinotto (2003). Stream classification was used to broadly categorize the character of a stream reach on the basis of its morphology, a Level I classification. A geomorphic assessment generally was based on the Level II and Level III classification (Rosgen, 1996) and involved a much more intensive and descriptive study of selected reaches to estimate the current stability of the stream channel as well as a description of the fluvial geomorphic processes acting on the reach. At each geomorphic study site, three detailed surveys were conducted—a longitudinal profile and two cross sections. Reinforcement bars were driven below grade at the ends of each cross section and a global positioning system (GPS) was used to mark the end points of all surveys so that future recovery and study are possible. At each cross section, a pebble count, adopted from Wolman (1954), was conducted to determine the particle-size distribution of the streambed materials. One core sample also was collected at each cross section by excavating the materials within a plastic cylinder that had been pressed into the sediment; these sediments were later sieved in the laboratory. Data from these core samples were utilized to determine the particle-size distribution of the materials that were potentially mobile (entrained) during the process of stream-channel formation. Core samples were collected from the downstream third of a bar at an approximate elevation equal to half the distance between the deepest part of the bankfull channel and the top of the bankfull channel. These core samples were collected on the nearest bar to the riffle wherein the cross-section survey was completed. When no depositional feature, such as a point bar, was present, core samples were collected from the streambed within the same riffle wherein the cross-section survey was completed. Digital photographs also were taken at each geomorphic study site to document current site conditions, and ancillary data such as the valley type (Rosgen, 1996) were noted.

Groundwater-flow models—A 2-dimensional cross-sectional or profile model and a 3-dimensional flow model of the area were constructed using natural hydrogeologic boundaries. The profile model is representative of a north-south cross section in the central part of the study area from Stony Creek in the north toward Swatara Creek in the south. The steady-state model was simulated quantitatively using the USGS software called TopoDrive (Hsieh, 2001). The model as constructed was 11,000 m long with 100 columns and 10 rows. Representative geology, structure, and hydraulic properties were input into the model. The uncalibrated 3-dimensional model was extended beyond the boundary of the FIG facility to represent the hydrogeologic characteristics of the area and to provide estimates of flow paths. The simulation was evaluated quantitatively by the use of the finite-difference groundwater-flow model software package called MODFLOW-2000 (Harbaugh and others, 2000). The simulation was done to determine the recharge and discharge areas and the intermediate groundwater and potential containment flow paths on the FIG facility and surrounding areas.

Surface Water

Climatological processes (rainfall) are primarily responsible for the annual and seasonal variability in streamflow. This variability introduces a great deal of complexity when discussing and evaluating changes in constituent water quality, transport, and delivery. This section discusses streamflow, water quality, and sediment in terms of summary statistics and drinking-water standards.

Streamflow

All surface waters leaving the FIG facility drain into the Swatara Creek watershed. Streamflow was continuously monitored at the two largest streams draining the facility, Indiantown Run and Manada Creek. Streamflow hydrographs for the two sites for the period of record, Oct. 1, 2002, through Sept. 30, 2005, are presented in figures 3 and 4. These dates correspond to the 2003, 2004, and 2005 water years.[1]

Statistics for total annual and annual mean daily flows and maximum and minimum mean daily flows are presented in table 2. Streamflow statistics from two additional streamgages (within 10 mi of FIG) of the project are presented to provide a greater spatial and temporal comparison of hydrologic conditions (table 2). The total annual flows for 2003, 2004, and 2005 at the two “on-facility” and two “off-facility” sites are comparable in terms of relative magnitude and change from year to year. The total annual flows for the two “on-facility” sites were about one-half to one-third less than the total annual flow at the two “off-facility” sites in 2001 and 2002, which indicates the total annual flows for years 2001 and 2002 for the two “on-facility” sites were lower than the water yield for years 2003, 2004, and 2005 (Durlin and Schaffstall, 2003, 2004). Annual water yields (volume of water normalized by area) for the two “off-facility” sites also indicate above-normal flow conditions in 2003–05 compared to 2001 and 2002.

Extreme hydrologic events—Two separate extreme events occurred during the period of record. The first was on August 11, 2003, in Qureg and Aires Run drainage areas, on the south-eastern-most boundary of the FIG facility. The intense rainfall from a thunderstorm produced an estimated flow of 1,980 ft^3/s at the miscellaneous sampling point in Aires Run (Lloyd Reed, U.S. Geological Survey, written commun., 2004). On the basis of the estimated rainfall amount of approximately 8 in. in 3.5 hours, rainfall frequency flow durations from nearby long-term streamgages, and estimations of unit discharges, the flow would be equivalent to greater than a 500-year flow (Herschfield, 1961; Bonnin and others, 2004).

[1]A water year is the 12-month period October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months.

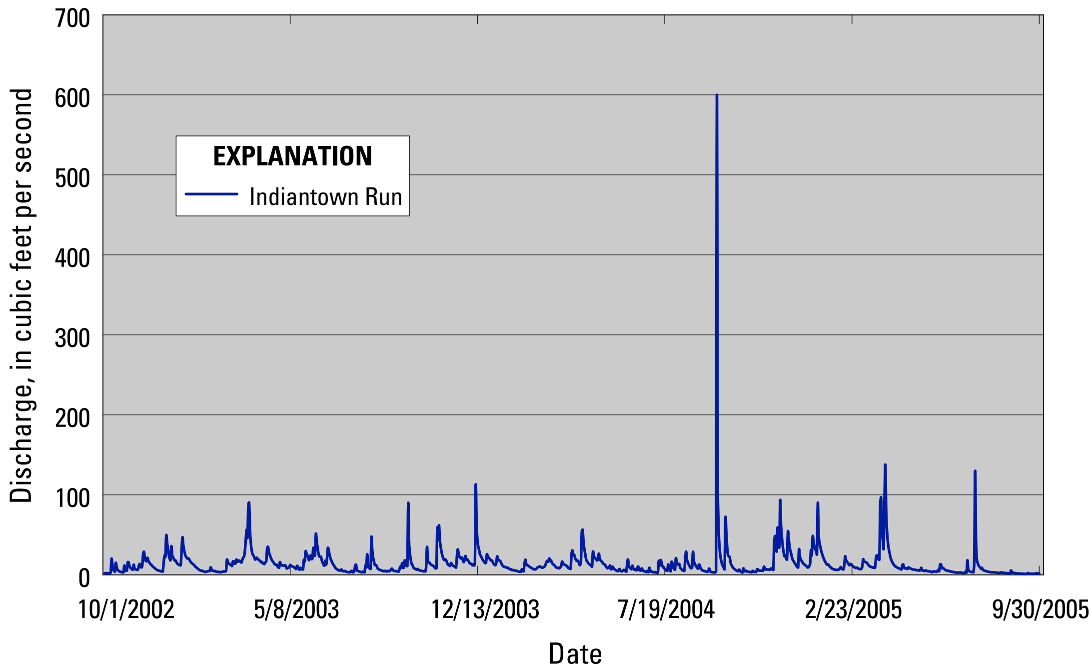


Figure 3. Daily mean-flow hydrograph for Indiantown Run at Indiantown, Pa., October 1, 2002, through September 30, 2005.

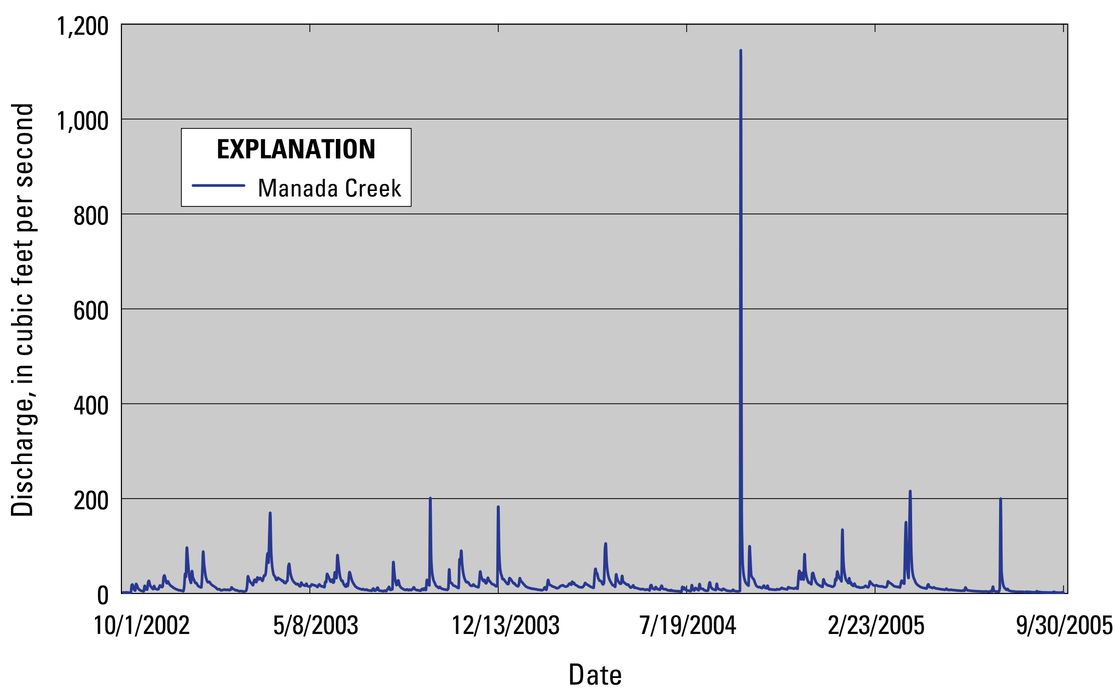


Figure 4. Daily mean-flow hydrograph for Manada Creek at Manada Gap, Pa., October 1, 2002, through September 30, 2005.

Table 2. Summary statistics for two project and two nearby streamgage sites.

[USGS, U.S. Geological Survey; mi^2, square miles, ft^3/s; cubic feet per second; (ft^3/s)/mi^2, cubic feet per second per square mile; WY; water year]

Stream site name and USGS identification number	Drainage area (mi^2)	Total annual flow (ft^3/s)	Annual yield [(ft^3/s)/mi^2]	Annual mean daily flow (ft^3/s)	Maximum mean daily flow (ft^3/s)	Minimum mean daily flow (ft^3/s)
Indiantown Run (01572950)						
WY 2003	5.48	5,056	923	13.9	90	1.8
WY 2004		5,292	966	14.5	384	2.8
WY 2005		4,730	863	13.0	139	1.2
Manada Creek (01573482)						
WY 2003	8.59	7,589	883	20.8	201	1.7
WY 2004		7,848	913	21.5	819	4.0
WY 2005		6,010	700	16.5	215	1.7
Comparison to nearby sites						
Swatara Creek near Pine Grove (01572025)						
WY 2001	116	50,670	437	139	2,850	18
WY 2002		37,985	327	104	829	14
WY 2003		121,200	1,045	332	2,760	34
WY 2004		108,640	936	297	6,790	51
WY 2005		91,260	767	250	3,220	19
Swatara Creek at Harpers Tavern (01573000)						
WY 2001	337	142,070	421	389	6,980	37
WY 2002		97,350	289	267	2,580	13
WY 2003		344,910	1,020	945	7,780	69
WY 2004		330,380	980	903	16,500	129
WY 2005		279,140	828	740	9,200	35

The other extreme hydrologic event was on September 18, 2004 (figs. 3–4), when precipitation from the remnants of Hurricane Ivan produced the highest recorded peak flows during the study. The hydrographs (appendix 2) illustrate that the flows were three times the magnitude of any other rainfall event. Peak instantaneous flows were estimated to be approximately 1,700 ft^3/s at Manada Creek and 960 ft^3/s at Indiantown Run. The flows overtopped the bridge road surfaces at both locations, toppled the gage house on Manada Creek (crest was approximately 11 ft), and scoured out and destroyed the instream monitoring equipment at Indiantown Run. On the basis of an estimated rainfall amount of approximately 7 in. in 4 hours, rainfall frequency flow durations from nearby long-term flow sites, and estimations of unit discharges, the flow would be equivalent to about a 500-year flow (Herschfield, 1961; Bonnin and others, 2004). The damage to the FIG facility was in the millions of dollars, the majority confined to the major training sites and tank trails, an area where a large amount of resources has been expended, mainly on sediment controls.

Water Quality

Major objectives of this study include characterizing the water quality within the boundary of the FIG facility, determining the baseline occurrence and distribution of contaminants in water, and assessing the potential for the surface water (groundwater to be discussed in a later section) transport of contaminants on and off the FIG facility. Therefore, a long-term monitoring plan was designed and implemented at two continuous flow and water-quality monitoring sites and five miscellaneous water-quality sites (table 3). Two of the miscellaneous sites (01573490 and 01573497) have staff gages to record stream height, and streamflow is measured at the time water-quality samples are collected. The other three miscellaneous sites have very limited sampling. Manual samples were collected at the three sites in order to characterize the sites and determine the need for future sampling. All sites had samples analyzed for nutrients, major ions, field characteristics, metals, volatile and semi-volatile organics, pesticides, explosives, and sediments. Additional details on the sampling frequency and sampled constituents are presented in table 1 and appendix 1.

Table 3. U.S. Geological Survey surface-water-quality site numbers and names, drainage area, and site purpose.

[USGS, U.S. Geological Survey; mi², square miles]

USGS site number	Site name	Drainage area (mi²)	Latitude/longitude	Site purpose
01572950	Indiantown Run near Harper Tavern	5.48	402620 763555	Continuous flow and turbidity and long-term monitoring
01573482	Manada Creek near Manada Gap	8.59	402424 764234	Continuous flow and turbidity and long-term monitoring
01573490	Tributary along Horseshoe Trail to Manada Creek	1.64	402409 754252	Miscellaneous site
01573497	Unnamed tributary along Rt. 443 to Manada Gap	3.06	402403 764257	Miscellaneous site
01572809	Aires Run above Coulter Road at Fort Indiantown Gap	1.74	402539 763314	Miscellaneous site (limited sampling)
01572979	Vesle Run downstream Airfield at Fort Indiantown Gap	.73	402540 763446	Miscellaneous site (limited sampling)
01572981	Unnamed tributary to Vesle Run at Fort Indiantown Gap	.79	402541 763450	Miscellaneous site (limited sampling)

Nutrients

Nutrients (nitrogen and phosphorus) are naturally occurring compounds found in every ecosystem. Human activities such as fertilizer use, wastewater treatment systems, septic systems, and car and power-plant emissions contribute additional nutrients to water resources through runoff, discharges, and atmospheric deposition. Elevated concentrations of nutrients increase aquatic plant growth, which in turn can alter benthic-macroinvertebrate communities. A total of 82 samples were collected and analyzed for nutrients. The majority were collected at the two continuous-record streamgages during base flow and stormflow. Additional samples were collected at the miscellaneous sites. The USEPA has set maximum and secondary contaminant levels for drinking water (U.S. Environmental Protection Agency, 1991, 1992, 1994), which are listed in appendix 1a. Results indicate concentrations for selected nutrients (table 4) were well below any primary or secondary drinking-water standards and Pennsylvania water-quality criteria for aquatic life and water supply. For example, the drinking-water standard for nitrate is 10 mg/L. The highest observed concentration was 1.8 mg/L or about five times less than the standard. Statistical summaries of nutrient data including maximum, mean, median, and minimum concentrations of all sampled constituents are presented in appendix 2a.

Major Ions

A total of 89 samples were analyzed for major ions. Calcium, magnesium, chloride, potassium, and sodium are the major ions present in most waters. They naturally originate from the soil and rock and are present in surface water through groundwater discharge. However, human activities such as road/ice treatments, septic-field discharge, overland runoff from fertilized areas, and atmospheric deposition also can lead to increased concentrations. Concentrations of the major ions are within the expected range (although on the lower end) on the basis of the geology and soils when compared to similar geologic settings in Pennsylvania (Barker, 1984). Statistical summaries of the major-ion data including maximum, mean, median, and minimum concentrations of all sampled constituents are presented in appendix 2a.

Field Characteristics

Specific conductance and temperature were measured continuously at the two continuous-record long-term sites. The pH was measured at the time of sample collection at all sites. Specific conductance is a measure of the capacity of water to conduct electrical current and is directly related to the concentration of dissolved ions. The daily mean specific conductance during base-flow conditions averaged 52 and 38 μS/cm at Indiantown Run and Manada Creek, respectively, indicating low ionic strength and low concentrations of ions. The pH (measure of the hydrogen ion activity) of the stream waters at the FIG facility ranged from 6.4 to 7.8; the mean was 7.1. The secondary drinking-water standard ranges from 6.5 to 8.5 (U.S. Environmental Protection Agency, 1992). If the pH is constantly 6 or lower, in conjunction with low ionic strength waters and low calcium concentrations, there may be some concern that the water might create corrosive conditions harmful to some plumbing systems.

Sediment

A 1995 report by the U.S. Department of Agriculture Natural Resources Conservation Service (USDA) identified major soil-erosion areas at the FIG facility (U.S. Department

Table 4. Summary statistics for selected nutrient and total suspended solids concentrations in milligrams per liter for all samples collected at the Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa. (sediment samples collected on Sept. 18, 2004, not included).

[P00600, total nitrogen as N; P00610, total ammonia as N; P00620, total nitrate as N; P00665, total phosphorus as P; P00671, dissolved inorganic phosphorus as P; P00530, total suspended solids]

	P00600	P00610	P00620	P00665	P00671	P00530
Minimum	0.67	0.02	0.15	0.02	0.03	1
25th percentile	.88	.05	.29	.03	.05	4
Mean	1.35	.10	.47	.07	.07	57
Median	1.3	.1	.34	.05	.05	16
75th percentile	1.6	.1	.45	.05	.05	71
Maximum	2.4	.5	1.8	1.2	.22	590
Total samples	127	127	127	127	127	127

of Agriculture, 1995). Manada Creek and Indiantown Run, the two largest watersheds, were identified as having the greatest problems, which were related to military training activities (Ogden Environmental and Energy Services Co., Inc., 2000). The USDA identified the primary source of erosion as the tracked-vehicle roads and trails; secondary sources include open range areas and streambank erosion. Major improvements to the vehicle trails and drainage systems began in 1997 and are ongoing (2009).

The USDA study estimated soil loss only to the streams. Data for fluvial sediment transport did not exist. Therefore, one of the objectives of long-term monitoring was to provide data on sediment concentrations and loads in streams to provide an indication of how much sediment leaves the FIG facility in surface water. The two continuous-record long-term sites were equipped with automatic samplers that would trigger to collect a sample on the basis of an increase in flow and (or) in turbidity. It was assumed that there could be occasions when the turbidity would increase with little change in flow, reflecting the sediment disturbance from ongoing training activity. However, the automatic samplers were rarely triggered on the basis of turbidity alone, a good indication that sediment-management efforts may be reducing sediment inputs to the streams.

A total of 115 total suspended solids (TSS) samples were collected from all 7 surface-water-quality sites during the study. In addition, 55 samples were collected and analyzed for suspended sediment (SS) by the USGS to correct for “inherent bias” between TSS and SS concentrations and to verify the turbidity readings. The bias is a result of different analytical methods used to measure TSS and SS concentrations, which tend to underestimate TSS concentrations at increased flow as the percentage of sand in the sample increases (Grey and others, 2000). The majority of samples were collected during stormflow when the majority of the sediment load is transported. The measure of the relation (variability) between TSS and SS was generally high at both of the long-term monitoring sites (r^2 of 0.85 at 01572950, Indiantown Run, and r^2 of 0.80 at 01573482, Manada Creek). Future discussion in this report of SS and TSS will be referred to as sediment. Sediment concentrations ranged from less than 3.0 mg/L (method reporting limit) to 14,000 mg/L on September 18, 2004, during the remnants of Hurricane Ivan. The maximum concentrations of sediment were 11,500 mg/L at Indiantown Run and 14,000 mg/L in Manada Creek and were 10–15 times higher than any previous sediment-concentration data. The data from this storm were not included in table 4 but were included in the statistical analysis presented in appendix 2a and in the estimation of sediment loads and yields for the two long-term streamgages.

Sediment and turbidity data have been collected intensively for 3 years at the two continuous-record sites established for long-term monitoring at the FIG facility. This short period of record prohibits a detailed analysis of seasonal patterns and trends, and more detailed information on actual source areas of sediment was not feasible. In addition to the collection of sediment samples, measurements of continuous turbidity were recorded. The measurement of turbidity was to reduce cost in sediment collection and analysis and to have a continuous record of sediment flux over the hydrograph. The regression between the turbidity values and sediment concentrations indicates a good relation at the two continuous-record long-term sites (table 5).

Table 5. Relation between the measured turbidity and sediment concentrations for sites at the Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa.

[USGS, U.S. Geological Survey]

USGS site number	Number of data points	Regression equation	Coefficient of determination (r^2)
01572950	70	$y = 1.013x + 1.41$	0.89
01573482	69	$y = 0.99x + 19.5$	.78

Because the turbidity probes used in the earlier part of the study only measured accurately to 1,000 NTU, sediment concentrations greater than 1,000 mg/L could not be used in the regression analysis. Sediment concentrations exceeded 1,000 mg/L for only one storm event, September 18, 2004, during the remnants of Hurricane Ivan. Current turbidity probes can measure up to 1,200 NTUs.

Typically, a change in flow creates a corresponding change in turbidity. The relation between turbidity and flow is indicated in figure 5. Although figure 5 is limited to 1 year of record for clarity, it is typical of the turbidity/flow relation at the two continuous-record long-term sites. Note the general seasonal pattern when turbidity readings are lower in winter versus the opposite in late summer and fall.

Sediment samples were used to help calibrate and verify the turbidity curve. The turbidity curve was used in conjunction with a discharge curve to estimate daily, monthly, and annual sediment loads using the USGS software program Graphical Constituent Loading Analysis System (GCLAS). Even though the monthly and annual loads were similar at the two sites (maximum and minimum loads occurred in about the same months, and annual loads were comparable by year), variability in the loads was primarily due to variability in flow. By far, the remnants of Hurricane Ivan had the most dominant effect on sediment loads (table 6 and figs. 6 and 7). The estimated monthly loads for September 2004 were 931 tons for Indiantown Run and 2,020 tons for Manada Creek. These loads represent approximately 95 and 97 percent of the September 2004 monthly load, approximately 79 and 83 percent of the total annual load for water year 2004, and 50 and 63 percent of the total sediment load during the study (2003–05) for Indiantown Run and Manada Creek, respectively.

Loads give an indication of the total mass of sediment passing a gaging site. In general, larger watersheds have more contributing drainage area and, therefore generate larger loads. Yields normalize the loads to drainage-area size to provide an estimation of the total mass generated per unit area. This normalization along with hydrologic and other basin characteristics (changes in land use and amount of disturbed land) was useful when comparing the amount of transported sediment to other watersheds. Similar to the sediment loads, yields are presented in table 7 with and without the September 18, 2004, storm. The impact of the storm event was obvious. Monthly average yields for 2004 were reduced from 17.9 to 4.46 ton/mi^2 at Indiantown Run and 23.5 to 4.47 ton/mi^2 at Manada Creek. The maximum and minimum monthly yields were measured at Indiantown Run in the same year (0.11 and 14.78 ton/mi^2, September and March 2005, respectively). On average, Indiantown Run generated more sediment per unit area (4.85 ton/mi^2) than Manada Creek (3.98 ton/mi^2) during the study period.

The annual yields for Indiantown Run and Manada Creek are lower than some other monitored subbasins in the Lower Susquehanna River Basin (fig. 8) and are related to the land use and amount of disturbed land. While some error exists in figure 8 because of the fact that all sites were not monitored concurrently, the relative magnitudes of error in yield estimations do provide comparable data (all sites monitored for at least 5 years between 1985 to present). Annual mean yields are arranged from high to low and generally represent changes in

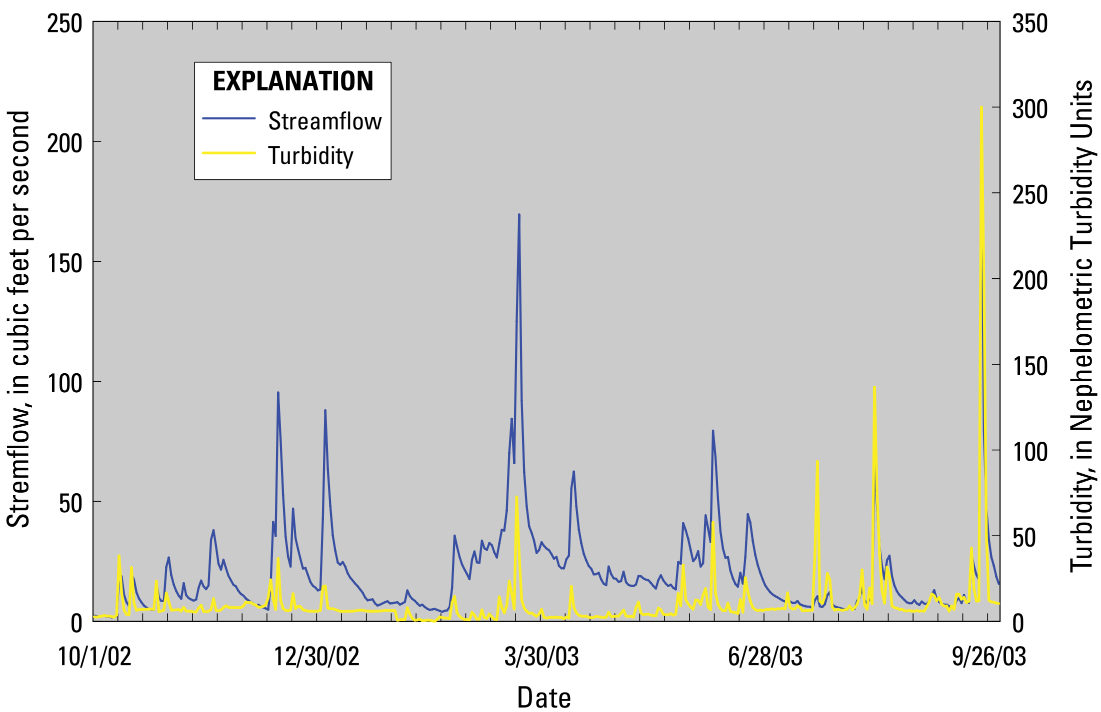


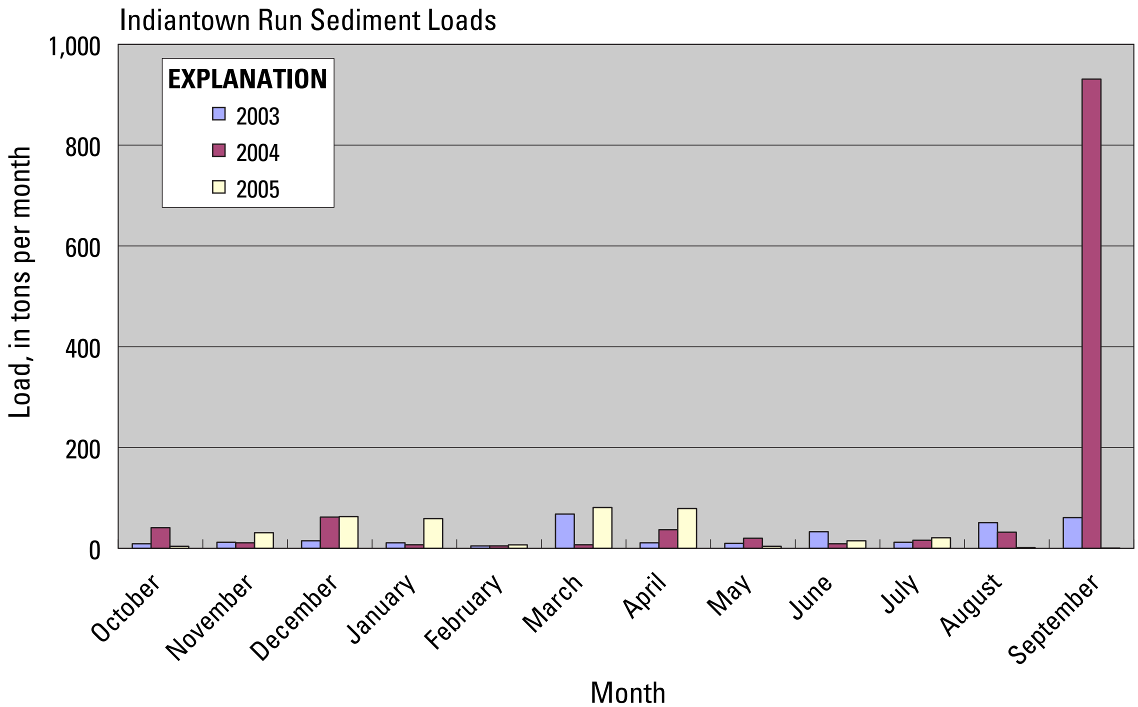
Figure 5. Relation between streamflow and turbidity at Manada Creek, October 1, 2002, through September 30, 2003.

Table 6. Monthly and annual estimated sediment loads for the two continuous-record long-term sites at the Fort Indiantown Gap facility based on suspended sediment concentrations and turbidity values. Loads for September 2004 and total loads for 2004 are shown with and (without) the remnants of Hurricane Ivan.

Month	Indiantown Run loads (tons)			Manada Creek loads (tons)		
	2003	2004	2005	2003	2004	2005
October	9.1	41	4	12	69	12
November	12	11	31	11	27	30
December	15	62	63	29	69	57
January	11	7.1	59	19	17	66
February	4.8	4.9	6.9	3	16	13
March	68	7.1	81	94	18	98
April	11	37	79	10	85	79
May	9.8	20	4	15	23	7.3
June	33	9.1	15	46	26	3.6
July	12	16	21	12	22	24
August	51	32	1.5	63	34	3.6
September	61	931 (46)	.59	62	2,020 (55)	2.3
Totals	298	1,178 (293)	366	376	2,426 (461)	396

Table 7. Monthly and annual estimated sediment yields for the two long-term sites at the Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa.

Month	Indiantown Run yields (tons per square mile)			Manada Creek yields (tons per square mile)		
	2003	2004	2005	2003	2004	2005
October	1.66	7.48	0.73	1.40	8.03	1.40
November	2.19	2.01	5.66	1.28	3.14	3.49
December	2.74	11.31	11.50	3.38	8.03	6.64
January	2.01	1.30	10.77	2.21	1.98	7.68
February	.88	.89	1.26	.35	1.86	1.51
March	12.41	1.30	14.78	10.94	2.10	11.41
April	2.01	6.75	14.42	1.16	9.90	9.20
May	1.79	3.65	.73	1.75	2.68	.85
June	6.02	1.66	2.74	5.36	3.03	.42
July	2.19	2.92	3.83	1.40	2.56	2.79
August	9.31	5.84	.27	7.33	3.96	.42
September	11.13	170 (8.39)	.11	7.22	235 (6.40)	.27
Totals	54.36	214.8 (53.52)	66.79	43.80	282.0 (53.64)	46.08
Average monthly	4.53	17.9 (4.46)	5.57	3.65	23.5 (4.47)	3.84



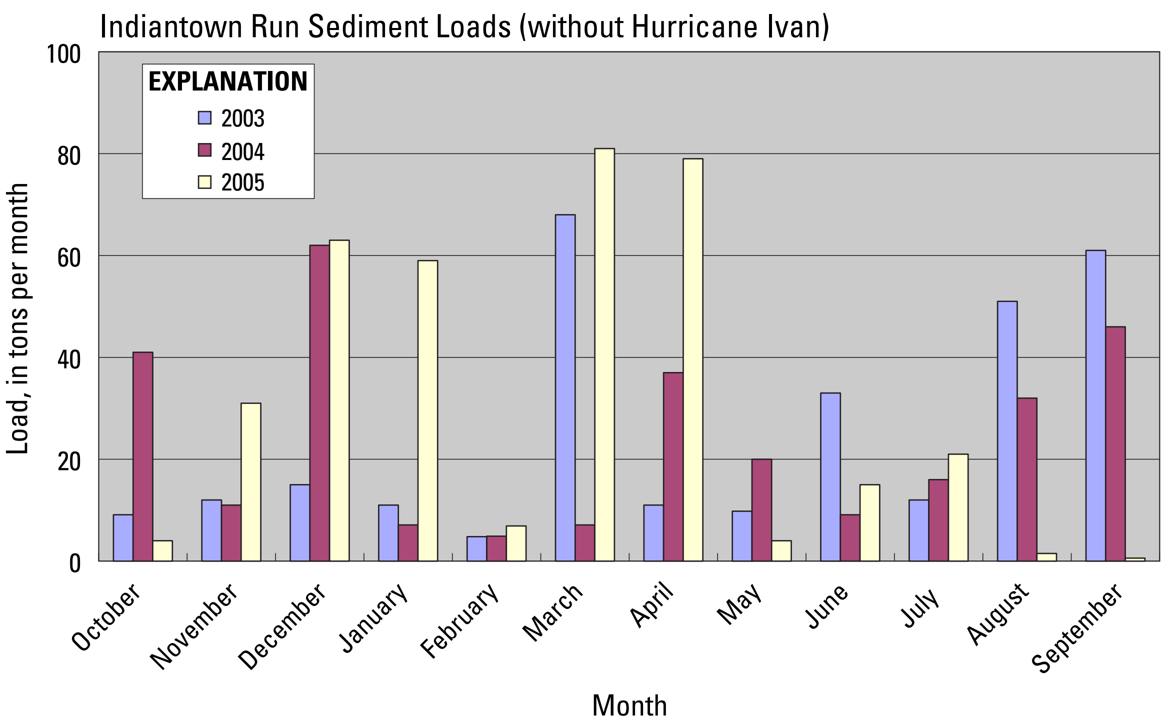
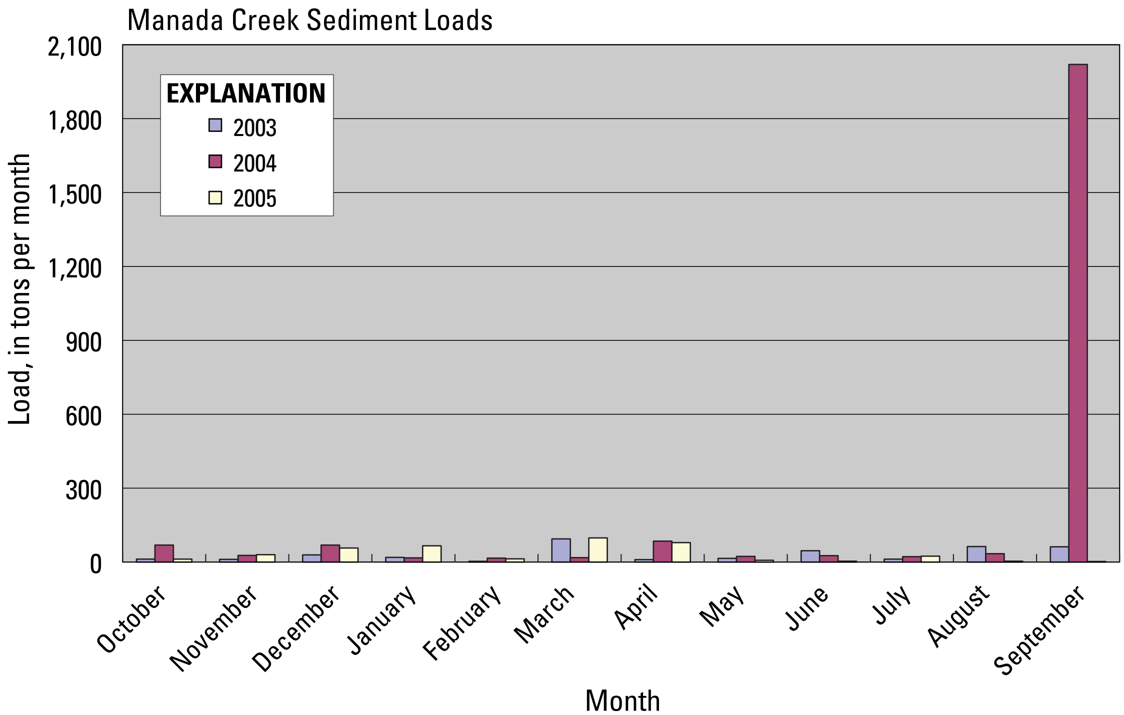


Figure 6. Sediment loads (tons) by month for years 2003 through 2005 at Indiantown Run (01572950) with (top) and without (bottom) the remnants of Hurricane Ivan (note scales are not the same).



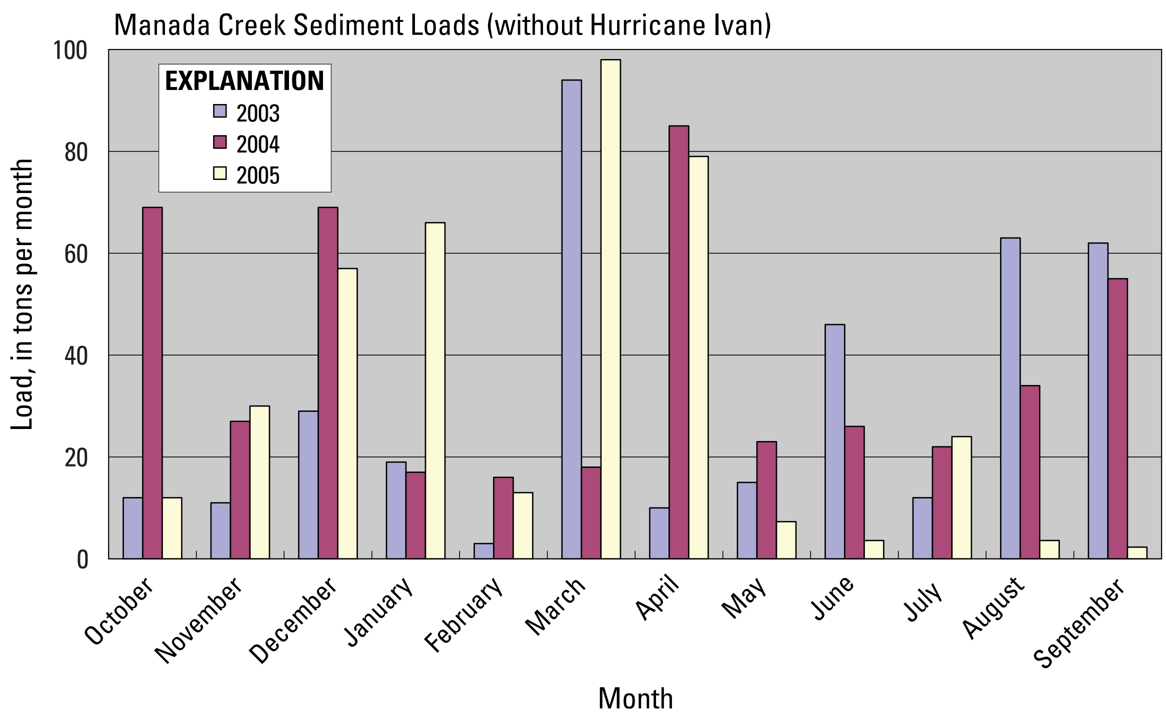


Figure 7. Sediment loads (tons) by month for years 2003 through 2005 at Manada Creek (01573482) with (top) and without (bottom) the remnants of Hurricane Ivan (note scales are not the same).

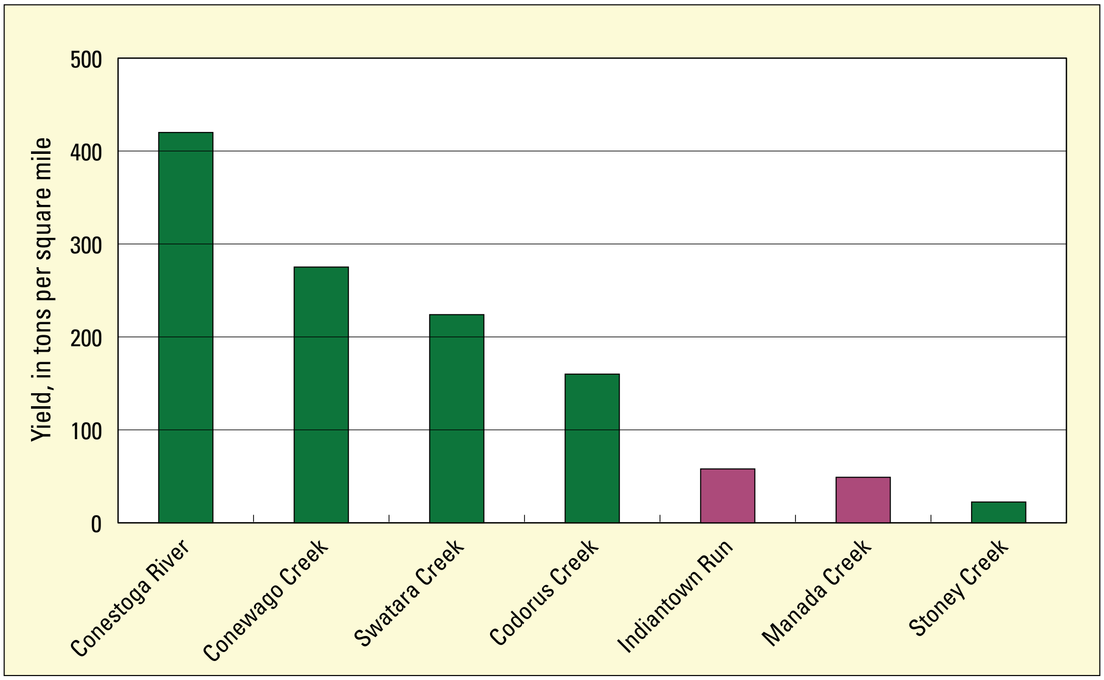


Figure 8. Comparison of sediment yields from the Fort Indiantown Gap sites (in red) with other basins in the Susquehanna River Basin.

land use from more to less agriculture (amount of disturbed land) and less to more forest (undisturbed land). Yields do not include the September 2004 storm. Yields for the sites at the FIG facility are within expectations—yields are lower than more disturbed agricultural, residential, and urban basins (Conestoga, Conewago, Swatara, and Codorus watersheds) and higher than the nearby undisturbed forested basin (Stony Creek). Because of the large amount of forested area in the watershed and the more recent sediment-erosion controls, the yields from the two largest streams draining the FIG facility are more representative of the yields from a forested basin than from urban and agricultural basins.

Metals

A total of 85 samples were collected and analyzed for metals. The majority of the samples were collected at the two continuous-record streamgages during base-flow and storm-flow conditions. Additional samples were collected at the miscellaneous sites. Metals were reported in micrograms per liter (parts per million). Similar to the nutrient data, results indicate mean concentrations were well below any primary or secondary drinking-water standards and Pennsylvania water-quality criteria for aquatic life and water supply for all metals except iron. For example, lead had a drinking-water action level of 15 µg/L (U.S. Environmental Protection Agency, 1994). The maximum concentration during the study from one sample was 6 µg/L; all the remaining samples for lead were at or below the method detection limit of 3.0 µg/L (table 8). The USEPA drinking-water standard for arsenic was lowered from 50 µg/L to 10 µg/L in 2006. The maximum concentration was 34 µg/L, and all other arsenic samples were at or below the current (2005) method detection level of 15 µg/L (table 8). The secondary drinking-water standards are set for odor and aesthetic reasons. Iron has a secondary drinking-water standard of 300 µg/L. The mean iron concentration was approximately 1,800 and 1,900 µg/L, respectively, for Indiantown Run and Manada Creek, and the maximum concentration was 8,600 µg/L. A previous study indicated naturally high iron concentrations in the groundwater underlying the FIG facility (Barker, 1984). For this reason, underlying geology contributes to the high iron concentrations in the sampled water and does not imply “unnatural” or contaminated conditions. Statistical summaries of the metals data including maximum, mean, median, and minimum concentrations of all sampled constituents are presented in appendix 2b.

Selected metals concentration data from the two continuous-record long-term sites at the FIG facility were compared to metals data from five randomly chosen nearby “off-facility” current sampling sites. Three sites are within the Swatara Creek Basin and two sites are outside the basin (table 9). The three sites in the Swatara Creek Basin in close proximity to the FIG-facility sites represented streams impacted by acid mine discharge. The two sites outside the Swatara Creek Basin are not in close proximity to the FIG facility sites and are in areas predominantly impacted by urban (Letort Run) and agricultural (Rambo Run) land use. In summary, the sites at the FIG facility had lower concentrations of metals than the three “off-facility” sites within the Swatara Creek Basin and higher concentrations than the two “off-facility” sites outside the Swatara Creek Basin.

Table 8. Summary statistics for selected metals concentrations, in micrograms per liter, from samples collected at the two long-term water-quality sites at Fort Indiantown Gap, Lebanon and Dauphin Counties, Pa.

[P01106, Aluminum as Al; P01002, Arsenic as As; P01042, Copper as Cu; P01045, Iron as Fe; P01051, Lead as Pb; P71900, Mercury as Hg]

	P01106	P01002	P01042	P01045	P01051	P71900
Minimum	20	4	10	120	3	0.1
25th percentile	47	10	10	310	3	.2
Mean	74	14.4	10.6	1,900	3.1	.19
Median	79.5	15	10	700	3	.2
75th percentile	100	15	10	3,300	3	.2
Maximum	130	34	20	8,600	6	.2
Total number of samples	127	127	127	127	127	127

Table 9. Summary statistics for selected total metal concentrations, in micrograms per liter, from the two continuous-record long-term monitoring sites at Fort Indiantown Gap and five off-facility comparison sites.

[USGS, U.S. Geological Survey; DA, drainage area in square miles; <, less than; --, no data; Al, aluminum; As, arsenic; Cu, copper; Fe, iron; Pb, lead]

USGS station name and (identification number)	DA	Minimum					Median					Maximum				
		Al	As	Cu	Fe	Pb	Al	As	Cu	Fe	Pb	Al	As	Cu	Fe	Pb
Indiantown Run at Indiantown Gap (01572950)	5.5	100	<10	<10	140	<3	350	15	10	530	3.2	1,700	30	20	3,700	6
Manada Creek near Manada Gap (01573482)	10.6	100	<10	<10	120	<3	300	15	10	250	3	800	30	20	980	6
Letort Run near Carlisle (01567795)	7.3	--	<4	<4	20	<1	--	<4	<4	84	<1	--	<4	<4	160	<1
Rambo Run near Stewartstown (01577180)	10	100	<4	<4	90	<1	116	<4	<4	215	<1	200	<4	<4	450	<1
Swatara Creek at Lorberry Junction (01571798)	42	100	40	<3	180	40	404	46	<3	960	40	1,600	80	<3	4,200	80
Swatara Creek near Ravine (01571820)	43	30	30	<3	60	<1	2,430	46	14	6,260	35	27,000	400	90	60,000	100
Swatara Creek near Pine Grove (015720205)	116	200	--	10	40	<1	2,400	--	15	4,200	4.8	18,900	--	120	54,400	100

Volatile and Semi-Volatile Organic Compounds, Pesticides, and Explosives

A total of 10 samples were collected for analysis of volatile and semi-volatile organic compounds (VOCs and SVOCs), 7 samples for pesticides, and 13 samples for explosives from the 2 continuous-record long-term and 5 miscellaneous sampling sites. Due to increased analysis costs, less samples were collected when compared to the number of samples collected for nutrients and metals. Sample collection was targeted to possible source areas considering location, land uses, and season. VOCs and SVOCs are widely used in industrial, commercial, and household applications. Many are suspected to cause cancer and enter the groundwater and surface water through spills, leakage from storage sites (tanks and lagoons), and disposal sites. Similar to the nutrients and metals, no concentrations were above any USEPA primary or secondary drinking-water standards. In fact, no VOCs or SVOCs were above the method detection limit in any of the samples, except one sample from Indiantown Run that had a detectable concentration of polychlorinated biphenyls (PCBs) but was well below the drinking-water standard. Pesticides (herbicides and insecticides) are used to control weed growth and insect populations. No pesticide concentrations were detected above the method detection limit. Explosives have been widely used at the FIG facility for more than 60 years. Several samples from each of the two continuous-record long-term sites had low but detectable levels of compounds related to the use of explosives that included cyclotrimethylenetrinitramine (RDX) and perchlorate. Currently (2009), no drinking-water or health-related standard exists for RDX or perchlorate. Statistical summaries including maximum, mean, median, and minimum concentrations of all sampled pesticide and explosive constituents are included in appendix 2b; VOCs and SVOCs are presented in appendix 2c.

Aquatic Biology

During July and August of 2002–05, the aquatic-invertebrate communities were sampled each year at 27 sites (fig. 9 and table 10) within and outside the boundaries of the FIG facility. Fish communities were sampled in 2004 for the purpose of comparing “on- and off-facility” sites to help determine if there were environmental impacts attributable to base operations.

Land disturbance commonly results in soil erosion, leading to water-quality problems and potential habitat loss (Jansen, 1997). Many studies have indicated the potential for environmental problems related to military training (Lanier-Graham, 1993; Austin and Bruch, 2000; Ehlen and Harmon, 2001; Dudley and others, 2002; Fang and others, 2003). However, other studies have shown that military areas having large tracts of undisturbed and less fragmented land than adjacent lands actually can increase plant and animal diversity and become refuges for sensitive taxa (Carvell, 2002; Anders and Dearborn, 2004).

Habitat

Habitat scores (based on RBP, sample forms in appendix 3) were fairly consistent at each site for the four consecutive sampling years. Four classifications were determined on the basis of score; poor, less than 47; marginal, 48 to 100; suboptimal, 101 to 153; and optimal, greater than 153; 200 is the highest possible score (Barbour and others, 1999). The lowest score was 85 at Forge Creek (fc-1, fig. 9, map number 6) in 2002 and the highest score was 188 at Gold Mine Run (GoldMineRunref-1, fig. 9, map number 7) in 2004 (table 11). Mean annual scores increased from 151 in 2002 to 155 and 163 in 2003 and 2004, respectively, then decreased to 140 in 2005. Between the 2004 and 2005 samplings, the remnants of Tropical Storm Ivan caused widespread and severe flooding and damage to the FIG facility. On the basis of mean scores, no sites were classified in the poor or marginal category. Thirteen sites were in the suboptimal category. The remaining 14 sites were in the optimal category including 4 of the 7 off-facility sites. Annual scores indicated two sites were in the marginal category; Forge Creek (fc-1, fig. 9, map number 6) in 2002 and unnamed tributary to Indiantown Run (utir-01, fig. 9, map number 22) in 2003. Both sites were on or predominantly drain the FIG facility (table 11). The overall mean classification was suboptimal for all sites and all years.

The largest change in year-to-year score (-74) was at St. Joseph’s Spring (sjs-01, fig. 9, map number 19) from 2004 to 2005; this was the only site to start as optimal and end as nearly marginal in the 4 years of sampling. Three sites, Gold Mine Run (GoldMineRunRef-1, fig. 9, map number 7), Indiantown Run site 2 (ir-2, fig. 9, map number 11), and Indiantown Run above Vesle Run at Indiantown (ir-3, fig. 9, map number 12), were in the optimal classification for all four sampling years; one site (unnamed tributary to Indiantown Run at Fort Indiantown Gap) (utir-01, fig. 9, map number 22) was classified as marginal all 4 years.

The number of sites classified as optimum increased from 9 in 2002 to 18 in 2004 (fig. 10). Some of the changes may have been because of the drought conditions in 2002 followed by the two wetter years that allowed for more vegetation to grow, which helped raise the scores within certain categories. However, these positive changes were offset in 2005 when the number of sites classified as optimum decreased to three, most likely because of the extreme flooding event following the 2004 sampling. No streams were classified as poor in any year.

Aquatic Invertebrates

Over the 4-year period 2002–05, land-use characteristics remained mostly unchanged; however, the hydrologic conditions at these sites were highly variable. During 2002, the study area was subject to an intense drought, reducing streams

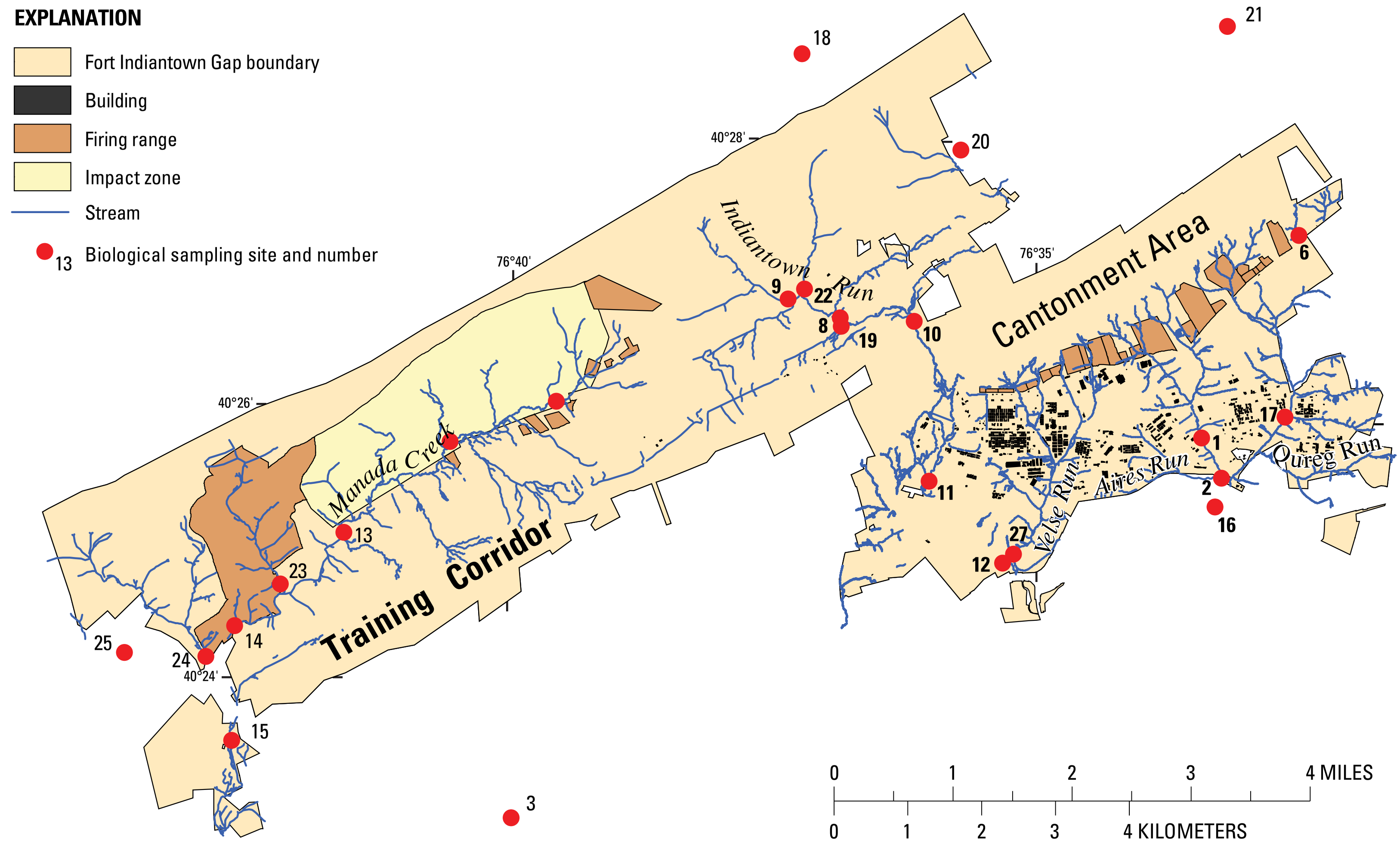


Figure 9. Location of biological sampling sites, Fort Indiantown Gap (FIG), Lebanon and Dauphin Counties, Pa. (four sites, numbers 4, 5, 7, and 26, are beyond the extent of this map)

Table 10. U.S. Geological Survey site information for the 27 biological sampling sites, collected July-August 2002–05 at Fort Indiantown Gap, Lebanon and Dauphin Counties, Pa.

[USGS, U.S. Geological survey; shaded, off-facility site]

USGS station identification number	Drainage area (square miles)	Map number (fig. 9)	Station name	Site name	Latitude	Longitude
01568693	7.51	18	Stony Creek near Fort Indiantown Gap, Pa.	ScMRef-1	402834	763751
01572112	2.45	5	Evening Branch above Gold Mine Run near Tower City, Pa.	ebMRef-1	403130	763230
01572113	1.16	7	Gold Mine Run near Tower City, Pa.	GoldMineRunRef-1	403133	763241
01572124	1.35	4	Bear Hole Run at Suedberg, Pa.	bhRef-1	403043	762823
01572145	.39	20	Trout Run at Fort Indiantown Gap, Pa.	tr-1	402753	763554
01572150	6.30	21	Trout Run near Inwood, Pa.	tr-2	402852	763313
01572300	.26	6	Forge Creek near Lickdale, Pa.	fc-1	402722	763229
01572804	1.60	1	Aires Run at Fort Indiantown Gap, Pa.	ar-1	402553	763355
01572814	2.25	2	Aires Run above Qureg Run at Fort Indiantown Gap, Pa.	ar-2	402535	763313
01572834	2.51	16	Qureg Run at Fort Indiantown Gap, Pa.	qr-1	402602	763236
01572844	5.58	17	Aires Run below Qureg Run at Fort Indiantown Gap, Pa.	qr-2	402532	763337
01572924	1.47	9	Indiantown Run above unnamed tributary at Fort Indiantown Gap, Pa.	ir-0.5	402656	763739
01572928	1.12	22	Unnamed tributary to Indiantown Run at Fort Indiantown Gap, Pa.	utir-01	402654	763714
01572940	.86	19	St Joseph Springs outflow at Fort Indiantown Gap, Pa.	sjs-01	402640	763651
01572944	4.68	8	Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.	HatImpact	402640	763648
01572948	5.38	10	Indiantown Run in Gap at Fort Indiantown Gap, Pa.	ir-1	402640	763609
01572956	6.27	11	Indiantown Run above Memorial Lake near Indiantown, Pa.	ir-2	402532	763601
01572975	8.38	12	Indiantown Run above Vesle Run at Indiantown, Pa.	ir-3	402456	753512
01572986	10.6	27	Vesle Run at Indiantown, Pa.	vr-1	402456	763509
01573300	2.90	3	Bow Creek at Grantville, Pa.	bcRef-1	402301	763954
01573472	6.19	13	Manada Creek along McLean Road near Manada Gap, Pa.	mc-1	402506	764136
01573480	1.08	23	Unnamed tributary to Manada Creek near Manada Gap, Pa.	utmcm-1	402448	764216
01573482	8.59	14	Manada Creek near Manada Gap, Pa.	mc-1.5	402424	764234
01573490	1.64	24	Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.	utmcm-2	402409	764252
01573496	2.55	25	Unnamed tributary to Manada Creek at Rt 443 near Manada Gap, Pa.	utmcm-3	402410	764345
01573501	14.3	15	Manada Creek below Manada Gap at Manada Gap, Pa.	mc-2	402332	764238
01573535	2.57	26	Unnamed tributary to Manada Creek near Sand Beach, Pa.	utmcvRef-1	402036	764102

Table 11. Individual and mean habitat scores for 2002–05 and site classification for the 27 sample sites, Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa.

[shaded; off-facility site]

Map number	Site name	Habitat scores					Classification
		2002	2003	2004	2005	Mean	
1	ar-1	111	119	168	142	135	Suboptimal
2	ar-2	152	121	125	127	131	Suboptimal
3	bcRef-1	124	140	125	139	132	Suboptimal
4	BHRef-1	149	169	180	147	161	Optimal
5	ebMRef1	186	173	180	150	172	Optimal
6	fc-1	85	114	136	124	115	Suboptimal
7	GoldMineRunRef-1	185	187	188	165	181	Optimal
8	HatImpact	152	157	160	136	151	Suboptimal
9	ir-0.5	119	163	164	143	147	Suboptimal
10	ir-1	153	169	172	119	153	Suboptimal
11	ir-2	177	180	185	171	178	Optimal
12	ir-3	171	164	176	168	170	Optimal
13	mc-1	167	160	166	143	159	Optimal
14	mc-1.5	176	171	186	130	166	Optimal
15	mc-2	157	174	183	144	165	Optimal
16	qr-1	120	129	114	127	123	Suboptimal
17	qr-2	147	134	171	151	151	Suboptimal
18	ScMRef-1	154	176	169	141	160	Optimal
19	sjs-01	169	164	181	107	155	Optimal
20	tr-1	157	178	175	135	161	Optimal
21	tr-2	164	152	174	147	159	Optimal
22	utir-01	104	94	115	112	106	Suboptimal
23	utmcm-1	175	173	168	142	165	Optimal
24	utmcm-2	164	170	168	144	162	Optimal
25	utmcm-3	144	156	152	158	153	Suboptimal
26	utmcvRef-1	147	148	151	111	139	Suboptimal
27	vr-1	172	158	166	151	162	Optimal
Mean		151	155	163	140	152	Suboptimal

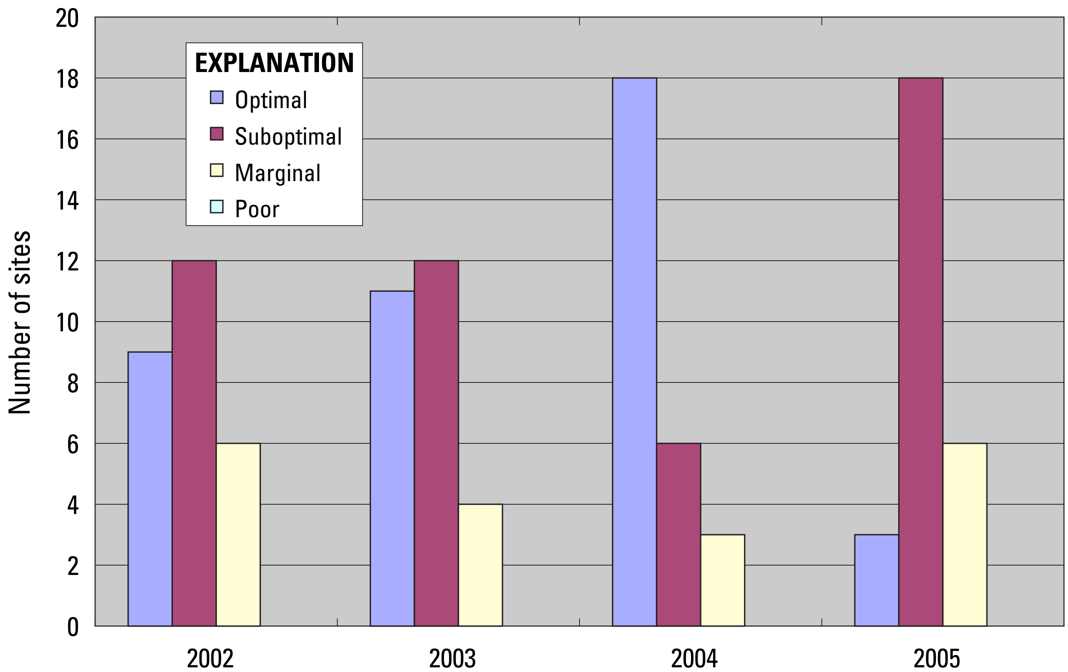


Figure 10. Habitat assessment scores for 27 sites from 2002 through 2005.

to low-flow conditions. In 2003, a series of severe thunderstorms crossed the FIG facility during the sampling period and caused major streamflow alterations, scouring and transporting the bottom materials. In 2004, the streamflow was well above average during the sampling period. In 2005, streamflow during the sampling period (July-August) was below normal, following an above-normal spring flow. Separating these natural hydrologic changes from actual impacts resulting from anthropogenic factors at the FIG facility could be difficult. However, examining the benthic-invertebrate community statistically over multiple years was useful for this purpose.

The 27 streams sampled ranged from less than 3 to about 30 ft wide; depths were from 0.1 to 1 m. Many of the sites were within forested areas with riparian buffer zones of varying widths. The pH values were mostly in the moderate range of 6–7, specific conductance ranged from 15 to 400 µS/cm, and dissolved oxygen concentrations were saturated.

Inventory of Aquatic Invertebrates

A comprehensive taxa (distinct organisms) list for the aquatic invertebrates collected from the 27 sites for each year from 2002 to 2005 is included in appendix 6. The summary totals and calculated metric values used in the analysis are also included. A total of 280 distinct taxa were identified (table 12).

There were 273 of 280 distinct taxa used in the calculation of the selected metrics and mean impact score; 237 were from the Phylum Arthropoda. Within this phylum, the greatest numbers of taxa identified were in the Class Insecta. Other phyla represented were Platyhelminthes (1 taxon); Nemertea (1 taxon); Nematoda (1 taxon); Annelida (14 taxa); Mollusca (9 taxa); and Chelicerata (10 taxa). In addition, seven taxa of crustaceans were identified; however, Crustacea is not used in any metric or index determination.

Metrics and Impacts

In order to analyze the benthic-macroinvertebrate community data, a series of metrics was calculated. Species taxa (total richness); Ephemeroptera, Plecoptera, and Trichoptera (EPT) values; and the HBI were selected as the primary metrics (table 13). However, because the metrics of taxa richness, EPT value, and HBI measure different aspects of the invertebrate community, a unanimous assessment is not expected and a majority defines the impact present (Bode and others, 2004). Species or taxa richness and EPT value are the total number of taxa (distinct organisms) found in a 100-animal subsample. The HBI is a measure of the pollution tolerance of the animals in the sample, calculated by multiplying the number of individuals of each taxa by its assigned tolerance value, summing the products, and dividing by the total number of individuals. On a 0–10 scale, tolerance values range from intolerant (0) to tolerant (10) (Hilsenhoff, 1988).

Lydy and others (2000) suggested that examining one metric alone in comparison studies may not be a suitable method for examining changes in water quality and instead suggested using a combination of metrics to define and describe the conditions. An impact scheme used by the New York State Department of Environmental Conservation (Bode and others, 2002) was followed in the present study, employing a four-tiered classification system (table 13) where the level of impact was assessed for each individual metric and

Table 12. Summary totals for the classification and identification of aquatic invertebrates collected at Fort Indiantown Gap, Lebanon and Dauphin Counties, Pa., 2002–05.

[(n); number of distinct taxa]

Phylum	Class	Order	(Common name)
Arthropoda (237)	Insecta	Collembola (4)	springtails
		Ephemeroptera (28)	mayflies
		Odonata (12)	dragon and damsel flies
		Hemiptera (3)	true bugs
		Plecoptera (23)	stoneflies
		Coleoptera (18)	beetles
		Megaloptera (4)	dobson and fish flies
		Trichoptera (40)	caddisflies
		Lepidoptera (2)	moths
		Diptera Midges (78) non midges (25)	true flies
Platyhelminthes (1)			
Nemertea (1)			
Nematoda (1)			
Annelida (14)			
Mollusca (9)			
Chelicerata (10)			
Crustacea (7)			

Table 13. Water-quality impact assessment based on biological metrics.

[EPT; Ephemeroptera, Plecoptera, and Trichoptera; HBI, Hilsenhoff Biotic Index]

Level of impact	Metrics			Mean impact score	Water-quality condition
	Taxa richness	EPT taxa richness	HBI score		
Non-impacted	Greater than 26	Greater than 10	0.0 to 4.50	7.51 to 10	Excellent
Slightly impacted	19 to 26	6 to 10	4.51 to 6.50	5.01 to 7.5	Good
Moderately impacted	11 to 18	2 to 5	6.51 to 8.50	2.51 to 5.0	Fair
Severely impacted	0 to 10	0 to 1	8.51 to 10.0	0 to 2.5	Poor

then averaged for a consensus determination. The "water-quality condition" was calculated on the basis of a range in individual metric score. Each individual score was converted to a "new" scale ranging from 0 to 10 and then averaged for the consensus (mean impact) determination of water-quality condition. For example, "non-impacted" indicated excellent water quality. The invertebrate community was diverse with at least 27 taxa in riffle habitat. The EPT taxa were well represented with greater than 10. The HBI was 0.00–4.50 and mean impact scores were between 7.50 and 10. This level of water quality includes pristine habitats and those receiving minimally adverse sources of pollutants. Conversely, "severely impacted" was reflective of poor water quality. The invertebrate community was limited to a few tolerant taxa. Taxa richness values were 10 or less. EPT value (taxa richness) was rare, with a range of 0–1. The dominant taxa were almost all midges and worms. The HBI ranges from 8.51–10, and mean impact scores were between 0 and 2.5. Ranges in impact assessment criteria for four different levels of impact are presented in table 13.

The three metrics selected for invertebrate analysis—Taxa richness, EPT value (taxa richness), and HBI score—not surprisingly showed variability over the 4 years of study. Taxa richness numbers ranged from 16 at bcREF-1 (fig. 9, map number 3) in 2003 to 46 at utmcm-1 (fig. 9, map number 23) in 2004. The mean for all sites for all years was 28. EPT values ranged from 2 at qr-1 (fig. 9, map number 16) in 2002 to 18 at ir-1 (fig. 9, map number 10) in 2004; the EPT scores at 80 percent of the sites were greater than 5. HBI scores ranged from 1.79 to 6.20 at the same site (fc-1, fig. 9, map number 6), and the mean score was 3.97.

A detailed annual summary for each of the 27 sites sampled for 2002–05 is presented in appendix 4. Of the 27 sites sampled, the mean impact scores at 17 sites were reflective of excellent water quality and at 10 sites indicated good water quality. No sites had fair or poor water quality on the basis of the 4-year average 2002–05 impact score (fig. 11). Of the 20 sites sampled on the FIG facility over the 4 years of study, 15 (75 percent) were considered to have excellent water quality and 5 (25 percent) had good water quality. Of the seven sites sampled off the base boundary, five sites (71 percent) were considered to be excellent and two (29 percent) were considered to be good. On the basis of the percentages of excellent and good water quality, site selection was valid for the representation of conditions on and off the FIG facility.

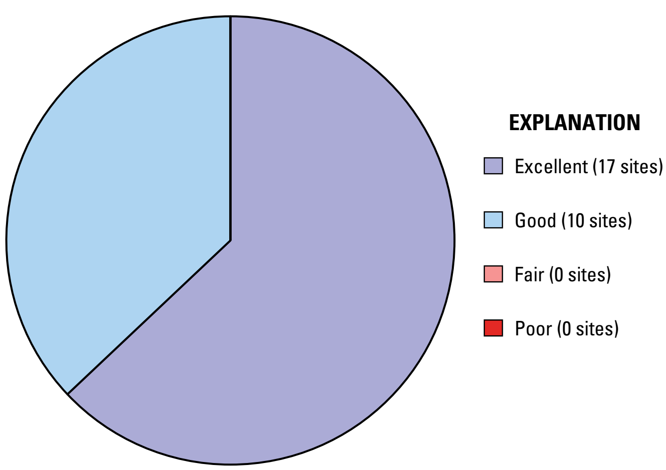


Figure 11. Results of mean impact scores for 27 aquatic-invertebrate sites from 2002 through 2005, Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa.

The number of sites by year for three metrics with associated level of impact and mean impact score are shown in table 14 and figure 12. The number of non-impacted sites was greatest in 2005. The greatest change was in the taxa richness metric where 12 fewer sites were classified as slightly impacted in 2003 as compared to 2002. Conversely, 11 more sites were classified as non-impacted in 2003 than in 2002 using the taxa richness metric. The HBI metric did not classify any sites as moderately or severely impacted. The EPT metric classified sites as moderately impacted in 3 of 4 years of sampling, the highest number of sites was five in 2002. The number of non-impacted sites generally increased in all three metrics from 2002 to 2005. Regardless of the metric used, none of the sites were classified as severely impacted in any of the 4 years.

Mean impact scores in table 14 were based on a "consensus" of the three metrics; taxa richness, EPT score, and HBI score. Figure 12 represents the mean scores based on the three metrics and indicates an increase each year in the number of sites classified as having excellent water quality. One site was classified as having fair water quality in 2003; no sites were classified as having poor water quality. Overall, benthic-invertebrate communities were in a less-affected condition in 2005 than in 2002 likely due to climate conditions and severe drought rather than to FIG-facility operations.

Seven sites were rated as excellent during the entire 4-year sampling period: Bear Hole Run (bhRef-1, fig. 9, map number 4, not shown), Indiantown Run in Gap (ir-1, fig. 9, map number 10), Manada Gap along Mclean Rd (mc-1, fig. 9, map number 13), St. Joseph's Spring (sjs-01, fig. 9, map number 19), Trout Run at Gap (tr-1, fig. 9, map number 20), Trout Run near Inwood (tr-2, fig. 9, map number 21), and unnamed tributary to Indiantown Run (utir-01, fig. 9, map number 22). Two sites were "worse" than others but not considered fair or poor—Bow Creek (bcRef-1, fig. 9, map number 3) and Qureg Run (qr-1, fig. 9, map number 16). The site that showed the most improvement over the 4-year period was Forge Creek (fc-1, fig. 9, map number 6), which had the lowest score (5.83) in water-quality condition in 2002 and improved to excellent (8.34) in 2005.

Based on the habitat and aquatic-invertebrate data from 2002 to 2005, habitat conditions worsened with time; in contrast, the invertebrate metrics and mean impacts improved with time. The dominant effects during the 4-year sampling period were the severe drought conditions in 2002 and the massive flooding event after the 2004 sampling. The invertebrates appeared most affected by the severe drought condition, which created less wetted area for community growth, and

Table 14. Number of sites by year, metric, and level of impact with mean scores for 2002–05, Fort Indiantown Gap facility and off-facility sites, Lebanon and Dauphin Counties, Pa.

[EPT; Ephemeroptera, Plecoptera, and Trichoptera, HBI; Hilsenhoff Biotic Index]

Level of impact	Metrics and year												Mean impact score				Water-quality condition
	Taxa richness				EPT Value (taxa richness)				HBI scores								
	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005	
Non-impacted	9	20	19	21	10	6	16	18	18	20	20	23	11	13	19	22	Excellent
Slightlyimpacted	17	5	8	6	12	19	10	9	9	7	7	4	16	13	8	5	Good
Moderatelyimpacted	1	2	0	0	5	3	1	0	0	0	0	0	0	1	0	0	Fair
Severely impacted	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Poor
Total	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	

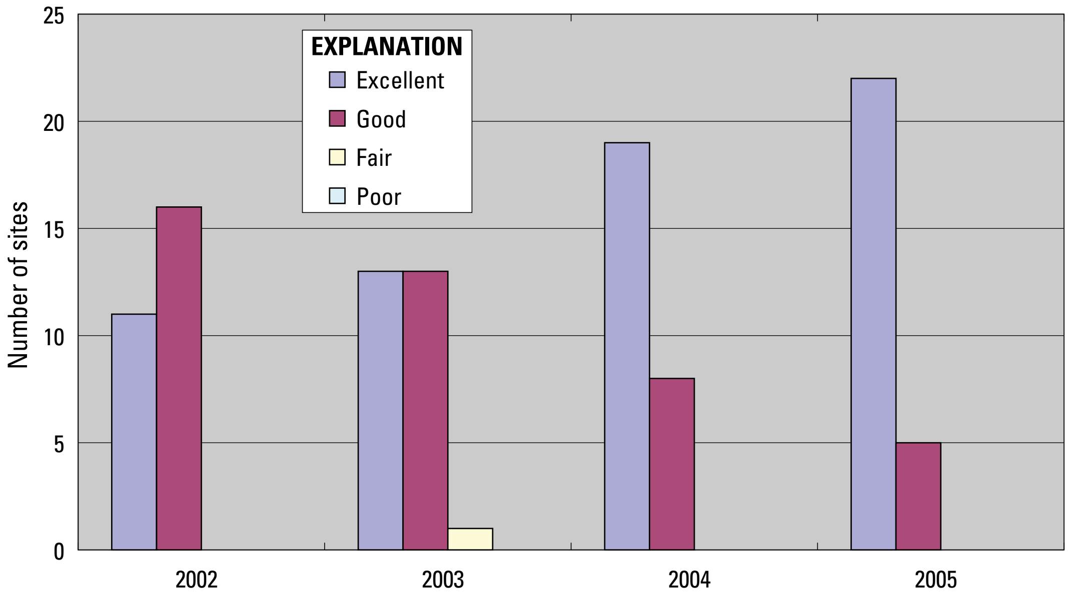


Figure 12. Results of mean impact scores for the 27 aquatic invertebrate sites by year, Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa.

higher average air and water temperatures; the habitat was most affected by the flooding that created physical (geomorphic) change to the stream channel.

Fish Community

Fish were sampled at 25 of the 27 invertebrate sites (table 15). Summary tables of the fish communities were created for each site and are presented in appendix 5. Simple statistics such as average length and weight were calculated. The percentage of each species to the total numbers collected in the community was calculated. Several metrics, catch-per-unit effort (CPUE), percent native species, percent intolerant species, percent dominant species, and total number of individuals, were calculated to show community differences or similarities among all the sites.

The fish surveys of the 25 sites on and off the FIG facility yielded a total of 4,818 fish with a biomass of 36,568 g. The CPUE ranged from 0.6 fish per minute at Evening Branch above Gold Mine Run to 15.1 at Aires Run above Quereg Run (table 15). A total of 33 species were collected.

The fish metrics indicate most sites were healthy. The two sites with the highest CPUE were Aires Run above Quereg Run and below Quereg Run. These two sites also yielded the greatest total number of individuals at a site. The number of sites with 100 percent native species was seven. Most sites had 90 percent or more of the taxa that were native species. The site with the lowest percentage of native species was Stony Creek. Gold Mine Run was the only site that had 100 percent of the species as intolerant, and the only species collected at the site were brook trout. Bear Hole Run and Evening Branch scored 45 percent or higher in both numbers of intolerant species and percent dominant species in their communities, the distribution being equal. At 20 of the sites, the percent intolerant species was 5 percent or less. The site with the most evenly distributed community was Quereg Run, where the dominant taxa were only 24 percent of the total species at the site. Gold Mine Run was the only site to have one taxon. With an increase in stream size, the number of taxa at a site also increased. The smaller, headwater streams had the lowest number of taxa, and the wider, deeper, warm-water sites had the highest number of taxa.

A TWINSPAN analysis was used to show the relation of the sites to each other on the basis of the communities present. This technique reduces “noise” in community data to provide a more accurate picture of the community structures (Gauch, 1982). The TWINSPAN analysis (fig. 13) showed site groupings on the basis of the species collected at each site. The first two sites to separate out were Gold Mine Run (GoldMineRunRef-1) and Evening Branch above Gold Mine Run (ebMRef-1). These sites separated out because brook trout were dominant species at these sites. Next, the sites separated out as warm-water and cold-water sites. This break was based on brown trout as an indicator species for the cold-water sites, and longnose dace (*Rhinichthys cataractae*), tessellated darter (*Etheostoma olmstedi*) and green sunfish (*Lepomis cyanellus*) as indicator species for the warm-water sites.

The cold-water sites were Gold Mine Run, Evening Branch, all the Manada Creek sites, both Trout Run sites, all the unnamed tributary sites to Manada Creek except for the off-facility sites, the unnamed tributary to Indiantown Run, and the Indiantown Run sites above Memorial Lake, Stony Creek, St. Joseph’s Spring, and Bear Hole Run (fig. 13). The first subgrouping includes Gold Mine Run (GoldMineRun-Ref-1) and Evening Branch (ebMRef-1), which separated out based on the absence of brown trout and river chub. The

Table 15. Fish metric statistics for fish data collected at Fort Indiantown Gap and nearby off-facility sites, Lebanon and Dauphin Counties, Pa.

[shaded, off-facility site]

Site name	Map number (fig. 9)	Catch-per-unit effort	Fish metrics				
			Percent native species[1]	Percent intolerant species	Percent dominant species	Total number of individuals	Total number of taxa
Aires Run at Fort Indiantown Gap (ar-1)	1	3.7	100	0	67	236	9
Aires Run above Quereg Run (ar-2)	2	15.1	100	0	50	725	8
Bow Creek (bcRef-1)	3	5.7	99	0	47	321	10
Bear Hole Run (bhRef-1)	4	7.1	100	47	47	163	6
Evening Branch above Gold Mine Run (ebMRef-1)	5	.6	86	45	45	22	4
Forge Creek (fc-1)	6		No fish data collected				
Gold Mine Run (GoldMineRunRef-1)	7	1.2	100	100	100	29	1
Indiantown Run below hatchery (HatImpact)	8	4.9	89	1	65	205	6
Indiantown Run above unnamed tributary (ir-0.5)	9	3.8	100	0	37	163	3
Indiantown Run at Fort Indiantown Gap (ir-1)	10	4.8	86	0	79	145	5
Indiantown Run above Memorial Lake (ir-2)	11	4.9	74	0	33	148	8
Indiantown Run above Vesle Run (ir-3)	12	3.7	98	0	36	194	17
Manada Creek above McLean Road (mc-1)	13	5.0	93	1	39	211	9
Manada Creek near Manada Gap (mc-1.5)	14	2.3	89	1	59	167	10
Manada Creek below Manada Gap (mc-2)	15	3.9	94	3	45	141	13
Quereg Run (qr-1)	16	2.0	83	0	24	82	14
Aires Run below Quereg Run (qr-2)	17	11.9	99	0	34	751	20
Stony Creek (ScMRef-1)	18	.9	50	21	46	28	6
St. Joseph's Spring (sjs-01)	19	2.3	97	0	97	70	2
Trout Run at Fort Indiantown Gap (tr-1)	20	1.7	100	26	70	47	3
Trout Run near Inwood (tr-2)	21	3.7	99	2	45	147	17
Unnamed tributary to Indiantown Run (utir-01)	22	3.2	100	1	49	89	5
Unnamed tributary to Manada Creek (utmcm-1)	23	3.4	81	4	64	181	5
Unnamed tributary to Manada Creek (utmcm-2)	24		No fish data collected				
Unnamed tributary to Manada Creek (utmcm-3)	25	1.0	94	0	53	34	7
Unnamed tributary to Manada Creek (utmcvRef-1)	26	4.0	99	0	43	260	9
Vesle Run (vr-1)	27	6.2	98	0	28	259	13

[1]Cooper, 1983; Plafkin and others, 1989; Roth and others, 1997.

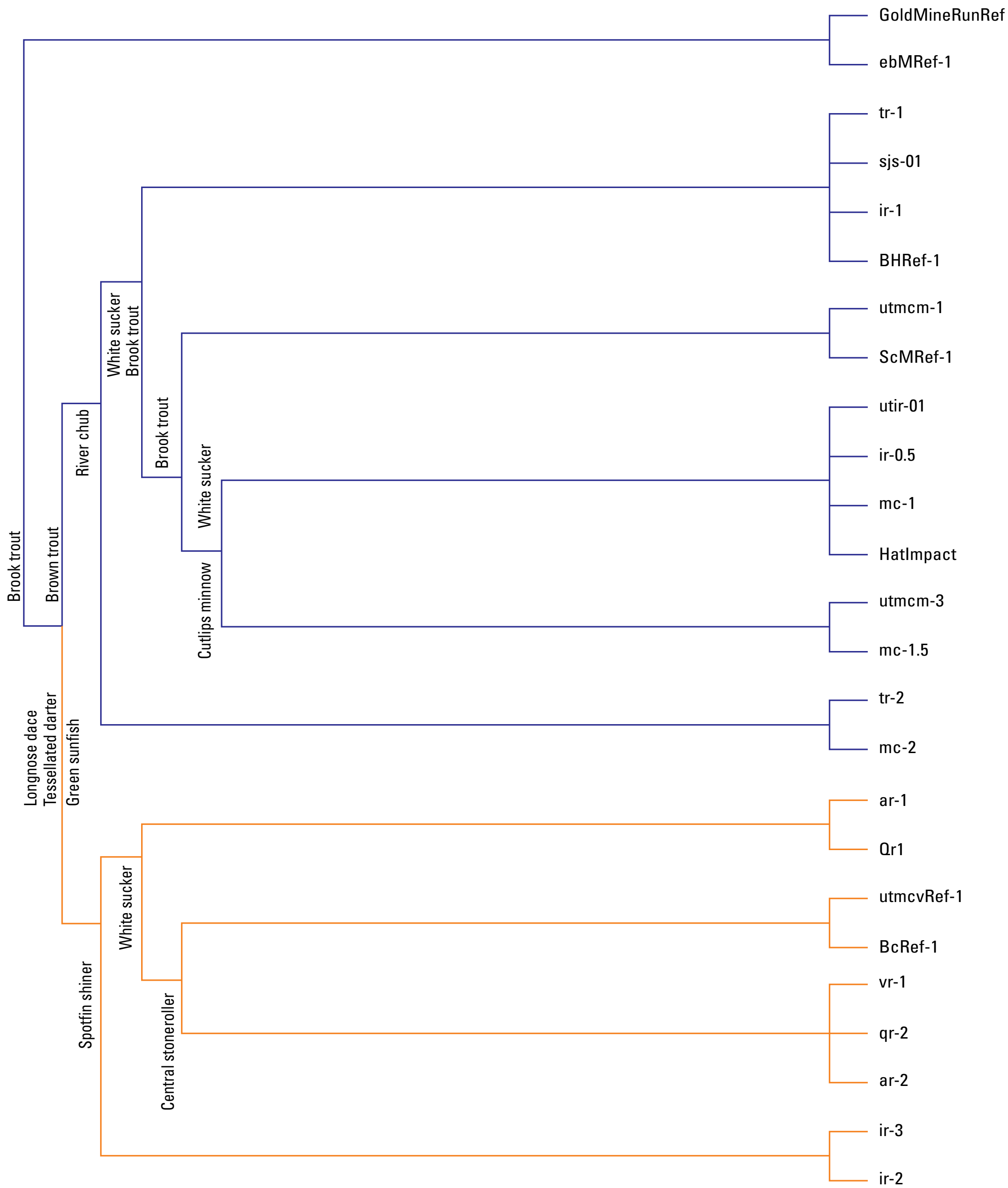


Figure 13. TWINSPAN analysis for the 25 fish sampling sites and warm-water (red-orange) or cold-water (blue) designation based on indicator species.

next subgrouping contains sites Trout Run (tr-1), St. Joseph's Spring (sjs-01), Indiantown Run at Fort Indiantown Gap (ir-1), and Bear Hole Run (bhRef-1). The sites separated out on the basis of the absence of white sucker (*Catastomus commersoni*) and brook trout. The next subgrouping of sites included an unnamed tributary to Manada Creek (utmcm-1) and Stony Creek (ScMRef-1), which was based on the presence of brook trout at these two sites. The next subgroup break was determined by the presence of white sucker for the next grouping—an unnamed tributary to Indiantown Run (utir-01), Indiantown Run above the unnamed tributary (ir-0.5), Manada Creek above McLean Road (mc-1), and Indiantown Run below the hatchery (HatImpact)—or cutlips minnow (*Exoglossum maxillingua*) for the next-to-last grouping—unnamed tributary to Manada Creek below Route 443 (utmcm-3), and Manada Creek near Manada Gap (mc-1.5). The last cold-water subgroup contains sites Trout Run (tr-2) and Manada Creek (mc-2), which separate out on the presence of river chub.

The warm-water sites that broke out first were Indiantown Run above Memorial Lake (ir-3) and Indiantown Run above Vesle Run (ir-2) and were at the opposite end of the TWINSPAN from Gold Mine Run and Evening Branch. These sites separated out on the presence of spotfin shiner (*Cyprinella spiloptera*). The next split consisted of Aries Run at Fort Indiantown Gap (ar-1) and Quereg Run at Fort Indiantown Gap (Qr-1) based on the absence of white sucker. The last break was based on the presence/absence of central stoneroller (*Campostoma anomalum*). A group of sites with the central stoneroller included unnamed tributary to Manada Creek (utmcvRef-1) and Bow Creek (BcRef-1), which were off-facility sites. The last grouping of sites indicated central stonerollers were present at Vesle Run (vr-1), Aires Run below Quereg Run (qr-2), and Aires Run above Quereg Run (ar-3).

In this survey of 25 sites (table 15, fig. 9), trout were found at 14 sites, on and off the FIG facility (table 16, appendix 5). Brook trout (*Salvelinus fontinalis*) were found at 10 sites, brown trout (*Salmo trutta*) at 9 sites, and rainbow trout (*Oncorhynchus mykiss*) at 3 sites. At Bear Hole Run (bhREF-1), one trout had a deformity of the spine. All the other trout had no visible deformities and appeared to be in good health. Bear Hole Run had the highest density of trout within a 100-m reach.

Not all the collected fish were native fish. Several reaches along Manada Creek, Stony Creek, and Trout Run

Table 16. Number and type of trout found at Fort Indiantown Gap and nearby off-facility sites, Lebanon and Dauphin Counties, Pa.

[shaded, off-facility site; mm,millimeters]

Site name	Map number (fig. 9)	Trout species	Size class		
			Small (1–100 mm)	Medium (101–180 mm)	Large (181–500 mm)
Bear Hole Run (bhRef-1)	4	Brook	23	47	5
Evening Branch (ebMRef-1)	5	Brook	0	6	4
Gold Mine Run (GoldMineRunRef-1)	7	Brook	13	22	2
Indiantown Run below hatchery (HatImpact)	8	Brook	0	0	1
		Brown	5	13	5
Indiantown Run at Fort Indiantown Gap (ir-1)	10	Brown	13	7	0
		Rainbow	0	1	0
Manada Creek above McLean Road (mc-1)	13	Brook	0	1	1
		Brown	5	7	2
Manada Creek near Manada Gap (mc-1.5)	14	Brook	0	1	0
		Brown	14	3	2
Manada Creek below Manada Gap (mc-2)	15	Brown	5	0	1
		Rainbow	0	0	2
Stony Creek (ScMRef-1)	18	Brook	0	5	1
		Brown	0	0	13
St. Joseph's Spring (sjs-01)	19	Brown	0	2	0
Trout Run at Fort Indiantown Gap (tr-1)	20	Brook	12	0	0
Trout Run near Inwood (tr-2)	21	Brook	0	1	1
Unnamed tributary to Manada Creek (utmcm-1)	23	Brook	5	2	0
		Brown	29	4	1
Unnamed tributary to Manada Creek (utmcm-3)	25	Brown	0	0	1
		Rainbow	0	0	1

were stocked by the Pennsylvania Fish and Boat Commission (2007). If a site had only larger fish, it was probably not a self-reproducing population and was likely stocked. Stocked trout usually are greater than 181 mm in total length. Size classes of fish for this study were defined as small (1–100 mm), medium (101–180 mm), and large (181–500 mm). Sites with a range of size classes are indicative of self-reproducing populations. Several sites, on and off the FIG facility, had several size classes of either brook trout or brown trout (table 16). Sites with only a few large fish were probably stocked or the fish migrated there from a nearby larger body of water.

Brook trout were found at 10 sites (table 16). Several of the off-facility sites had multiple counts of brook trout of varying size classes (Bear Hole Run, Evening Branch, Gold Mine Run, and Stony Creek). Bear Hole Run and Gold Mine Run had all three size classes. Trout Run at Fort Indiantown Gap (tr-1) only had smaller fish, but this stream was very narrow and shallow and it would be difficult to support fish in the larger size classes. The unnamed tributary to Manada Creek (utmcm-1) had no fish in the large class but had fish in the small and medium ranges. Conversely, Evening Branch (ebMRef-1) did not have any brook trout in the small range, but the medium and large size classes had several fish. Other sites with only one or two brook trout in either the medium or large size classes were Indiantown Run below Hatchery (HatImpact), two Manada Creek sites (mc-1 and mc-1.5), and Trout Run near Inwood (tr-2).

Brown trout were found at nine sites including one off-facility site (table 16). Sites with fish in all three size classes included Indiantown Run below Hatchery (HatImpact) and three of the Manada Creek sites (mc-1, mc-1.5, and utmcm-1). Indiantown Run at Fort Indiantown Gap (ir-1) contained 13 brown trout in the small size and 7 in the median size. Manada Creek below Manada Gap (mc-2) had five brown trout in the small size class and one in the large size class. St. Joseph’s Spring had only brown trout in the medium size class. Unnamed tributary to Manada Creek (utmcm-3), which is close to the mouth into Manada Creek, had one large brown trout. The Stony Creek off-facility site contained 13 brown trout, all in the large size class.

Four rainbow trout in the medium and large size classes were found at three sites—two at Manada Creek (mc-2), one at Indiantown Run (ir-1), and one at an unnamed tributary to Manada Creek (utmcm-3). Rainbow trout were not native and therefore represent stocked streams.

Stream Geomorphology, Classification, and Assessment

The fluvial geomorphic assessment of the FIG facility was conducted in two parts in the summer of 2004, broadly following the guidelines defined in Rosgen (1996). The first part of the fluvial geomorphic assessment was a delineation of the watersheds within the boundaries of the FIG facility and geomorphic stream classification. These classifications were not used in this report to imply the relative stability or instability of a stream channel (in relation to how sensitive the channel is to future disturbances) but to describe the stream channel on the basis of the relative pattern, profile, and dimension (geomorphic properties). The second part of the fluvial geomorphic assessment involved a detailed analysis of two individual stream reaches. These reaches were near USGS streamgages in the two largest watersheds within the boundary of the FIG facility, 01572950 (Indiantown Run near Harper Tavern, Pa.), and 01573482 (Manada Creek near Manada Gap, Pa.). This analysis was used to predict how “stable” the stream channel was, as well as the vulnerability of the stream channel to future changes within the watershed.

Stream Classification

The geomorphic stream classes within the FIG facility were delineated and included in a geographic information system (GIS) coverage. On the basis of the total distance of all stream reaches classified within the FIG facility, 58 percent were classified as B class, 36 percent were C class, 2 percent were A class, 1 percent were E class, 1 percent were G class, 1 percent were F class, and <1 percent were undifferentiated B and F class. Stream classes B, C, and A are generally considered to be in dynamic equilibrium with the transport of sediment and, therefore, relatively stable. On this basis, approximately 96 percent of the stream reaches are “stable.” More detailed discussion on stream “class” is included later in the section.

Fluvial geomorphic stream classes change over time, or “evolve,” in relation to the characteristics of the watershed. Therefore, stream types within a watershed generally can be related to each other by what is called the “stage of reach evolution” (Simon, 1989). The stage of reach evolution does not imply long-term stability but describes a process when used in conjunction with the stream classification that can help to identify the previous classification of a disturbed stream reach. It also indicates what that reach will likely become (evolve to) in the future as it returns to a state of dynamic equilibrium (balanced with the water and sediment loads supplied from the upstream basin). Simon (1989) and Rosgen (2002), among others, have identified at least nine possible scenarios to generally describe common, evolutionary sequences that many natural streams undergo as they progress from an undisturbed state to a disturbed state and back to a new undisturbed state (table 17). The beginning and end classes of each of the nine scenarios (C-, E-, and B-class streams) generally describe a stream reach that is considered to be in a state of dynamic equilibrium, transporting the upstream watershed-supplied water and sediment without exhibiting signs of rapid erosion or aggradation within the stream channel.

Table 17. Potential stream-channel evolutionary scenarios (from Rosgen, 2002; Simon, 1989).

Scenario number	Evolutionary sequence
1	E>C>Gc>F>C>E
2	C>D>C
3	C>D>Gc>F>C
4	C>G>F>Bc
5	E>Gc>F>C>E
6	B>G>Fb>B
7	Eb>G>B
8	C>G>F>D>C
9	C>G>F>C

Entrenched stream classes exhibiting little or no available flood plains (G- and F-class streams) are in the center of an evolutionary sequence. These stream reaches likely began as non- or lesser-entrenched stream classes (C-, E-, or B-class streams) and are likely in the process of evolving back into these same classes described above (table 17). This evolutionary process depends on confined streams attempting to erode restrictive banks (those that confine flood waters to a narrow, high-energy channel) and develop a flood plain.

There are two general exceptions to the concept of stream evolution, the A- and D-class channels. A-class stream channels are absent from the evolutionary scenarios (table 17) because these channels are considered robust and usually will not evolve into another stream class in a time scale reasonable for description in this context. D-class (braided) stream channels are generally the result of large sediment loads that exceed the ability of the stream to transport the material under the given flow conditions.

In the case of the FIG facility, most G-class channels are confined to developed, or previously developed, areas and are likely the result of stormwater runoff from impervious areas. When entrenched stream classes (G- and F-class streams) are mapped and located among largely non-entrenched stream reaches (C-, E-, or B-class streams), this commonly indicates the response of the stream channel to changes in the runoff characteristics of the watershed above. On the basis of this potential response to changes within the watershed, the presence of G- and F-class streams commonly indicates locations with runoff or sediment-supply problems, such as excessive downstream sedimentation resulting from entrenchment. These excess sediments may lead to degradation of downstream stormwater structures and fish-spawning beds and may cause increased flooding within downstream reaches.

Other natural factors also affect the morphology and stability of the stream channels within the FIG facility. Type and concentration of riparian vegetation, natural flooding, and wildlife can alter the local stream-channel morphology. For example, beavers have constructed several dams within the FIG facility; these dams will cause backwater flooding (fig. 14) as well as accelerated bank erosion in the immediate vicinity of the dam. Accelerated bank erosion near a beaver dam (or other obstruction) also is common and is the natural result of a stream trying to bypass an obstacle by taking the path of least resistance; the bank material is easier to erode than the beaver dam.

Beaver dams also trap sediments. Because the stream has the ability (energy) to transport a certain amount of sediment, any sediment lost within the impoundment area of the dam will be restored downstream by increased erosion. For this reason, waters exiting a dam or any environment that limits or removes sediment from the stream are termed “sediment starved.” In time, the stream channel downstream from these dams will likely experience increased erosion and potentially become entrenched, going from a non-entrenched class of C or E to an entrenched class of G or F. Removal of the riparian vegetation by beavers also affects the reaches they occupy. Beavers can clear a substantial amount of woody vegetation from the riparian areas of the stream channel; these areas are then susceptible to accelerated bank erosion upon abandonment of the dam by beavers and (or) subsequent failure of the structure. Even though beavers can seriously affect stream-channel morphology, they also create a very diverse and important habitat, form wetlands that can filter many pathogens from the water column, and create areas of emergent vegetation.

Geomorphic Analyses

Detailed geomorphic study reaches were selected at two sites to assess fluvial geomorphic conditions in the largest watersheds within the FIG facility. The stream reaches were near existing USGS streamgages at Indiantown Run and Manada Creek. At each site, the force the stream could exert on the streambed was evaluated against the size of the materials within the stream channel. Imbalances in this relation generally are indicative of either an unstable condition or other factors that may be influencing the hydraulics of the stream reach; for example, excess force could result in increased erosion, and too little force could result in aggradation of the stream channel. The analysis included determination of the entrenchment ratio (does the stream have an available flood plain?), width to depth ratio (is the channel narrow and deep or wide and shallow?), channel materials (how big or small is the streambed material?), particle entrainment (how large of a particle can the stream move?), and the slope. On the basis of these measurements and calculations, the force available in the channel to move streambed materials can be estimated, as well as the size and type of the material available to be moved.

Figure 14. Backwater flooding on a tank trail resulting from a beaver dam plugging the culvert below an existing tank trail.

The Indiantown Run geomorphic study reach was adjacent to Pennsylvania State Highway (SR) 443 and begins approximately 200 ft upstream from the intersection of SR 443 and Lake Road and ends approximately 700 ft downstream from the streamgage. This geomorphic study reach was 900 ft long and is adjacent to USGS streamgage 01572950 (Indiantown Run near Harper Tavern, Pa.); 5.48 mi^2 drains to the reach. The reach is at the downstream end of a narrow gap through a prominent ridge; the adjacent valley and flood plain widened abruptly approximately half way along the reach as the stream exited this gap. Deciduous and evergreen trees dominated the valley and adjacent hillsides in the watershed, which was largely undeveloped and comprised of military-training areas; however, the headwaters of Indiantown Run were home to several beavers that had created several large impoundment/wetland areas. The bankfull channel was well-defined throughout this reach and generally was denoted by an abrupt change in bank angle, changes in riparian vegetation, and depositional features throughout the reach. In this area, Indiantown Run was not entrenched and had an available, functioning flood plain to dissipate the forces associated with natural, intermittent flooding; however, immediately upstream, the flood plain was severely limited because of a narrow gap in the ridge through which the stream flowed.

Severe aggradation in the stream channel and the flood plain was evident in the downstream portion of the geomorphic study reach and was likely because of sediment-laden water deposition within the flood plain and losing competence as it exited the gap. The bulk of this sediment was likely the result of large-magnitude flooding associated with the remnants of Hurricane Ivan on September 18, 2004, and was not likely representative of bankfull conditions. During the remnants of Hurricane Ivan, 960 ft^3/s passed through this reach compared to an estimated bankfull discharge of 195 ft^3/s; the resulting competence of the stream under these extreme conditions was substantially higher than the more frequent bankfull discharge. This aggradation was apparent throughout the reach in several ways. First, mapping of geomorphic stream classes prior to the hurricane indicated this reach was classified as a slightly entrenched B-class stream; subsequent to the hurricane, aggradation of streambed changed the stream type to a non-entrenched C-class stream. Second, many trees within the flood plain had no visible root flare and large amounts of cobbles and boulders covered the entire flood plain, generally an indication of sediment deposition within the flood plain. Third, the longitudinal profile (fig. 15, thalweg, center of channel) showed a prominent bulge on the downstream end of the reach that is comprised of a large pile of large cobbles and boulders

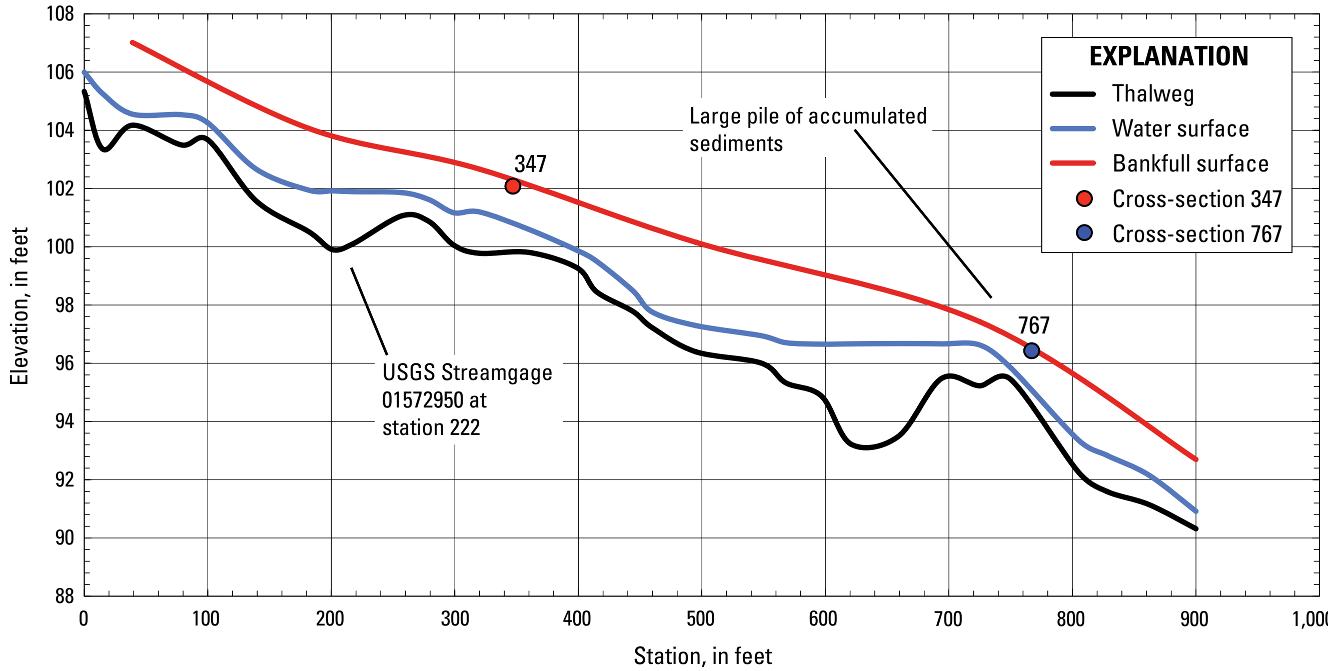


Figure 15. Longitudinal profile at Indiantown Run showing locations of two surveyed cross sections, Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa. [thalweg; center of channel]

in the approximate location where the stream lost competence because of overflow onto an adjacent flood plain.

At the upstream cross section (station 347, fig. 15 and table 18), calculations indicated the stream, at bankfull flow, had the potential to move an estimated 90 to 210 mm particle; the largest particle (Di) in a core sample collected from an adjacent point bar was 457 mm. To move the 457 mm particle, the estimated mean bankfull water depth required was 2.5 ft and the estimated bankfull water-surface slope required was 0.022 ft/ft. The existing mean bankfull water depth at cross-section 347 was 1.4 ft, and the existing bankfull water-surface slope was 0.012 ft/ft. At the downstream cross section (station 767, fig. 15 and table 18), calculations indicated the stream had the potential to move an estimated 145 to 338 mm particle; the largest particle (Di) in a core sample collected from an adjacent point bar was 305 mm. To move the 305 mm particle, the estimated mean bankfull water depth required was 1.3 ft and the estimated bankfull water-surface slope required was 0.038 ft/ft. The existing mean bankfull water depth at cross-section 767 was 1.0 ft, and the existing bankfull water-surface slope was 0.028 ft/ft.

Cross-section 347 indicated that most fine sediment was removed by Hurricane Ivan and only large aggregate remained in the stream channel; analysis of current project data predicted that finer sediments supplied from upstream would likely be deposited through this reach until a graded condition was achieved. Cross-section 767 indicated a very high slope developed along the downstream face of the sediment pile, which increased the available energy and the consequent ability to entrain particles. Within the downstream portion of the geomorphic study reach (767 to 900 ft), a large majority of the particles within the streambed would likely be transported by frequent bankfull flows and the previous graded system would likely be reformed at a lower elevation and a lesser slope as the excess sediment was transported downstream. This prediction of evolution to a future graded condition was conditional in that the runoff response and sediment loads upstream within the watershed must remain unchanged. On the basis of these observations and the geomorphic data presented in table 18, this reach of Indiantown Run was likely in a state of flux because of the effects of the hurricane and should not be considered either stable or graded under the current pattern, profile, and dimension.

The Manada Creek geomorphic study reach was directly downstream from Fogarty Road and began at the USGS streamgage 01573482 (Manada Creek near Manada Gap, Pa.) and ended 1,300 ft downstream. The longitudinal profile, or side view, of the Manada Creek geomorphic study reach is shown in figure 16 with the locations of each of the two surveyed cross sections. The reach is in a relatively narrow valley bounded by steep ridges on both sides, and the drainage area above the reach is 8.59 mi^2. Deciduous and evergreen trees dominated the valley and adjacent hillsides and the watershed above the reach was largely undeveloped and comprised of military-training areas.

The bankfull channel was well-defined throughout this reach and generally was denoted by an abrupt change in bank angle, changes in riparian vegetation, and depositional features throughout the reach; however, the culvert carrying Fogarty Road over Manada Creek prevented this feature from being extended to the staff plate at the USGS streamgage. Manada Creek, in this area, was not entrenched and had an available,

Table 18. Site-specific geomorphic data for Manada Creek and Indiantown Run, Fort Indiantown Gap, Lebanon and Dauphin Counties, Pa.

[XS, cross section; ft^3/s, cubic feet per second; ft^2, feet squared; ft, feet; ft/ft, feet per foot; mm, millimeter; >, greater than; D84, particle size of which 84 percent of total sample is finer; D50, particle size which is 50 percent of particle size; D100, largest particle size from core sample]

Parameter	Manada Creek geomorphic study site			Indiantown Run geomorphic study site		
	Reach	XS 761	XS 1218	Reach	XS 347	XS 767
Bankfull discharge (ft^3/s)	340			195		
Bankfull area (ft^2)		95.6	91.3		43.6	40.4
Mean bankfull depth (ft)		2.4	1.9		1.4	1.0
Maximum bankfull depth (ft)		3.5	3.1		1.9	
Bankfull width (ft)		40.3	47.0		31.0	40.5
Entrenchment ratio		>2.2	>2.2		>2.2	>2.2
Hydraulic radius (ft)		2.1	1.8		1.4	1.0
Bankfull slope (ft/ft)	.004	.004	.004	.004	.012	.028
Sinuosity	1.1			1.1		
Stream class[1]		C4	C4		C4	C3b
Valley type[2]		II	II		II	III
D84 (mm)		110	118		136	147
D50 (mm)		50	35		52	69
D100 (mm)		229	76		457	305

[1]C-class streams are characterized by Rosgen (1996) as located in narrow to wide valleys, constructed from alluvial deposition, with well-developed flood plains.

[2]Valley Type II is characterized by moderate slope with gentle sloping sides in colluvial valleys while Valley Type III is characterized by alluvial fans and debris cones (Rosgen, 1996)

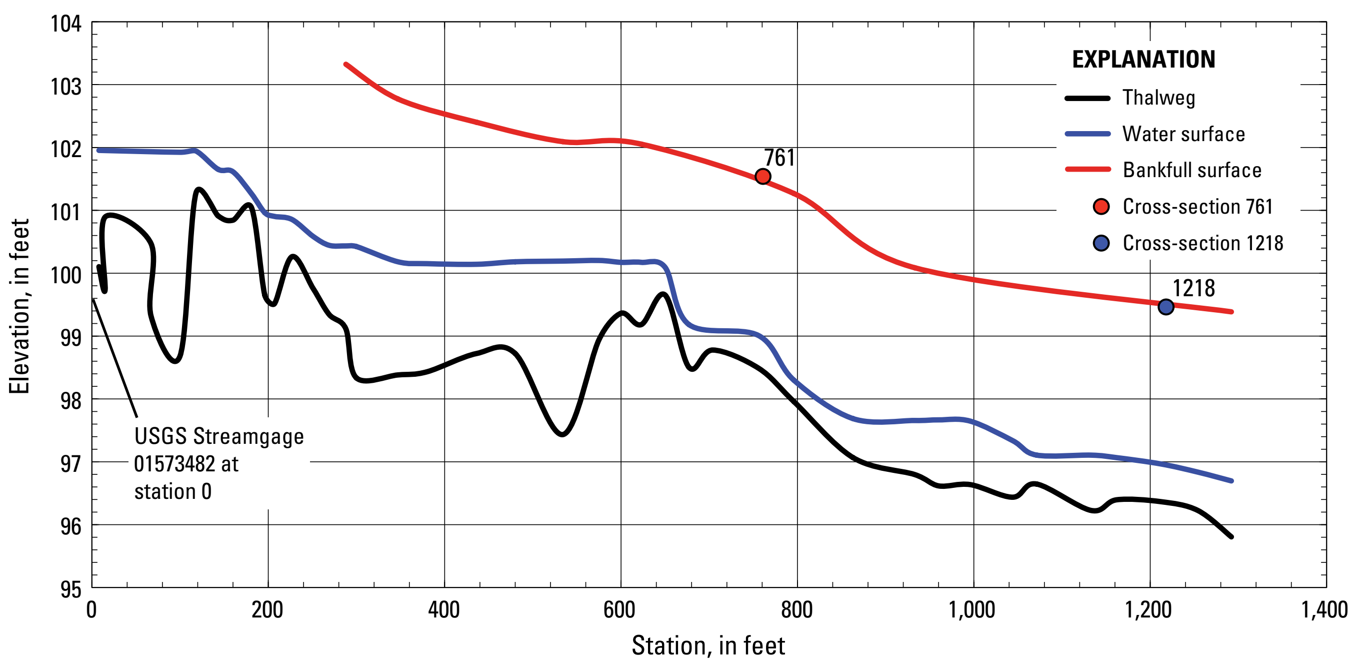


Figure 16. Longitudinal profile at Manada Creek showing locations of two surveyed cross sections, Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa.

functioning flood plain to dissipate the forces associated with natural, intermittent flooding (with the exception of the area in the immediate vicinity of the Fogarty Road culvert).

Debris piles were common throughout the reach; field observations suggested that the majority of this debris originated from the steep hillsides of the adjacent ridges because of slope failure and dead material washing into the stream from the flood-plain areas. Limited streambank erosion and (or) channel migration undoubtedly added to the total debris within the stream channel. This debris caused local areas of high energy and scour as was noted by the observation of "bright" or clean sediment in these areas. Clean sediments were readily visible in the field because the biological coatings were removed by abrasion as the particles were transported downstream. These clean sediments were eventually deposited in local scour holes or stored in bars upon recession of flood waters and the consequent decrease in the energy required to transport them.

Geomorphic data collected within this Manada Creek reach suggested it was stable and could be conditionally considered graded, assuming the stream was allowed to recover to pre-flood condition with no changes in runoff response or sediment supply upstream within the watershed. This reach had recently been subjected to a large-magnitude flood resulting from the remnants of Hurricane Ivan on September 18, 2004 (1,700 ft^3/s as compared to an estimated bankfull discharge of 330 ft^3/s). The reach remained relatively intact with little sign of erosion or disturbance other than an influx of debris from the surrounding hillsides and flood plain and the associated local scour holes as water was forced around these obstructions. The largest change between pre- and post-flood conditions, with the exception of added debris, was the removal of many bars and other fine sediments along the streambed and banks.

At cross-section station 761 (fig. 16 and table 18), calculations indicated the stream at bankfull flow had the potential to move an estimated 49- to 114-mm particle; the largest particle (Di) was 229 mm in a core sample collected from an adjacent mid-channel bar (formed largely of displaced bed materials and not stored transient sediments). To move the 229-mm particle, the estimated mean bankfull water depth required was 6.2 ft, and the estimated bankfull water-surface slope required was 0.012 ft/ft. The existing mean bankfull water depth at cross-section 761 was 2.4 ft, and the existing bankfull water-surface slope was 0.004 ft/ft. At cross-section 1218 (fig. 16 and table 18), calculations indicated the stream had the potential to move an estimated 35- to 82-mm particle; the largest particle (Di) in a core sample collected from an adjacent point bar was 76 mm. To move a 76-mm particle, the estimated mean bankfull water depth required was 2.1 ft, and the estimated bankfull water-surface slope required was 0.004 ft/ft. The existing mean bankfull water depth at cross-section 1218 was 1.9 ft, and the existing bankfull water-surface slope was 0.004 ft/ft.

These data indicated that much of the fine sediment had been washed downstream by the flood event caused by precipitation from the remnants of Hurricane Ivan, leaving mostly large material within the stream channel, as noted at cross-section 761. Fine material would likely be deposited within the region of this cross section until the reach again comes into equilibrium with additional sediment supplied from upstream in the watershed. Where previous bars or portions of those bars remain, such as downstream at cross-section 1218, data suggested that Manada Creek had sufficient energy to transport these sediments through the reach without eroding the streambed, which was armored by much larger particles as observed upstream at cross-section 761. This data, along with the presence of an available, functioning flood plain, suggested a graded condition exists within the Manada Creek Watershed within and above this geomorphic study reach.

Simulations of Groundwater Flow

Computer models of groundwater flow were developed on a regional scale surrounding the entire area of the FIG facility to simulate patterns of groundwater movement from recharge to discharge areas on the basis of a generalized conceptual model of the regional hydrogeology. Vertical groundwater-flow patterns were illustrated by use of a 2-dimensional finite-element, cross-sectional model and horizontal patterns of flow were illustrated by use of a 3-dimensional finite-difference model. Locations of the cross-sectional and 3-dimensional models are shown in figure 17.

Conceptual Model

A conceptual model of recharge, movement, and discharge of groundwater was used to guide development of the cross-sectional and 3-dimensional models. The groundwater-flow system at the FIG facility was conceptualized as a complex system in which water moves through the subsurface within fractured bedrock from topographically high areas to low areas, discharging as base flow to local streams. Recharge to the system is by precipitation. The distribution of the recharge can vary spatially because of differences in precipitation amount, slope, aspect, soils, and rock type.

Groundwater-flow patterns in the local system are affected by the numerous rock types of differing lithologic and hydrologic properties, the folded and faulted geologic structure, and the distribution of fractures. Discharge from the system is to local streams on and near the FIG facility. Substantial interbasin flow was probably unlikely because of the well-integrated drainage network and steep topography, but that possibility was tested with the cross-sectional model.

Cross-Sectional Model

A 2-dimensional, steady-state, finite element, cross-sectional model was constructed along a representative trace in the central part of the FIG study area. The cross section was constructed from Stony Creek in the northwest to Swatara

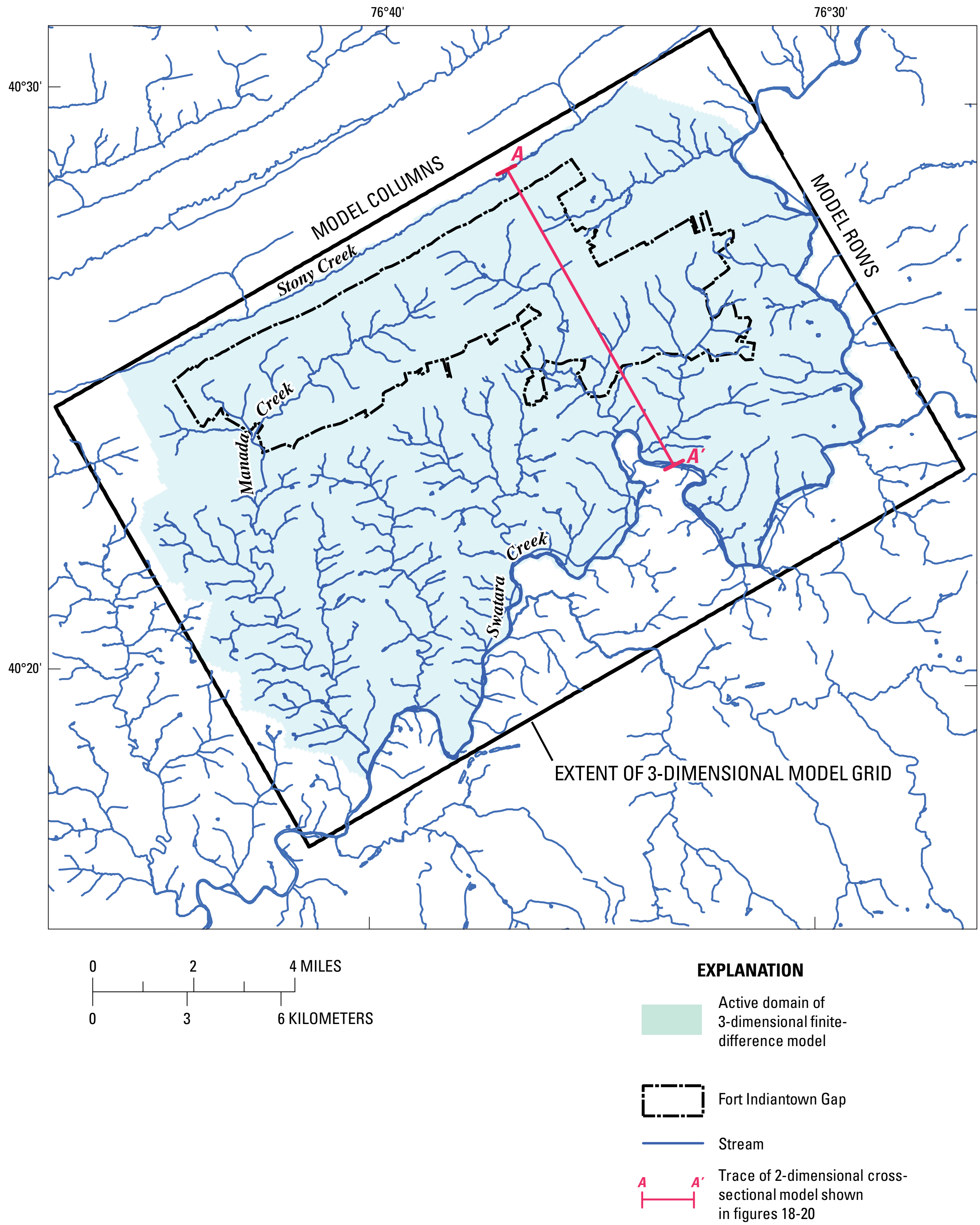


Figure 17. Location of the 2-dimensional, cross-sectional model (trace A-A'), and extent of the 3-dimensional finite-difference model at Fort Indiantown Gap, Lebanon and Dauphin Counties, Pa.

Creek in the southeast (fig. 18). Groundwater-flow paths were simulated quantitatively along this trace using the modeling software TopoDrive (Hsieh, 2001).

The model was 11,000 m long with 100 columns (each 110 m wide) and 10 rows dividing the saturated thickness of the aquifer into 10 layers of variable thickness. The top surface of the cross section was represented as the water table and the aquifer thickness varied from 300 m on the eastern end of the section to about 500 m beneath the ridges (fig. 18).

The geologic structure represented in the model was generalized into five units with similar horizontal hydraulic conductivity, as indicated by different colors in figure 18. The monoclinal beds dipping to the north from Second and Blue Mountains are part of a larger synclinorium to the north. Geologic units to the south of Blue Mountain were generalized and represented by discontinuous horizontal beds displaced by thrust faults in this area. At the base of the model, horizontal units of low hydraulic conductivity were used to simulate a conceptualized decrease in water-bearing fractures and groundwater flow at depth. The values of hydraulic conductivity assigned to each geologic unit in the cross-sectional model are given in table 19.

Simulations from the 2-dimensional cross-sectional model showed the strong influence of topography on groundwater-flow paths, resulting in groundwater basins that were essentially coincident with surface-water basins. In the Training Corridor area, groundwater flow was contained between Second Mountain and Blue Mountain. Groundwater recharge in the Training Corridor moved from topographically high areas toward the valley between the mountains, and discharged to Manada Creek (fig. 19). In the southern part of the cross-sectional model, which included the Cantonment Area, groundwater moved from topographically high areas toward the valleys and was discharged to local streams that were tributaries to Swatara Creek to the south.

Hypothetical simulations, constructed by varying the hydraulic conductivity of geologic units in the 2-dimensional cross-sectional model, were conducted to determine if groundwater was likely to flow from the Training Corridor area northward into Stony Creek valley. In hypothetical modeling simulations, interbasin groundwater flow to the north under Second Mountain could only be achieved by assigning a narrow band of highly permeable, northward-dipping bedrock with a good hydraulic connection to Stony Creek, surrounded by much less permeable units. In this simulation, one hydrogeologic unit with a hydraulic conductivity of 0.01 m/d encompassed most of the study area and a single unit with hydraulic conductivity of 86 m/d extended from the Training Corridor to the Stony Creek valley (fig. 20). Given that a nearly 4-order-of-magnitude difference in hydraulic-conductivity difference was needed under Second Mountain in the model to simulate interbasin groundwater flow to Stony Creek, it is unlikely that groundwater is able to move out of the Training Corridor area to the north.

3-Dimensional Model

A steady-state 3-dimensional model was developed to simulate regional groundwater flow by use of the finite-difference groundwater-flow model MODFLOW-2000 (Harbaugh and others, 2000) and particle-tracking program MODPATH (Pollock, 1994). The model was used to simulate the general altitude and configuration of the potentiometric surface and to illustrate generalized groundwater-flow paths in the Training and Cantonment Areas. Because the model was uncalibrated, the results could differ substantially if the assumed model parameters are not representative of actual conditions.

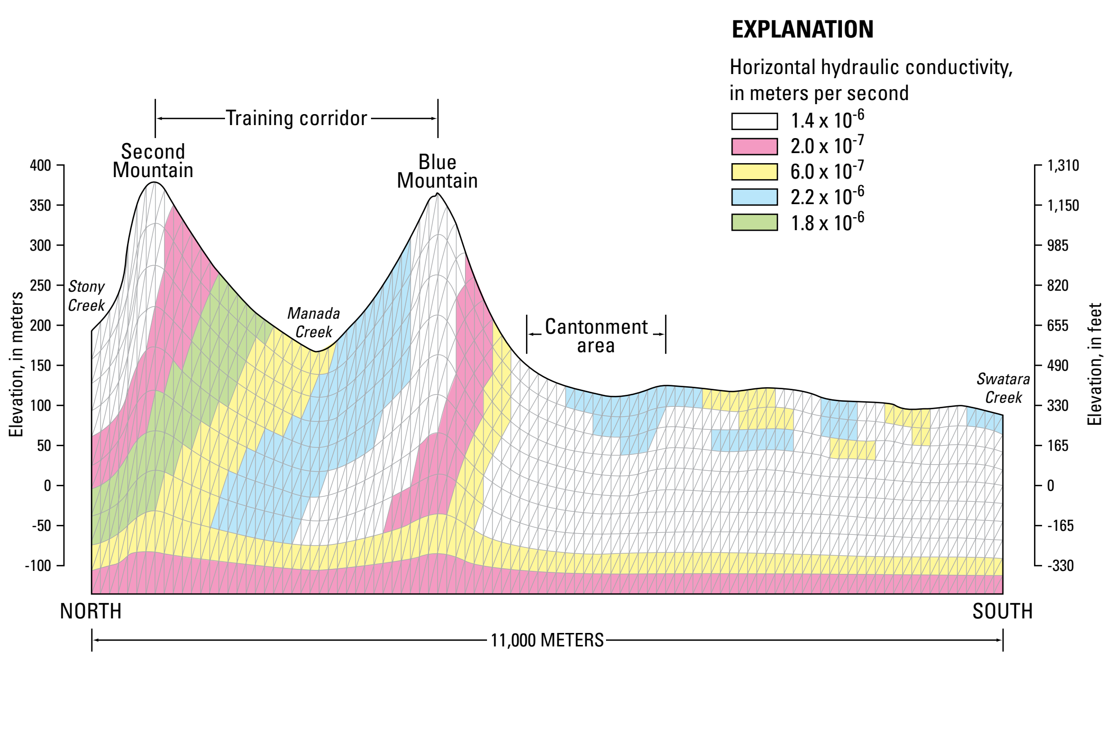


Figure 18. Cross-sectional model through the Fort Indiantown Gap study area showing topography, hydraulic-conductivity values, and local geographic features (vertical exaggeration times 10).

Table 19. Hydraulic-conductivity values assigned to represent geologic units in the cross-sectional and 3-dimensional groundwater models of the Fort Indiantown Gap area, Lebanon and Dauphin Counties, Pa.

Geologic unit	Geologic age	Horizontal hydraulic conductivity, in meters per day		
		Median values from specific-capacity data	Values used in the cross-sectional model and color code used in figures 18–19	Values used in the upper layer of the 3-dimensional finite-difference model
Mauch Chunk Formation	Mississippian	1.4×10^{-6}	1.4×10^{-6}	1.4×10^{-6}
Pocono Formation	Mississippian	4.0×10^{-7}	2.2×10^{-7}	3.0×10^{-7}
Spechty Kopf Formation[1]	Mississippian	4.0×10^{-7}	2.2×10^{-7}	6.0×10^{-7}
Duncannon Member of Catskill Formation	Devonian	1.0×10^{-7}	2.2×10^{-7}	2.9×10^{-7}
Clarks Ferry Member of Catskill Formation	Devonian	2.1×10^{-7}	2.2×10^{-7}	2.2×10^{-7}
Sherman Creek Member of Catskill Formation	Devonian	1.7×10^{-6}	1.8×10^{-6}	1.7×10^{-6}
Irish Valley Member of Catskill Formation	Devonian	5.8×10^{-7}	6.0×10^{-7}	5.8×10^{-7}
Trimmers Rock Formation	Devonian	5.8×10^{-7}	6.0×10^{-7}	5.8×10^{-7}
Hamilton Group	Devonian	2.1×10^{-6}	2.2×10^{-6}	2.1×10^{-6}
Onondaga Formation	Devonian/Silurian	5.8×10^{-7}	Not present in section	5.8×10^{-7}
Bloomsburg Formation	Silurian	2.2×10^{-6}	2.2×10^{-6}	2.2×10^{-6}
Clinton Group	Silurian	1.4×10^{-6}	1.4×10^{-6}	1.2×10^{-6}
Tuscarora Formation	Silurian	3.0×10^{-7}	2.2×10^{-7}	3.0×10^{-7}
Martinsburg Formation	Ordovician	6.8×10^{-7}	6.0×10^{-7}	6.8×10^{-7}
Hamburg Sequence rocks (Multiple Units)	Ordovician	1.4×10^{-6}	6.0×10^{-7} 2.2×10^{-6}	1.4×10^{-6}

[1]Specific-capacity data were not available for the Spechty Kopf Formation, so hydraulic conductivity initially was assigned the same value as the Pocono Formation.

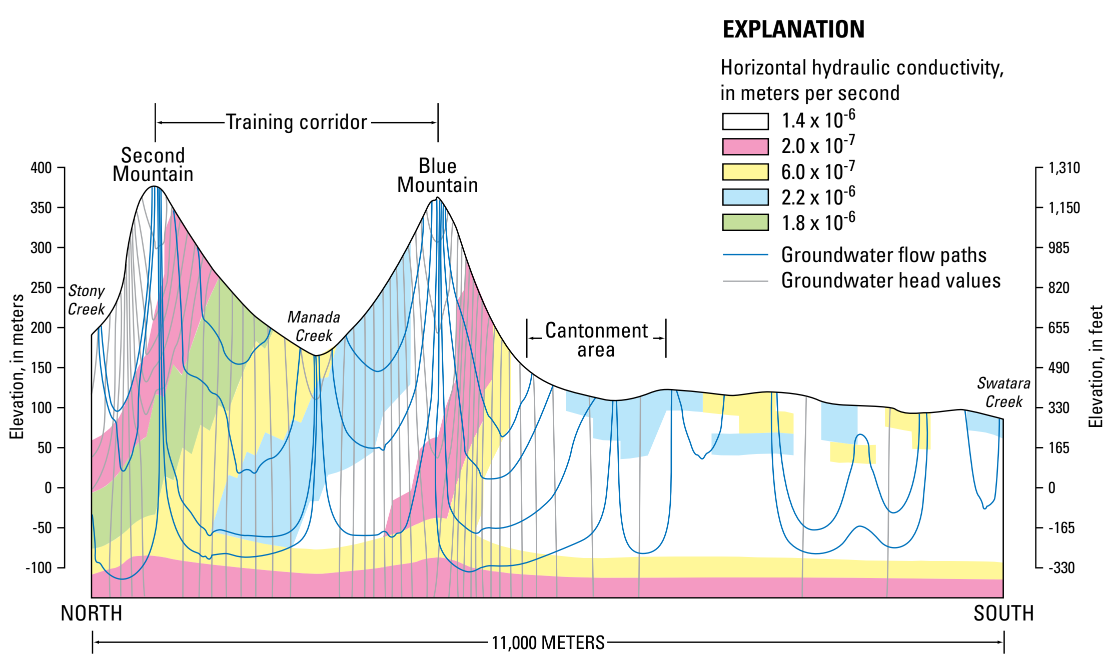


Figure 19. Simulated groundwater flow paths in the 2-dimensional cross-sectional model of the Fort Indiantown Gap study area.

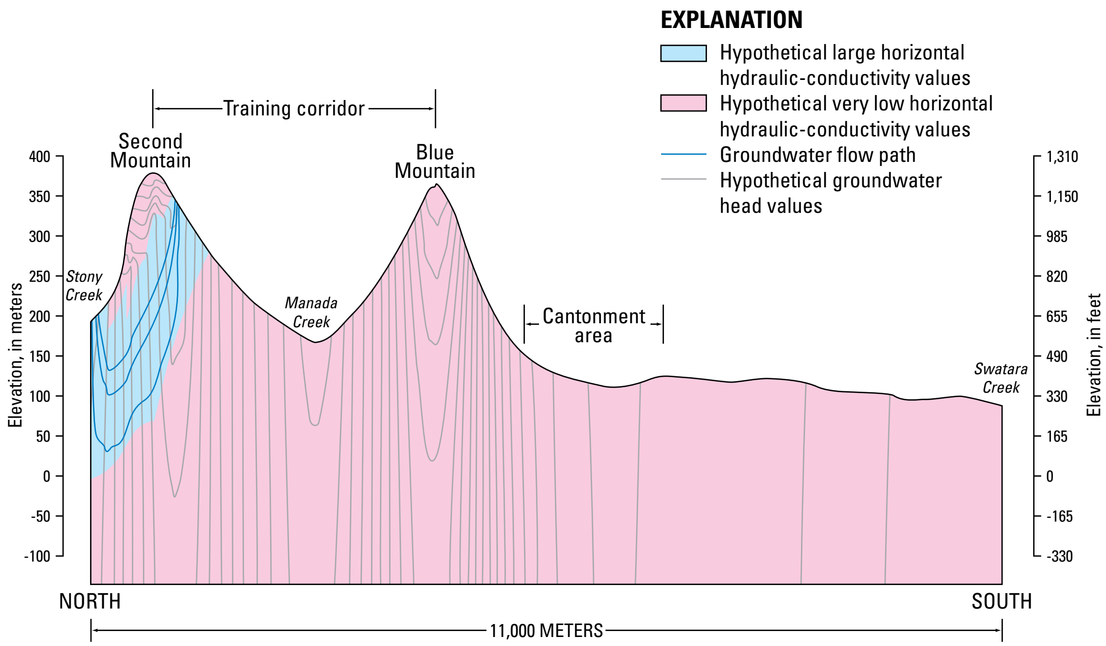


Figure 20. Hypothetical interbasin groundwater flow simulated in the 2-dimensional cross-sectional model within a relatively narrow band of northward dipping bedrock with large hydraulic conductivity (blue), surrounded by bedrock with smaller hydraulic conductivity (red).

Model Development

The location of the 3-dimensional model is shown in figure 17. The modeled area was divided into 161 rows and 240 columns, creating a grid of square cells 328 ft on a side. Lateral boundaries of the model were placed, to the extent possible, at natural hydrologic boundaries, which resulted in an active model area of a considerably greater size (112 mi^2) than the area of the FIG facility (26.5 mi^2). To the north and northwest, Stony Creek was simulated as a specified-head boundary. To the north and northeast, the surface-water basin divides of small streams were simulated as no-flow boundaries. To the east and south, Swatara Creek was simulated as a specified-head boundary. To the south and west, the western part of the Manada Creek surface-water basin boundary was simulated as a no-flow boundary, and the remaining western part of the model was simulated as a no-flow boundary to its intersection with Swatera Creek.

Vertically, the model was divided into two layers to separate the more highly fractured bedrock aquifers close to land surface from the less fractured deeper bedrock aquifers. The top of the upper layer was set equal to the altitude of land surface from the USGS 30-m digital elevation model. The thickness of the upper layer was 50 m throughout the model. The bottom layer was 100 m thick, and the bottom surface was simulated as a no-flow boundary. The model grid was oriented with the rows roughly parallel to the general strike of the rock (north-northeast) and has 161 rows and 240 columns. The mapped contacts between geologic units at the surface were assumed to be vertical with depth (fig. 21).

All inflow to the model was from areal recharge, and all discharge was to streams. The assigned recharge value was 12 in/yr. Streams were simulated with the drain package in MODFLOW with altitudes set equal to land surface and the drain-conductance multiplier set equal to 5 m/d. No withdrawals from wells were simulated.

Hydraulic-conductivity values were computed using specific-capacity data from short-duration, single-well pumping tests obtained from the USGS Ground Water Inventory System (GWSI). Those values were subsequently adjusted where necessary in the model so that simulated groundwater altitudes were below land surface. Horizontal hydraulic-conductivity values assigned to geologic units in the upper layer of the 3-dimensional model are presented in table 19. The vertical hydraulic conductivity of the upper layer was assumed to be one-tenth of the horizontal hydraulic-conductivity value. In the lower layer, the horizontal hydraulic conductivity was assigned as one-twentieth of the upper layer and vertical hydraulic conductivity was one-fiftieth of the horizontal hydraulic conductivity of the lower layer.

Model Results

Simulations were made to illustrate the (1) general altitude and configuration of the water table, (2) generalized groundwater-flow paths in the Cantonment Area, and (3) advective movement from a hypothetical contaminant in the Training Area. The steady-state altitude and configuration of the potentiometric surface under natural, unstressed conditions is shown in figure 22. Water-level altitudes ranged from 325 to 1,070 ft above NGVD 29. The highest water levels were present beneath Second Mountain and Blue Mountain. From those highs, groundwater-level altitudes decreased toward the central part of the Training Corridor and toward local stream valleys within the Cantonment Area. The lowest groundwater altitudes were along Swatara Creek, the regional discharge location for groundwater.

Steady-state groundwater-flow paths were simulated in the Cantonment Area by starting a flow path at land surface to represent recharge at every cell within the upper layer of the model and then by tracking each particle to its discharge location (fig. 23). The flow paths indicated that nearly all groundwater that was recharged in the Cantonment Area discharged to a local stream within the FIG facility (fig. 23). Deep regional flow beneath the local streams to a distant discharge location such as Swatara Creek was not indicated. However, groundwater discharged to local streams eventually flowed off the FIG facility as part of the streamflow.

Simulated groundwater-flow paths for a hypothetical spill or leaking landfill in the western part of the Training Corridor area of the FIG facility are shown in figure 24. Flow paths showed groundwater movement from a source location to discharge locations within the local headwaters of Manada Creek. Simulations indicated that movement of groundwater was within a local flow system and not beyond FIG boundaries.

Model Limitations

The groundwater models developed for this study are uncalibrated and conceptual in nature and are presented to demonstrate the potential usefulness of groundwater modeling to show groundwater-flow directions. The hydraulic properties of geologic units beneath the FIG facility have not been tested and water levels were not available for calibration, so the results should be viewed with caution. The geologic structure of the area is complex and was highly generalized in this model with two layers. Information on the general aquifer properties of geologic units described in county water-resources reports were used to assign hydraulic-conductivity values; recharge was assumed to be spatially uniform, and GIS data layers of land-surface altitude and stream locations were used to define boundary conditions. The model could be improved if data were collected to better define hydrologic properties and provide observations to which model results could be compared.

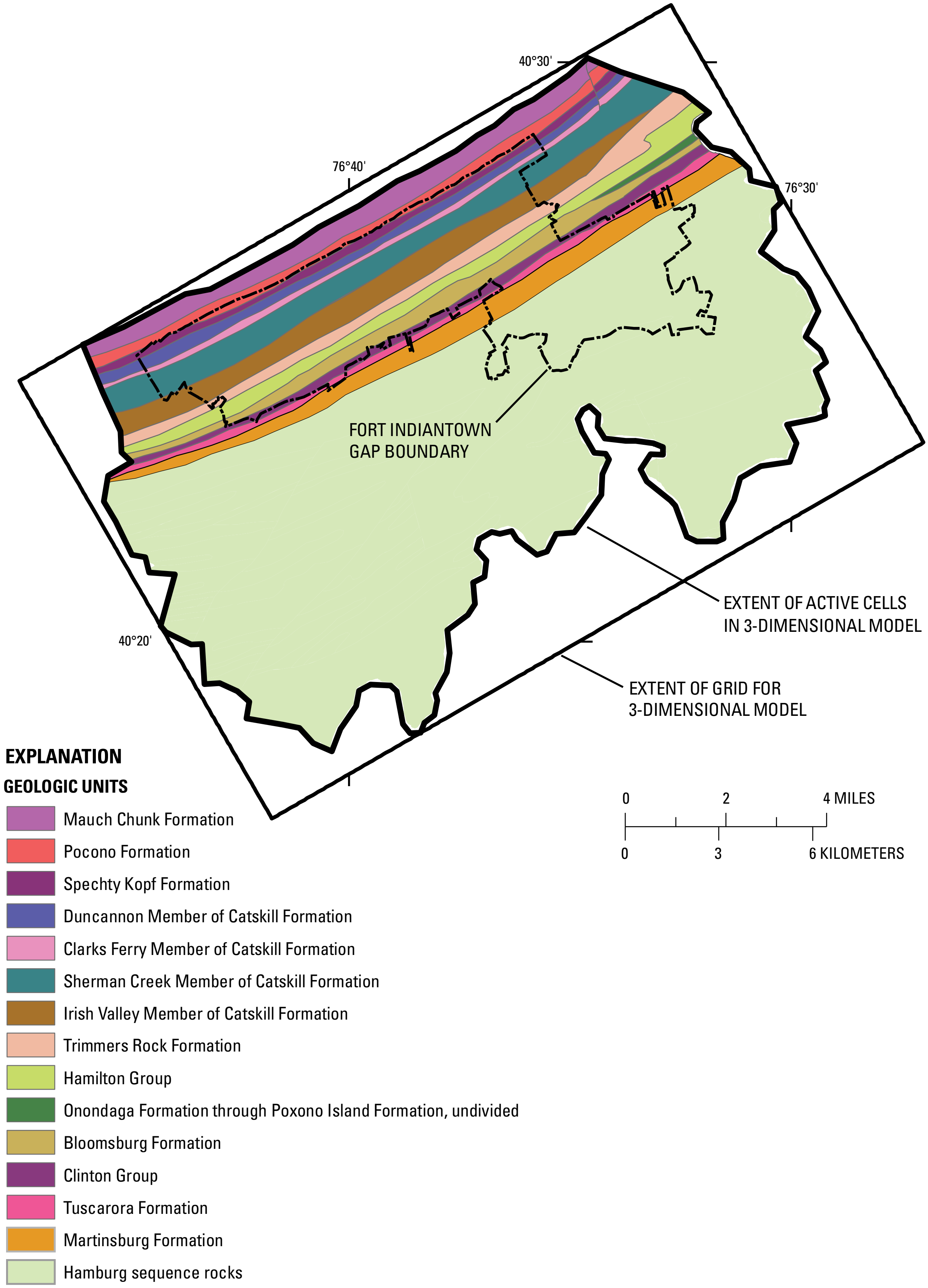


Figure 21. Groundwater model area with active area (colored), inactive area (not colored), and the surface representation of different geologic units (in various colors).

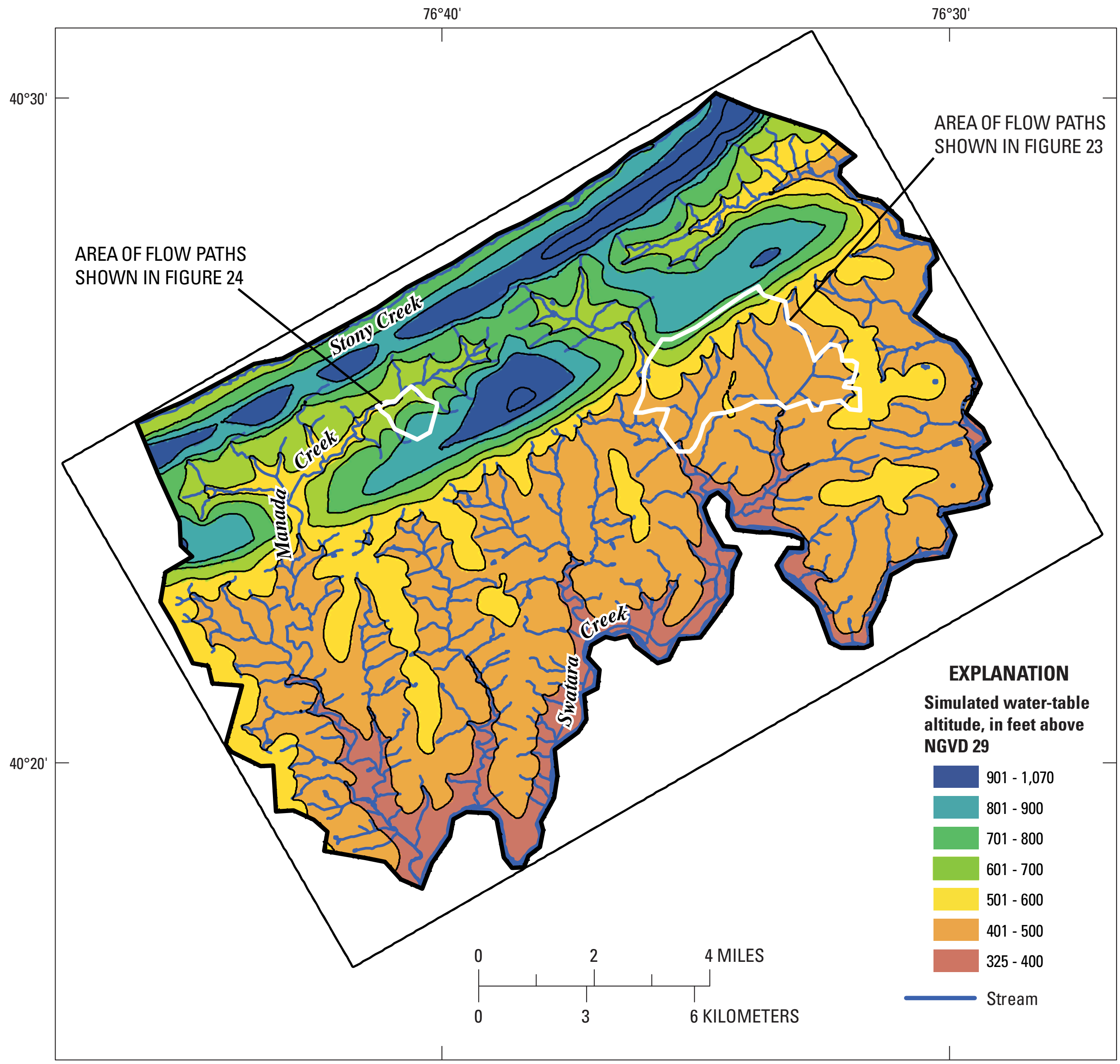


Figure 22. Regional altitude and configuration of the water table simulated in the 3-dimensional model of the Fort Indiantown Gap area, Lebanon and Dauphin Counties, Pa.

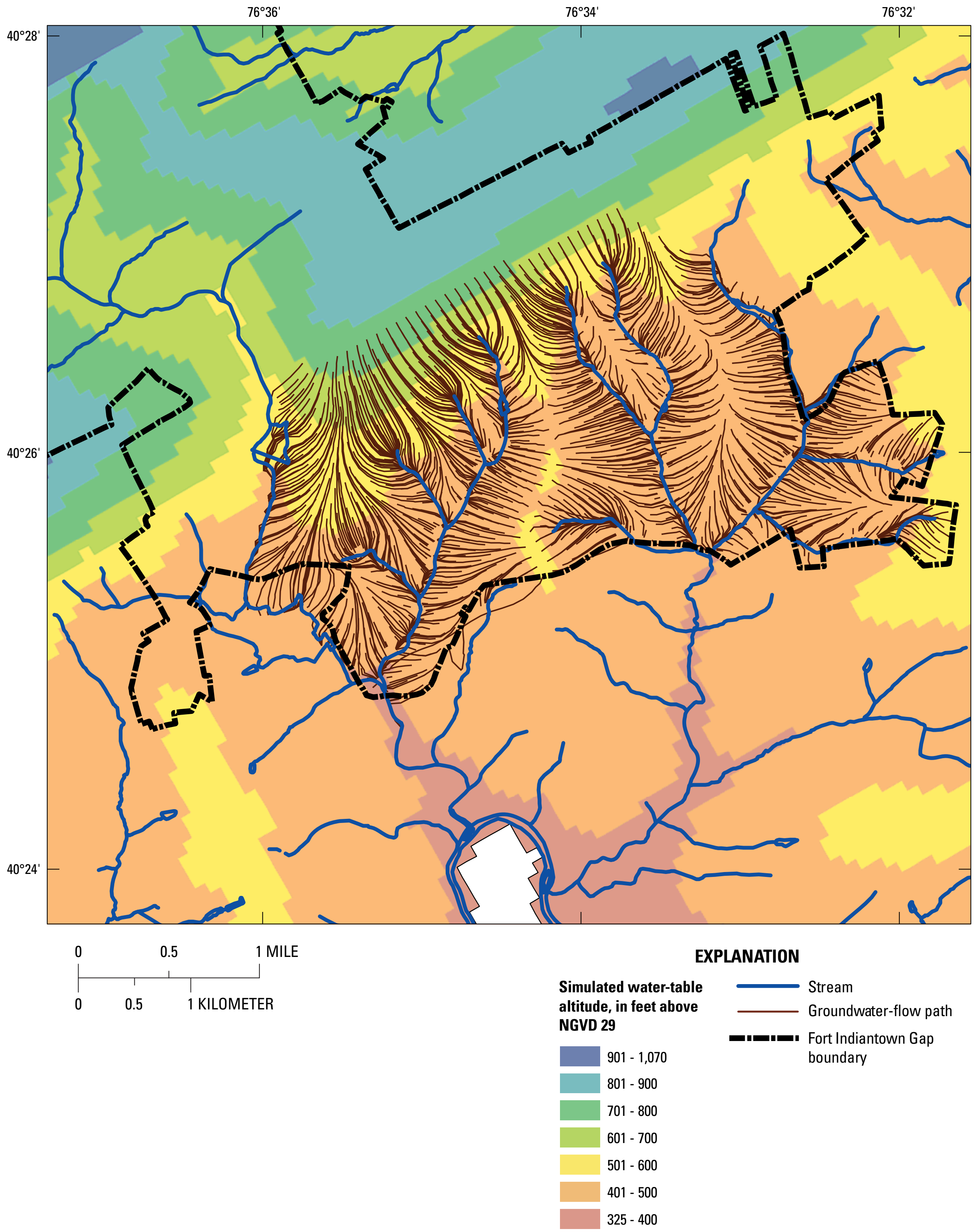


Figure 23. Groundwater flow paths simulated by the 3-dimensional model of the Cantonment Area of the Fort Indiantown Gap facility, Lebanon and Dauphin Counties, Pa.

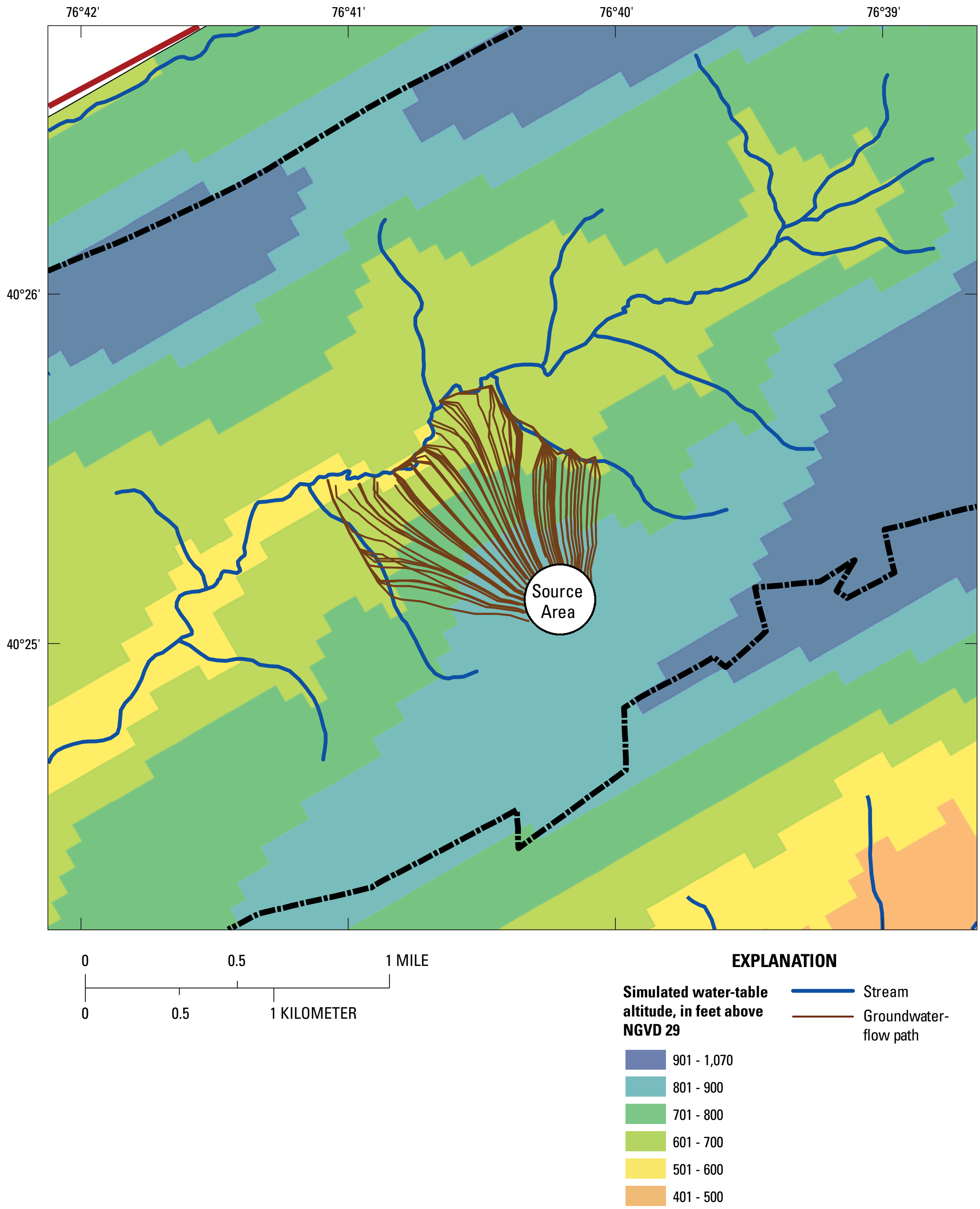


Figure 24. Groundwater flow paths from a hypothetical contaminant spill in the Manada Creek Training Corridor area, Fort Indiantown Gap, Lebanon and Dauphin Counties, Pa.

Summary

The USGS in cooperation with the Pennsylvania Department of Military and Veterans Affairs began a project in the summer of 2002 at the Fort Indiantown Gap (FIG) National Guard training facility in south-central Pennsylvania. This report describes the results of this investigation from 2002 to 2005. The National Guard is charged with protecting the environment while ensuring that the military-training mission is achieved. The USGS collected base-line data on water quality, stream habitat, and stage of stream evolution and initiated long-term monitoring of water resources on the FIG facility to meet the goals of assessing current conditions and protecting the resources.

Continuous monitoring of streamflow was conducted at two sites that were established for collection of long-term record. Annual mean flows for water years 2003–05 indicated above-normal streamflow conditions. Instantaneous streamflow was measured at five miscellaneous sites at the same time water-quality samples were collected. Water-quality analyses included nutrients, metals, major ions, sediment, pesticides, volatile and semi-volatile organic compounds, and explosives. In addition, turbidity was continuously monitored at the two continuous-record long-term sites. The continuous turbidity data were used to develop daily sediment loads.

Results of the water-quality sampling indicated no exceedances for any constituent except iron above the primary and secondary drinking-water standards or health-advisory levels set by the U.S. Environmental Protection Agency (USEPA). Iron concentrations were naturally elevated in the groundwater within the watershed. The mean iron concentration was about1,800 µg/L at Indiantown Run and 1,900 µg/L in Manada Creek; the secondary standard set for iron is 300 µg/L. The majority of the other constituents analyzed were at or below the detection limit. Detectable concentrations were measured for two by-products of explosives, compounds that currently (2009) have no drinking water or health-related standards.

Sediment loads were dominated by the effects of the remnants of Hurricane Ivan in September 2004. More than 60 percent of the sediment load measured during the entire study was transported past the monitoring sites in just 2 days during that event. Sediment yields from sites within the FIG facility, when compared to basins with varying amount of disturbed land (agriculture, urban, mining, and forest), were similar to yields from areas with higher amounts of undisturbed land (forest).

Aquatic invertebrates were collected at 27 sites in the summers of 2002–05. Using mean metrics scores and impact classifications, 15 of the 20 sites within the FIG facility were considered non-impacted and 5 were slightly impacted. Seven sites were outside the boundary of the FIG facility; five of those sites were considered non-impacted and two were slightly impacted. When sites were broken out by year, the number of sites considered non-impacted according to mean impact scores increased from 11 in 2002, to 13 in 2003, to 19 in 2004, and to 22 in 2005. Overall, benthic-invertebrate communities were in a less-affected condition in 2005 compared to 2002, likely due to the severe drought condition in 2002 rather than any specific base operations.

Fish were sampled at 25 of the 27 invertebrate sites in 2004. Simple statistics such as average length and weight were calculated. Several metrics—catch-per-unit-effort (CPUE), percent native species, percent intolerant species, percent dominant species, and total number of individuals—were calculated to show community differences or similarities among all the sites. The sampling totaled 4,818 fish from 33 species with a biomass of 36,568 grams. The fish metrics indicated most fish communities at sampled sites were healthy. The two sites with the highest CPUE, Aires Run above and below Quereg Run, also yielded the greatest total number of individuals at a site. The number of sites with 100 percent native species was seven. Most sites had 90 percent or more of the taxa that were native species. At 20 of the sites, the percent intolerant species was 5 percent or less. Trout were found at 14 sites, on and off the FIG facility. Brook trout were found at 10 sites, brown trout were found at 9 sites, and rainbow trout were found at 3 sites.

A fluvial geomorphic assessment of the FIG facility was conducted in two parts in the summer of 2004. The first part of the assessment was a delineation of the watersheds within the boundaries of the FIG facility and geomorphic stream classification. The second part of the fluvial geomorphic assessment involved a detailed analysis of two individual stream reaches near the long-term streamgages to predict how “stable” the stream channel was, as well as the vulnerability of the stream channel to future changes within the watershed. On the basis of the total distance of all stream reaches classified within the FIG facility, 94 percent were classified as B-class or C-class channels and considered “stable;” 6 percent were classified as A class, E class, G class, F class, and as undifferentiated B and F class and considered “unstable.”

Severe aggradation in both the stream channel and flood plain was evident in the downstream portion of the geomorphic study reach near the Indiantown Run streamgage and was likely the result of large-magnitude flooding associated with the effects of the remnants of Hurricane Ivan on September 18, 2004, and was not representative of bankfull conditions. The other geomorphic study reach was near the streamgage on Manada Creek. The reach remained relatively intact with little sign of erosion or disturbance from the flooding associated with the effects of the remnants of Hurricane Ivan, other than an influx of debris and large scour holes as water was forced around these obstructions. The most observable change at Manada Creek between pre- and post-flood conditions, other than added debris, was the obvious removal of many bars and other fine sediments along the streambed and banks.

Two groundwater-flow models were constructed as part of this study. They included a conceptual, 2-dimensional cross-sectional digital model and a preliminary, uncalibrated 3-dimensional finite-difference model Conceptual modeling of

the regional study area indicated that the hydrogeology of the area involved a complex system with 21 geologic units and 2 general hydrologic settings. Cross-sectional or profile modeling indicated localized flow from topographically high areas to discharge areas at local streams and creeks in the topographically low areas. This model also indicated interbasin flow of groundwater from the corridor area of the FIG facility northward to Stony Creek valley was unlikely. An uncalibrated, 3-dimensional finite-difference flow model indicated that simulated water-table contours closely reflect observed conditions. Also, flow-path analyses indicated that nearly all recharge in the Cantonment area flows to local creeks and streams on the FIG facility and then leaves via those creeks and streams. Finally, simulated results in the Training Corridor area indicate that the groundwater-flow model can be used to track flow paths from a hypothetical contaminant location to eventual groundwater discharge as base flow in local creeks and streams.

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Appendix 1—Parameter Codes, Constituents Analyzed, Reporting Levels, and Primary and Secondary Drinking Water Standards

Appendix 1a. Nutrients, sediment, and major ions.

[mg/L, milligrams per liter; —, no standard]

Parameter code	Parameter name	Reporting level (mg/L)	Drinking water standard (mg/L)
80124	Drainage area (square miles)		
00900	Hardness, total (mg/L as $CaCO_3$)	—	—
00915	Calcium, dissolved (mg/L as CA)	0.2	—
00916	Calcium, total recoverable (mg/L as Ca)	.2	—
00925	Magnesium, dissolved (mg/L as Mg)	.2	—
00927	Magnesium, total (mg/L as Mg)	.2	—
00935	Potassium, dissolved (mg/L as K)	3	—
00937	Potassium, total (mg/L as K)	3	—
00931	Sodium adsorption ratio	—	—
00940	Chloride, dissolved (mg/L as Cl)	3	250
00951	Fluoride, total (mg/L as F)	1	2
00945	Sulfate, dissolved (mg/L as SO_4)	5	250
00540	Residue, fixed non filterable (mg/L)	4	—
00530	Residue, total non filterable (mg/L)	4	—
80154	Suspended sediment	1	—
00625	Nitrogen, ammonia plus organic, total (mg/L as N)	.5	—
71846	Nitrogen, ammonia, dissolved (mg/L as NH_4)	.1	—
00610	Nitrogen, ammonia, total (mg/L as N)	.1	—
71845	Nitrogen, ammonia, total (mg/L as NH_4)	—	—
00620	Nitrogen, nitrate, total (mg/L as N)	.1	10
00630	Nitrogen, nitrite plus nitrate, total (mg/L as N)	.1	10
00615	Nitrogen, nitrite, total (mg/L as N)	.01	1
00605	Nitrogen, organic, total (mg/L as N)	—	
00600	Nitrogen, total (mg/L as N)	—	10
00660	Phosphate ortho, dissolved (mg/L as PO_4)	.5	—
00671	Phosphorus, orthophosphate, dissolved (mg/L as P)	.05	—
00665	Phosphorus, total (mg/L as P)	.05	—
00680	Carbon organic, total (mg/L as C)	1	—

Appendix 1b. Metals.

Parameter code	Parameter name	Reporting level (µg/L)	Drinking water standard (µg/L)
01106	Aluminum dissolved (as Al)	100	50-200
01105	Aluminum, total (as Al)		100
01095	Antimony dissolved (as Sb)	10	6
01097	Antimony total (as Sb)	10	6
01000	Arsenic dissolved (as As)	15	50 (new standard of 10 in 2006)
01002	Arsenic total (as As)	15	50 (new standard of 10 in 2006)
01005	Barium dissolved (as Ba)	10	2,000
01007	Barium total (as Ba)	10	2,000
01010	Beryllium dissolved (as Be)	5	4
01012	Beryllium total (as Be)	5	5
01025	Cadmium dissolved (as Cd)	5	5
01027	Cadmium total (as Cd)	5	5
01030	Chromium dissolved (as Cr)	10	100
01034	Chromium total (as Cr)	10	100
01035	Cobalt dissolved (as Co)	10	100
01037	Cobalt total (as Co)	10	—
01040	Copper dissolved (as Cu)	10	—
01042	Copper total (as Cu)	10	1,300
01046	Iron dissolved (as Fe)	100	1,300
01045	Iron, total, (as Fe)	100	300
01049	Lead dissolved (as Pb)	3	300
01051	Lead total (as Pb)	3	15
01056	Manganese dissolved (as Mn)	10	50
01055	Manganese total (as Mn)	10	50
71890	Mercury, dissolved (as Hg)	.2	2
71900	Mercury, total recov (as Hg)	.2	2
01060	Molybdenum dissolved (as Mo)	20	—
01062	Molybdenum total (as Mo)	20	—
01065	Nickel dissolved (as Ni)		40
01067	Nickel total (as Ni)	40	—
01145	Selenium dissolved (as Se)	15	50
01147	Selenium total (as Se)	15	15
01075	Silver dissolved (as Ag)	10	50
01077	Silver total (as Ag)	10	100
01057	Thallium dissolved (as Tl)	10	2
01059	Thallium total (as Tl)	10	2
01085	Vanadium dissolved (as V)	10	—
01087	Vanadium total (as V)	10	—
01090	Zinc dissolved (as Zn)	20	5,000
01092	Zinc total (as Zn)	20	5,000

Appendix 1c. Pesticides and polychlorinated biphenyls (PCB).

[µg/L, micrograms per liter]

Parameter code	Parameter name	Reporting level (µg/L)	Drinking water standard (µg/L)
39330	Aldrin, total	0.05	
39337	Alpha BHC total	.05	
34671	Aroclor 1016CB total	1	2
39488	Aroclor 1221CB total	1	2
39492	Aroclor 1232CB total	1	2
39496	Aroclor 1242CB total	1	2
39500	Aroclor 1248CB total	1	2
39504	Aroclor 1254CB total	1	2
39508	Aroclor 1260CB total	1	2
39062	Chlordane, cis isomer, water, whole	.05	2
39065	Chlordane, trans isomer, water	.05	2
39380	Dieldrin, total	.05	—
34361	Endosulfan I, water, whole	.05	—
34356	Endosulfan II, water, unfiltered	.05	—
34351	Endosulfan sulfate total	.05	—
34366	Endrin aldehyde total	.05	2
39390	Endrin, water, unfiltered, recoverable	.05	2
39420	Heptachlor epoxide, total	.05	.2
39410	Heptachlor, total	.05	.04
39340	Lindane, total	.05	.2
39480	Methoxychlor, total	.05	40
39310	p’-DDD, total	.05	—
39320	p’-DDE total	.05	—
39300	p’-DDT, total	.05	—

Appendix 1d. Explosives.

[µg/L, micrograms per liter; —, no standard]

Parameter code	Parameter name	Reporting level (µg/L)	Drinking water standard (µg/L)
49232	Benzene, 1,3,5-trinitro-, water, filtered	0.12	—
49230	Benzene, m-dinitro- water, filtered	.12	—
49229	Benzene, nitro- water, filtered	.12	—
34447	Benzene, nitro-, water, unfiltered	.12	—
49234	HMX, octogen (cyclotetramethylene-tetranitramine), water, filtered	.6	—
49233	RDX, cyclonite (cyclotrimethylenetrinitramine), water, filtered	.6	—
62226	Tetryl, water, unfiltered	.12	—
49226	Toluene, 2,4,6-trinitro-, water	.12	—
49228	Toluene, 2,4-dinitro-, water, filtered	.12	—
49227	Toluene, 2,6-dinitro-, water, filtered	.12	—
49221	Toluene, m-nitro-, water, filtered	.12	—
49223	Toluene, o-nitro-, water, filtered	.12	—
49222	Toluene,-nitro-, water, filtered	.12	—
61209	Perchlorate, water,total	.01	—

Appendix 1e. Volatile and semi-volatile organics.

µg/L, mirograms per liter; —, no standard]

Parameter code	Parameter name	Reporting level (µg/L)	Drinking water standard (µg/L)
62268	O-Cresol, soil	10	—
34556	1,2,5,6-Dibenzanthracene, total	10	—
77687	2,4,5-Trichlorophenol, water, whole, total	10	—
34621	2,4,6-Trichlorophenol, total	10	—
34606	2,4,Dimethylphenol, total	10	—
34601	2,4-Dichlorophenol, total	10	—
34616	2,4-Dinitrophenol, total	10	—
34611	2,4-Dinitrotoluene, total	10	—
34626	2,6-Dinitrotoluene, total	10	—
34581	2-Chloronaphthalene, total	10	—
34586	2-Chlorophenol, total	10	—
30195	2-Nitroaniline, water, whole	50	—
34591	2-Nitrophenol, total	10	—
34631	3,3’-Dichlorobenzidine, total	50	—
78300	3-Nitroaniline, water, whole, total	50	—
34657	4,6-Dinitroorthocresol, total	50	—
34636	4-Bromophenylhenyl ether, water, unfiltered	10	—
50312	4-Chloroaniline, water, filtered	10	—
34641	4-Chlorophenylhenyl ether, water, unfiltered	10	—
30196	4-Nitroaniline, water, whole	50	—
34646	4-Nitrophenol, total	50	—
34205	Acenaphthene, total	10	—
34200	Acenapthylene, total	10	—
77057	Acetate, vinyl, water, unfiltered	2	—
49225	Aniline, 2-methyl-, 3,5-dinitro-, water, filtered	.12	—
49224	Aniline, 4-methyl-, 3,5-dinitro-, water, filtered	.12	—
34220	Anthracene, total	10	—
34247	Benzo ayrene, total	10	—
34230	Benzo b fluoranthene, total	10	—
34242	Benzo k fluoranthene, total	10	—
34526	Benzo[a]anthracene, water, unfiltered	10	—
34521	Benzo[g,h,i]perylene, water, unfiltered,	10	—
39338	Beta benzene hexachloride, total	.05	—
34278	Bis(2-chloroethoxy) methane, total	10	—
34273	Bis(2-chloroethyl) ether, water, unfiltered	10	—
34283	Bis(2-chloroisopropyl) ether, total	10	—
39100	Bis(2-etylhexyl)hthalate, whole, water,	10	—
77571	Carbazole, water, unfiltered	10	—
34320	Chrysene, total	10	—
34386	Cyclopentadiene, hexachloro-, water, unfiltered	50	50
34259	Delta benzene hexachloride, total	.05	—
81302	Dibenzofuran, water, whole, total	10	—
34336	Diethylhthalate, total	10	—
34341	Dimethylhthalate, total	10	—
39110	Di-n-butylphthalate, total	10	—
34596	Dinoctylhthalate, total	10	—
34376	Fluoranthene, total	10	—
34381	Fluorene, total	10	—

Appendix 1e. Volatile and semi-volatile organics.

µg/L, mirograms per liter; —, no standard]

Parameter code	Parameter name	Reporting level (µg/L)	Drinking water standard (µg/L)
39700	Hexachlorobenzene, total	10	1
34403	Indeno (1,2,3-cd)yrene, total	10	—
34408	Isophorone, total	10	—
34292	n-Butylbenzylphthalate, total	10	—
34428	n-Nitrosodi-n-propylamine, total	10	—
34433	n-Nitrosodiphenylamine, total	10	—
34452	Arachlorometa cresol, total	10	—
39032	Entachlorophenol, total	50	—
34461	Phenanthrene, total	10	—
34694	Phenol, water, unfiltered,	10	—
32730	Phenols, total	20	—
34469	Pyrene, total	10	0.2
34506	1,1,1-Trichloroethane, total	1	200
34511	1,1,2-Trichloroethane, total	1	5
34496	1,1-Dichloroethane, total	1	—
34501	1,1-Dichloroethylene, total	1	7
77443	1,2,3-Trichloropropane, water, whole, total	1	—
32103	1,2-Dichloroethane, total	1	5
34541	1,2-Dichloropropane, total	1	5
34546	Trans-1,2-dichloroethene, total	1	—
77103	2-Hexanone, water, whole, total	5	—
81552	Acetone, water, whole, total	10	—
34551	Benzene, 1,2,4-trichloro-, water, unfiltered	1	—
34566	Benzene, 1,3-dichloro-, water, unfiltered	1	—
34571	Benzene, 1,4-dichloro-, water, unfiltered	1	—
34536	Benzene, o-dichloro-, water, unfiltered	1	—
34030	Benzene, total	1	5
32104	Bromoform, total	1	—
77041	Carbon disulfide, water, whole, , total	1	—
32102	Carbon tetrachloride, water, unfiltered	1	5
34301	Chlorobenzene, total	1	100
32105	Chlorodibromomethane, total	1	—
34311	Chloroethane, total	2	—
32106	Chloroform, total	1	—
77093	Cis-1,2-dichloroethene, water, whole,, total	1	7
34704	Cis-1,3-dichloropropene, total	1	—
32101	Bromodichloromethane, water, unfiltered	1	—
77562	Ethane, 1,1,1,2-tetrachloro-, water, unfiltered	10	—
34516	Ethane, 1,1,2,2-tetrachloro-, water, unfiltered	10	—
34396	Ethane, hexachloro-, water, unfiltered	10	—
34371	Ethylbenzene, total	1	7
39702	Hexachlorobutadiene, total µg/L	10	—
78032	Methyl tertiary-butyl ether (MTBE), water unfiltered	5	—
34413	Methylbromide, total	2	—
34418	Methylchloride,, total	2	—
34423	Methylene chloride, water, unfiltered	1	—
81595	Methylethylketone, water, whole, , total	5	—
78133	Methyl isobutyl ketone, water, whole, total	5	—

Appendix 1e. Volatile and semi-volatile organics.

µg/L, mirograms per liter; —, no standard]

Parameter code	Parameter name	Reporting level (µg/L)	Drinking water standard (µg/L)
85795	m-Xylene/p-xylene, water, unfiltered	2	—
34696	Naphthalene, total	10	—
77135	o-Xylene, water, whole, total	1	—
77128	Styrene, total	1	100
34475	Tetrachloroethylene, total	1	5
34010	Toluene,, total	1	100
34699	Trans-1,3-dichloropropene, total	1	—
39180	Trichloroethylene, total	1	5
39175	Vinyl chloride, total	1	2

Appendix 2—Statistical Summaries of Water-Quality Data

For all tables in appendix 2, if one sample was collected, only the median concentration value is presented; if two samples were collected, the minimum and maximum concentration values are presented; if three samples were collected, the minimum, median, and maximum concentrations values are presented; otherwise, all statistics are reported.

Appendix 2a. Nutrients, major ions, and metals.

[Pxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; <. less than; N/D, not detected]

Station number 01572809										
Statistics	**P81024**	**P00916**	**P00927**	**P00937**	**P00929**	**P00951**	**P00530**	**P00625**	**P71845**	**P00610**
Minimum		1.9	4.4	1.5	3.9	<1	<1	<0.15	<0.18	<0.14
Median	1.74	25	6.2	2.2	8.7	<1	<1	<.15	<.18	<.14
Maximum		32	7.5	2.8	12	<1	<1	<.15	<.18	<.14
n	1	3	3	3	3	3	3	3	3	3

Statistics	P00620	P00615	P00665	P01105	P01097	P01002	P01012	P01027	P01034	P01037
Minimum	<0.15	<0.004	<0.05	<100	<10	15	<5	<5	<10	<10
Median	<.15	<.004	<.05	<100	<10	15	<5	<5	<10	<10
Maximum	<.15	<.004	<.05	<100	<10	15	<5	<5	<10	<10
n	3	3	3	3	3	3	3	3	3	3

Statistics	P01042	P01045	P01051	P01055	P71900	P01062	P01067	P01147	P01077	P01059
Minimum	<10	250	<3	<20	0.2	<20	40	15	0.94	<10
Median	<10	250	<3	<20	.2	<20	40	15	.94	<10
Maximum	<10	250	<3	<20	.2	<20	40	15	.94	<10
n	3	3	<3	3	3	3	3	3	3	3

Statistics	P01087	P01092
Minimum	<10	20
Median	<10	20
Maximum	<10	20
n	3	3

Station number 01572950										
Statistics	**P81024**	**P00900**	**P00915**	**P00916**	**P00925**	**P00927**	**P00935**	**P00937**	**P00931**	**P00930**
Minimum		15	3.7	2.6	1.4	1.1	0.55	0.5	0.7	2.3
Mean		19	4.9	4.27	1.7	1.69	.72	1.05	.7	4.1
Median	5.48	19	4.9	4.2	1.7	1.6	.72	1.1	.7	4.1
Maximum		23	6.1	6.3	2	3.1	.89	1.7	.7	5.9
n	1	40	40	40	40	40	40	40	40	40

Appendix 2a. Nutrients, major ions, and metals.

[Pxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; <. less than; N/D, not detected]

Statistics	P00929	P00940	P00951	P00945	P00530	P81054	P80154*	P00625	P71845
Minimum	1.5	2.8	0.1	2.4	2	16	16	0.09	0.13
Mean	3.75	4.18	.53	4.31	58.1	419	1,324	.37	.18
Median	2.7	3.6	.25	4.3	16	240	474	.39	.18
Maximum	11	11	1	6.9	590	1,390	11,500	.5	.23
n	40	40	40	40	40	36	32	40	40

Statistics	P00610	P00620	P00630	P00615	P00660	P00671	P00665	P00600	P00680	P01106
Minimum	0.022	0.23	0.12	0.002	0.15	0.028	0.017	0.12	0.8	48
Mean	.08	.34	.3	.01	.47	.08	.06	.33	1.1	75.75
Median	.088	.325	.2	.005	.5	.05	.04	.3	1.1	77.5
Maximum	.18	.51	1.3	.01	.5	.22	.38	1.5	1.4	100
n	40	40	40	40	40	40	40	40	40	40

Statistics	P01105	P01095	P01097	P01000	P01002	P01005	P01010	P01012	P01025	P01027
Minimum	100	<10	<10	<10	4	19	<5	<5	<5	5
Mean	576	<10	11.36	11.25	14.73	21.75	<5	<5	<5	5.71
Median	350	<10	10	10	15	22	<5	<5	<5	5
Maximum	1700	<10	20	15	30	24	<5	<5	<5	10
n	40	40	40	40	40	40	40	40	40	40

Statistics	P01030	P01034	P01035	P01037	P01040	P01042	P01046	P01045	P01049	P01051
Minimum	<10	1	<10	<10	<10	<10	70	140	<3	3
Mean	<10	8.73	<10	<10	<10	10.83	167.5	887.09	<3	3.2
Median	<10	10	<10	<10	<10	10	140	530	<3	3
Maximum	<10	20	<10	<10	<10	20	320	3700	<3	6
n	40	40	40	40	40	40	40	40	40	40

Statistics	P01056	P01055	P71890	P71900	P01060	P01062	P01065	P01067	P01145	P01147
Minimum	<20	10	0.03	0.1	2	20	<40	40	5	5
Mean	<20	142.86	.16	.18	15.5	22.73	<40	42.35	7.5	14.32
Median	<20	40	.2	.2	20	20	<40	40	5	15
Maximum	<20	880	.2	.2	20	40	<40	80	15	30
n	40	40	40	40	40	40	40	40	40	40

Statistics	P01075	P01077	P01057	P01059	P01085	P01087	P01090	P01092
Minimum	<10	0.78	<10	10	<10	10	<20	10
Mean	<10	9.74	<10	11.36	<10	10.6	<20	28.5
Median	<10	10	<10	10	<10	10	<20	20
Maximum	<10	20	<10	20	<10	20	<20	120
n	40	40	40	40	40	40	40	40

Appendix 2a. Nutrients, major ions, and metals.

[Pxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; <. less than; N/D, not detected]

Station number 01572979

Statistics	P81024	P00916	P00927	P00937	P00929	P00951	P00530	P00625	P71845	P00610
Minimum	0.73	18	4.4	3.3	7.9	1	22	0.43	0.64	0.04
Maximum		18	4.4	3.3	7.9	1	24	.67	.64	.5
n	1	2	2	2	2	2	2	2	2	2

Statistics	P00620	P00630	P00615	P00605	P00671	P00665	P00600	P71887	P01105	P01095
Minimum	0.24	0.33	0.007	0.17	N/D	0.04	1	4.4	1400	N/D
Maximum	.24	.36	.007	.17	N/D	.049	1	4.4	1400	N/D
n	2	2	2	2	2	2	2	2	2	2

Statistics	P01097	P01002	P01012	P01027	P01034	P01045	P01055	P71900	P01062	P01067
Minimum	<10	<15	<5	<5	<2	2000	70	0.2	20	40
Maximum	<10	<15	<5	<5	<2	2000	70	.2	20	40
n	2	2	2	2	2	2	2	2	2	2

Statistics	P01147	P01077	P01057	P01059	P01092
Minimum	<15	<10	N/D	<10	<10
Maximum	<15	<10	N/D	<10	<10
n	2	2	2	2	2

Station number 01572981

Statistics	P81024	P00916	P00925	P00927	P00935	P00937	P00929	P00951	P00530	P00625
Minimum	0.79	3.7	N/D	1.4	N/D	1.6	3.9	1	24	0.4
Maximum		3.7	N/D	1.4	N/D	1.6	3.9	1	35	.43
n	1	2	2	2	2	2	2	2	2	2

Statistics	P71845	P00610	P00620	P00630	P00615	P00665	P00600	P01105	P01097	P01002
Minimum	0.15	0.12	0.54	0.3	0.005	0.03	0.3	900	<10	15
Maximum	.19	.15	.54	.52	.02	.037	.55	900	<10	15
n	2	2	2	2	2	2	2	2	2	2

Statistics	P01012	P01027	P01034	P01045	P01051	P01055	P71900	P01062	P01067	P01147
Minimum	5	5	<10	1200	3	130	0.2	20	40	15
Maximum	5	5	<10	1200	3	130	.2	20	40	15
n	2	2	2	2	2	2	2	2	2	2

Statistics	P01077	P01059	P01087	P01092
Minimum	<10	<10	<10	20
Maximum	<10	<10	<10	20
n	2	2	2	2

Appendix 2a. Nutrients, major ions, and metals.

[Pxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; <. less than; N/D, not detected]

Station number 01573482

Statistics	P81024	P00900	P00915	P00916	P00925	P00927	P00935	P00937	P00931	P00930
Minimum		9	1.9	1.9	0.98	0.9	0.58	0.6	N/D	1.8
Mean		10.67	2.3	2.43	1.19	1.26	.64	1.33	N/D	3.93
Median	8.59	11	2.4	2.4	1.3	1.3	.61	1.1	N/D	5
Maximum		12	2.6	3.3	1.3	1.8	.74	3	N/D	5
n	1	50	50	50	50	50	50	50	50	50

Statistics	P00929	P00940	P00951	P00945	P00530	P80154	P80154*	P00625	P71845
Minimum	1.4	0.7	0.1	2.2	1.6	9	9	0.09	0.15
Mean	3.65	1.69	.64	4.15	89	298	1,330	.36	.22
Median	4.2	1.8	1	4.6	63	301	328	.385	.24
Maximum	5	2	1	6.2	300	601	14,000	.54	.26
n	50	50	50	50	54	26	30	50	50

Statistics	P00610	P00620	P00630	P00615	P00605	P00660	P00671	P00665	P00600	P71887
Minimum	0.031	0.17	0.12	0.003	N/D	<0.5	0.03	0.018	0.67	<3
Mean	.1	.32	.34	.01	N/D	<.5	.06	.05	.67	<3
Median	.1	.3	.2	.004	N/D	<.5	.05	.05	.67	<3
Maximum	.2	.55	2	.01	N/D	<.5	.15	.14	.67	<3
n	50	50	50	50	50	50	50	50	50	50

Statistics	P00680	P01106	P01105	P01095	P01097	P01000	P01002	P01005	P01010	P01012
Minimum	1.4	28	<100	5	4	10	10	19	<0.5	<0.5
Mean	2.7	66.2	344	9	11	11	15.2	22.7	<.5	<.5
Median	1.5	59	300	10	10	10	15	23.8	<.5	<.5
Maximum	5.2	100	800	10	20	15	30	26	<.5	<.5
n	50	50	50	50	50	50	50	50	50	50

Statistics	P01025	P01027	P01030	P01034	P01035	P01037	P01040	P01042	P01046	P01045
Minimum	<0.5	5	<10	1	<10	<10	<10	10	50	120
Mean	<.5	5.23	<10	7.91	<10	<10	<10	11.67	116	386
Median	<.5	5	<10	<10	<10	<10	<10	10	130	250
Maximum	<.5	10	<10	20	<10	<10	<10	20	160	980
n	50	50	50	50	50	50	50	50	50	50

Statistics	P01049	P01051	P01056	P01055	P71890	P71900	P01060	P01062	P01065	P01067
Minimum	<3	3	10	20	<0.05	0.1	<20	3	<40	40
Mean	<3	3.27	20	146.4	.15	.19	<20	20.9	<40	42.6
Median	<3	3	20	140	.2	.2	<20	20	<40	45
Maximum	<3	6	30	420	.2	.2	<20	40	<40	80
n	50	50	50	50	50	50	50	50	50	50

Appendix 2a. Nutrients, major ions, and metals.

[Pxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; <. less than; N/D, not detected]

Statistics	P01145	P01147	P01075	P01077	P01057	P01059	P01085	P01087	P01090	P01092
Minimum	5	5	<10	0.65	<10	<10	<10	<10	<20	<10
Mean	7	14.2	<10	9.72	<10	10.8	<10	10.7	<20	29.5
Median	5	15	<10	10	<10	10	<10	10	<20	20
Maximum	15	30	<10	20	<10	20	<10	20	<20	60
n	50	50	50	50	50	50	50	50	50	50

Station number 01573490

Statistics	P00916	P00927	P00937	P00929	P00940	P00951	P00945	P00530	P00625	P71845
Minimum		1.2	0.6	1.4	1.3	0.1	3.3	2	0.25	0.15
Mean		1.39	.92	2.99	2.24	.38	5.38	31.85	.466	.21
Median	2.2	1.4	.8	2.6	1.85	.2	5.15	4	.5	.21
Maximum		1.6	1.8	5	5.2	1	7.7	350	.51	.27
n	1	19	19	19	19	19	19	19	19	19

Statistics	P00610	P00620	P00630	P00615	P00605	P00660	P00671	P00665	P00600	P71887
Minimum	0.029	0.2	0.13	<0.004	0.3	0.5	0.032	0.018	0.15	3.7
Mean	.097	.333	.24	.01	.3	.5	.08	.04	.27	3.7
Median	.1	.33	.21	.01	.3	.5	.05	.05	.25	3.7
Maximum	.21	.45	.45	.01	.3	.5	.18	.05	.55	3.7
n	19	19	19	19	19	19	19	19	19	19

Statistics	P00680	P01106	P01105	P01095	P01097	P01000	P01002	P01005	P01010	P01012
Minimum	<2	<100	100	<10	4	<10	8	35	<5	<5
Mean	<2	115	344	<10	9.54	<10	13.31	38	<5	<5
Median	<2	115	300	<10	10	<10	15	38	<5	<5
Maximum	<2	130	800	10	10	<10	15	41	<5	<5
n	19	19	19	19	19	19	19	19	19	19

Statistics	P01025	P01027	P01030	P01034	P01035	P01037	P01040	P01042	P01046	P01045
Minimum	<5	<5	<10	2	<10	<10	<10	<10	<100	120
Mean	<5	<5	<10	9.38	<10	<10	<10	<10	215	386
Median	<5	<5	<10	<10	<10	<10	<10	<10	215	250
Maximum	<5	<5	<10	<10	<10	<10	<10	<10	330	980
n	19	19	19	19	19	19	19	19	19	19

Statistics	P01049	P01051	P01056	P01055	P71890	P71900	P01060	P01062	P01065	P01067
Minimum	<3	<3	20	20	<0.2	<0.2	<20	2	<40	<40
Mean	<3	<3	35	60	<.2	<.2	<20	17.2	<40	<40
Median	<3	<3	35	40	<.2	<.2	<20	20	<40	<40
Maximum	<3	<3	50	170	<.2	<.2	<20	20	<40	<40
n	19	19	19	19	19	19	19	19	19	19

Appendix 2a. Nutrients, major ions, and metals.

[Pxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; <. less than; N/D, not detected]

Statistics	P01145	P01147	P01075	P01077	P01057	P01059	P01085	P01087	P01090	P01092
Minimum	<0.5	5	1	0.8	<10	3	<10	<10	20	10
Mean	<.5	15	5.5	8.61	<10	9.46	<10	<10	20	17
Median	<.5	15	10	10	<10	10	<10	<10	20	20
Maximum	<.5	19	19	10	<10	10	<10	<10	20	20
n	19	19	19	19	19	19	19	19	19	19

Station number 01573497

Statistics	P81024	P00916	P00925	P00927	P00937	P00929	P00940	P00951	P00945	P00530
Minimum		4.6	N/D	2	0.9	1.7	1.8	0.1	2.2	2
Mean		6.02	N/D	2.38	1.56	4.42	9.19	.43	8.86	20.18
Median	3.06	5.7	N/D	2.35	1.25	4.7	7.8	.2	4.8	5.5
Maximum		8.6	N/D	3	2.6	5.7	31	1	42	200
n	1	17	0	17	17	17	17	17	17	17

Statistics	P00625	P71845	P00610	P00620	P00630	P00615	P00605	P00660	P00671	P00665
Minimum	0.12	0.19	0.03	0.35	0.32	0.002	N/D	0.12	0.05	0.02
Mean	.34	.19	.08	1.02	1.08	.01	N/D	.46	.07	.13
Median	.2	.19	.086	.975	.97	.007	N/D	.5	.05	.045
Maximum	.61	.19	.15	1.7	2	.034	N/D	.5	.16	1.2
n	17	17	17	17	17	17	17	17	17	17

Statistics	P00600	P71887	P00680	P01106	P01105	P01095	P01097	P01000	P01002	P01005
Minimum	1.6	6.9	1.7	20	<100	<10	<10	<10	4	26
Mean	1.87	8.13	1.7	20	387.5	<10	<10	<10	13.25	26
Median	1.6	7	1.7	20	300	<10	<10	<10	15	26
Maximum	2.4	10.5	1.7	20	1100	<10	<10	<10	15	26
n	17	17	17	17	17	17	17	17	17	17

Statistics	P01010	P01012	P01025	P01027	P01030	P01034	P01035	P01037	P01040	P01042
Minimum	<0.5	<0.5	<0.5	<0.5	<10	3	<10	<10	<10	<10
Mean	<.5	<.5	<.5	<.5	<10	9.42	<10	<10	<10	<10
Median	<.5	<.5	<.5	<.5	<10	<10	<10	<10	<10	<10
Maximum	<.5	<.5	<.5	<.5	<10	<10	<10	<10	<10	<10
n	17	17	17	17	17	17	17	17	17	17

Statistics	P01046	P01045	P01049	P01051	P01056	P01055	P71890	P71900	P01060	P01062
Minimum	120	130	<3	<3	20	20	0.04	0.2	<20	<20
Mean	120	490	<3	<3	20	65.8	.04	.2	<20	<20
Median	120	330	<3	<3	20	50	.04	.2	<20	<20
Maximum	120	1600	<3	<3	20	140	.04	.2	<20	<20
n	17	17	17	17	17	17	17	17	17	17

Appendix 2a. Nutrients, major ions, and metals.

[Pxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; <. less than; N/D, not detected]

Statistics	P01065	P01067	P01145	P01147	P01075	P01077	P01057	P01059	P01085	P01087
Minimum	<40	<40	<0.5	5	<10	0.46	<10	<10	<10	<10
Mean	<40	<40	<.5	13.3	<10	7.68	<10	<10	<10	<10
Median	<40	<40	<.5	15	<10	<10	<10	<10	<10	<10
Maximum	<40	<40	<.5	15	<10	<10	<10	<10	<10	<10
n	17	17	17	17	17	17	17	17	17	17

Statistics	P01090	P01092
Minimum	<20	<10
Mean	<20	19
Median	<20	20
Maximum	<20	30
n	17	17

*Includes results with the flood event of September 19, 2004.

Appendix 2b. Explosives and pesticides.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Station number 01572809

Statistics	P49232	P49230	P49228	P49227	P49223	P49221	P49222	P39330	P34361	P39065
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1	1

Statistics	P39337	P34671	P39488	P39492	P39496	P39500	P39504	P39508	P34356
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P39062	P39380	P34351	P34366	P39390	P39420	P39410	P49234	P39340
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P49229	P34447	P39310	P39320	P39300	P39480	P49233	P62226	P49226
Median	N/D	0.12	N/D	N/D	N/D	N/D	N/D	0.12	N/D
n	1	1	1	1	1	1	1	1	1

Station number 01572950

Statistics	P49232	P49230	P49228	P49227	P49223	P49221	P49222	P39330	P34361	P39065
Minimum	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.05	<0.1	<0.1
Mean	<.12	<.12	<.12	<.12	<.12	<.12	<.12	<.05	<.1	<.1
Median	<.12	<.12	<.12	<.12	<.12	<.12	<.12	<.05	<.1	<.1
Maximum	<.12	<.12	<.12	<.12	<.12	<.12	<.12	<.05	<.1	<.1
n	12	12	12	12	12	12	12	12	12	12

Statistics	P39337	P34671	P39488	P39492	P39496	P39500	P39504	P39508	P49226
Minimum	<0.05	<1	<1	<1	<1	<1	<1	<1	<0.12
Mean	<.05	1.75	1.75	1.75	1.75	1.75	1.75	1.75	<.12
Median	<.05	1.75	1.75	1.75	1.75	1.75	1.75	1.75	<.12
Maximum	<.05	2.5	2.5	2.5	2.5	2.5	2.5	2.5	<.12
n	12	12	12	12	12	12	12	12	12

Statistics	P34356	P39062	P39380	P34351	P34366	P39390	P39420	P39410	P49234
Minimum	<0.05	<0.1	<0.05	<0.1	<0.1	<0.05	<0.05	<0.05	<0.12
Mean	<.05	<.1	<.05	<.1	<.1	<.05	<.05	<.05	<.12
Median	<.05	<.1	<.05	<.1	<.1	<.05	<.05	<.05	<.12
Maximum	<.05	<.1	<.05	<.1	<.1	<.05	<.05	<.05	<.12
n	12	12	12	12	12	12	12	12	12

Appendix 2b. Explosives and pesticides.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P39340	P49229	P34447	P39310	P39320	P39300	P39480	P49233	P62226
Minimum	<0.05	0.12	0.12	<0.1	<0.05	<0.1	<0.1	<0.039	<0.12
Mean	<.05	.12	6.71	<.1	<.05	<.1	<.1	<.039	<.12
Median	<.05	.12	10	<.1	<.05	<.1	<.1	<.039	<.12
Maximum	<.05	.12	10	<.1	<.05	<.1	<.1	<.039	<.12
n	12	12	12	12	12	12	12	12	12

Station number 01572979

Statistics	P49232	P49230	P49228	P49227	P49223	P49221	P49222	P39330	P34361	P39065
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2	2

Statistics	P39337	P34671	P39488	P39492	P39496	P39500	P39504	P39508	P34356
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P39062	P39380	P34351	P34366	P39390	P39420	P39410	P49234	P39340
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P49229	P34447	P39310	P39320	P39300	P39480	P49233	P62226	P49226
Minimum	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Station number 01572981

Statistics	P49232	P49230	P49228	P49227	P49223	P49221	P49222	P39330	P34361	P39065
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2	2

Statistics	P39337	P34671	P39488	P39492	P39496	P39500	P39504	P39508	P34356
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Appendix 2b. Explosives and pesticides.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P39062	P39380	P34351	P34366	P39390	P39420	P39410	P49234	P39340
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P49229	P34447	P39310	P39320	P39300	P39480	P49233	P62226	P49226
Minimum	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Station number 01573482

Statistics	P49232	P49230	P49228	P49227	P49223	P49221	P49222	P39330	P34361	P39065
Minimum	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.05	<0.1	<0.1
Mean	<.12	<.12	<.12	<.12	<.12	<.12	<.12	<.05	<.1	<.1
Median	<.12	<.12	<.12	<.12	<.12	<.12	<.12	<.05	<.1	<.1
Maximum	<.12	<.12	<.12	<.12	<.12	<.12	<.12	<.05	<.1	<.1
n	13	13	13	13	13	13	13	13	13	13

Statistics	P39337	P34671	P39488	P39492	P39496	P39500	P39504	P39508	P34356	P49226
Minimum	<0.05	<1	<1	<1	<1	<1	<1	<1	<0.05	<0.12
Mean	<.05	<1	<1	<1	<1	<1	<1	<1	<.05	<.12
Median	<.05	<1	<1	<1	<1	<1	<1	<1	<.05	<.12
Maximum	<.05	<1	<1	<1	<1	<1	<1	<1	<.05	<.12
n	13	13	13	13	13	13	13	13	13	13

Statistics	P39062	P39380	P34351	P34366	P39390	P39420	P39410	P49234	P39340
Minimum	<0.1	<0.05	<0.1	<0.1	<0.05	<0.05	<0.05	0.12	<0.05
Mean	<.1	<.05	<.1	<.1	<.05	<.05	<.05	.12	<.05
Median	<.1	<.05	<.1	<.1	<.05	<.05	<.05	.12	<.05
Maximum	<.1	<.05	<.1	<.1	<.05	<.05	<.05	.12	<.05
n	13	13	13	13	13	13	13	13	13

Statistics	P49229	P34447	P39310	P39320	P39300	P39480	P49233	P62226
Minimum	<0.12	0.12	<0.1	<0.05	<0.1	<0.1	0.18	<0.12
Mean	<.12	6.7	<.1	<.05	<.1	<.1	.245	<.12
Median	<.12	10	<.1	<.05	<.1	<.1	.245	<.12
Maximum	<.12	10	<.1	<.05	<.1	<.1	.31	<.12
n	13	13	13	13	13	13	13	13

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Station number 01572809									
Statistics	**P81024**	**P77687**	**P34621**	**P34601**	**P34606**	**P34616**	**P34611**	**P34626**	**P49225**
Median	1.74	N/D	N/D	N/D	N/D	N/D	0.12	0.12	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P34581**	**P34586**	**P34657**	**P30195**	**P34591**	**P34631**	**P78300**	**P49224**	**P34636**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P34452**	**P50312**	**P34641**	**P30196**	**P34646**	**P34381**	**P34205**	**P34200**	**P34220**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P34526**	**P34247**	**P34230**	**P34521**	**P34242**	**P34292**	**P39338**	**P34278**	**P34273**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P34283**	**P39100**	**P77571**	**P34320**	**P34259**	**P34556**	**P81302**	**P34336**	**P34341**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P39110**	**P34596**	**P34376**	**P39700**	**P34386**	**P34403**	**P34408**	**P34428**	**P34433**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P62268**	**P39032**	**P34461**	**P34694**	**P32730**	**P34469**	**P77057**	**P77562**	**P34506**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P34516**	**P34511**	**P34496**	**P34501**	**P77443**	**P34551**	**P34536**	**P32103**	**P34541**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P34566**	**P34571**	**P81552**	**P34030**	**P32101**	**P34413**	**P77041**	**P34301**	**P34311**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1
Statistics	**P34418**	**P77093**	**P34704**	**P32105**	**P34423**	**P81595**	**P34371**	**P39702**	**P34396**
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P78133	P85795	P34696	P77103	P77135	P77128	P78032	P34475	P32102
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P34010	P34546	P34699	P32104	P39180	P32106	P39175
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1

Station number 01572950

Statistics	P81024	P77687	P34621	P34601	P34606	P34616	P34611	P34626	P49224
Minimum		<10	<10	<10	<10	50	0.12	0.12	<0.12
Mean		<10	<10	<10	<10	50	6.7	6.7	<.12
Median	5.48	<10	<10	<10	<10	50	10	10	<.12
Maximum		<10	<10	<10	<10	50	10	10	<.12
n	6	6	6	6	6	6	6	6	6

Statistics	P49225	P34581	P34586	P34657	P30195	P34591	P34631	P78300
Minimum	<0.12	<10	<10	<50	<50	<10	<50	<50
Mean	<.12	<10	<10	<50	<50	<10	<50	<50
Median	<.12	<10	<10	<50	<50	<10	<50	<50
Maximum	<.12	<10	<10	<50	<50	<10	<50	<50
n	6	6	6	6	6	6	6	6

Statistics	P34636	P34452	P50312	P34641	P30196	P34646	P34381	P34205	P34200
Minimum	<10	<10	<10	<10	<50	<50	<10	<10	<10
Mean	<10	<10	<10	<10	<50	<50	<10	<10	<10
Median	<10	<10	<10	<10	<50	<50	<10	<10	<10
Maximum	<10	<10	<10	<10	<50	<50	<10	<10	<10
n	6	6	6	6	6	6	6	6	6

Statistics	P34220	P34526	P34247	P34230	P34521	P34242	P34292	P39338	P34278
Minimum	<10	<10	<10	<10	<10	<10	<10	<0.05	<10
Mean	<10	<10	<10	<10	<10	<10	<10	<.05	<10
Median	<10	<10	<10	<10	<10	<10	<10	<.05	<10
Maximum	<10	<10	<10	<10	<10	<10	<10	<.05	<10
n	6	6	6	6	6	6	6	6	6

Statistics	P34273	P34283	P39100	P77571	P34320	P34259	P34556	P81302	P34336
Minimum	<10	<10	<10	<10	<10	<0.05	<10	<10	<10
Mean	<10	<10	<10	<10	<10	<.05	<10	<10	<10
Median	<10	<10	<10	<10	<10	<.05	<10	<10	<10
Maximum	<10	<10	<10	<10	<10	<.05	<10	<10	<10
n	6	6	6	6	6	6	6	6	6

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P34341	P39110	P34596	P34376	P39700	P34386	P34403	P34408	P34428
Minimum	<10	<10	<10	<10	<10	<50	<10	<10	<10
Mean	<10	<10	<10	<10	<10	<50	<10	<10	<10
Median	<10	<10	<10	<10	<10	<50	<10	<10	<10
Maximum	<10	<10	<10	<10	<10	<50	<10	<10	<10
n	6	6	6	6	6	6	6	6	6

Statistics	P34433	P62268	P39032	P34461	P34694	P32730	P34469	P77057	P77562
Minimum	<10	<10	50	<10	<10	0.02	<10	<2	<1
Mean	<10	<10	50	<10	<10	.02	<10	<2	<1
Median	<10	<10	50	<10	<10	.02	<10	<2	<1
Maximum	<10	<10	50	<10	<10	.02	<10	<2	<1
n	6	6	6	6	6	6	6	6	6

Statistics	P34506	P34516	P34511	P34496	P34501	P77443	P34551	P34536	P32103
Minimum	<1	<1	<1	<1	<1	<1	<10	<10	<1
Mean	<1	<1	<1	<1	<1	<1	<10	<10	<1
Median	<1	<1	<1	<1	<1	<1	<10	<10	<1
Maximum	<1	<1	<1	<1	<1	<1	<10	<10	<1
n	6	6	6	6	6	6	6	6	6

Statistics	P34541	P34566	P34571	P81552	P34030	P32101	P34413	P77041	P34301
Minimum	<1	<10	<10	<10	<1	<1	<2	<1	<1
Mean	<1	<10	<10	<10	<1	<1	<2	<1	<1
Median	<1	<10	<10	<10	<1	<1	<2	<1	<1
Maximum	<1	<10	<10	<10	<1	<1	<2	<1	<1
n	6	6	6	6	6	6	6	6	6

Statistics	P34311	P34418	P77093	P34704	P32105	P34423	P81595	P34371	P39702
Minimum	<2	<2	<1	<1	<1	<1	<5	<1	<10
Mean	<2	<2	<1	<1	<1	<1	<5	<1	<10
Median	<2	<2	<1	<1	<1	<1	<5	<1	<10
Maximum	<2	<2	<1	<1	<1	<1	<5	<1	<10
n	6	6	6	6	6	6	6	6	6

Statistics	P34396	P78133	P85795	P34696	P77103	P77135	P77128	P78032	P34475
Minimum	<10	5	<2	<10	<5	<1	<1	<5	<1
Mean	<10	5	<2	<10	<5	<1	<1	<5	<1
Median	<10	5	<2	<10	<5	<1	<1	<5	<1
Maximum	<10	5	<2	<10	<5	<1	<1	<5	<1
n	6	6	6	6	6	6	6	6	6

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P32102	P34010	P34546	P34699	P32104	P39180	P32106	P39175
Minimum	<1	<1	0.5	<1	<1	<1	<1	<1
Mean	<1	<1	.5	<1	<1	<1	<1	<1
Median	<1	<1	.5	<1	<1	<1	<1	<1
Maximum	<1	<1	.5	<1	<1	<1	<1	<1
n	6	6	6	6	6	6	6	6

Station number 01572979

Statistics	P81024	P77687	P34621	P34601	P34606	P34616	P34611	P34626	P49225
Minimum	0.73	<10	<10	<10	<10	50	<10	<10	N/D
Maximum	.73	<10	<10	<10	<10	50	<10	<10	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P34581	P34586	P34657	P30195	P34591	P34631	P78300	P49224	P34636
Minimum	<10	<10	50	50	<10	50	50	N/D	<10
Maximum	<10	<10	50	50	<10	50	50	N/D	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P34452	P50312	P34641	P30196	P34646	P34381	P34205	P34200	P34220
Minimum	<10	<10	<10	50	50	<10	<10	<10	<10
Maximum	<10	<10	<10	50	50	<10	<10	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P34526	P34247	P34230	P34521	P34242	P34292	P39338	P34278	P34273
Minimum	<10	<10	<10	<10	<10	<10	N/D	<10	<10
Maximum	<10	<10	<10	<10	<10	<10	N/D	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P34283	P39100	P77571	P34320	P34259	P34556	P81302	P34336	P34341
Minimum	<10	<10	<10	<10	N/D	<10	<10	<10	<10
Maximum	<10	<10	<10	<10	N/D	<10	<10	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P39110	P34596	P34376	P39700	P34386	P34403	P34408	P34428	P34433
Minimum	<10	<10	<10	<10	50	<10	<10	<10	<10
Maximum	<10	<10	<10	<10	50	<10	<10	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P62268	P39032	P34461	P34694	P32730	P34469	P77057	P77562	P34506
Minimum	<10	50	<10	<10	0.02	<10	N/D	N/D	N/D
Maximum	<10	50	<10	<10	.02	<10	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P34516	P34511	P34496	P34501	P77443	P34551	P34536	P32103	P34541
Minimum	N/D	N/D	N/D	N/D	N/D	<10	<10	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	<10	<10	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P34566	P34571	P81552	P34030	P32101	P34413	P77041	P34301	P34311
Minimum	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P34418	P77093	P34704	P32105	P34423	P81595	P34371	P39702	P34396
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	<10	<10
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P78133	P85795	P34696	P77103	P77135	P77128	P78032	P34475	P32102
Minimum	N/D	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P34010	P34546	P34699	P32104	P39180	P32106	P39175
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2

Station number 01572981

Statistics	P81024	P77687	P34621	P34601	P34606	P34616	P34611	P34626	P49225
Minimum	0.79	<10	<10	<10	<10	50	<10	<10	N/D
Maximum	.79	<10	<10	<10	<10	50	<10	<10	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P34581	P34586	P34657	P30195	P34591	P34631	P78300	P49224	P34636
Minimum	<10	<10	50	50	<10	50	50	N/D	<10
Maximum	<10	<10	50	50	<10	50	50	N/D	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P34452	P50312	P34641	P30196	P34646	P34381	P34205	P34200	P34220
Minimum	<10	<10	<10	50	50	<10	<10	<10	<10
Maximum	<10	<10	<10	50	50	<10	<10	<10	<10
n	2	2	2	2	2	2	2	2	2

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P34526	P34247	P34230	P34521	P34242	P34292	P39338	P34278	P34273
Minimum	<10	<10	<10	<10	<10	<10	N/D	<10	<10
Maximum	<10	<10	<10	<10	<10	<10	N/D	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P34283	P39100	P77571	P34320	P34259	P34556	P81302	P34336	P34341
Minimum	<10	14	<10	<10	N/D	<10	<10	<10	<10
Maximum	<10	14	<10	<10	N/D	<10	<10	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P39110	P34596	P34376	P39700	P34386	P34403	P34408	P34428	P34433
Minimum	<10	<10	<10	<10	50	<10	<10	<10	<10
Maximum	<10	<10	<10	<10	50	<10	<10	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P62268	P39032	P34461	P34694	P32730	P34469	P77057	P77562	P34506
Minimum	<10	50	<10	<10	N/D	<10	N/D	N/D	N/D
Maximum	<10	50	<10	<10	N/D	<10	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P34516	P34511	P34496	P34501	P77443	P34551	P34536	P32103	P34541
Minimum	N/D	N/D	N/D	N/D	N/D	<10	<10	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	<10	<10	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P34566	P34571	P81552	P34030	P32101	P34413	P77041	P34301	P34311
Minimum	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	<10	<10	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Statistics	P34418	P77093	P34704	P32105	P34423	P81595	P34371	P39702	P34396
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	<10	<10
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D	<10	<10
n	2	2	2	2	2	2	2	2	2

Statistics	P78133	P85795	P34696	P77103	P77135	P77128	P78032	P34475	P32102
Minimum	N/D	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	<10	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2	2	2

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P34010	P34546	P34699	P32104	P39180	P32106	P39175
Minimum	N/D	N/D	N/D	N/D	N/D	N/D	N/D
Maximum	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	2	2	2	2	2	2	2

Station number 01573482

Statistics	P81024	P77687	P34621	P34601	P34606	P34616	P34611	P34626	P49224
Minimum		<10	<10	<10	<10	<50	0.12	0.12	<0.12
Mean		<10	<10	<10	<10	<50	6.7	6.7	<.12
Median	8.59	<10	<10	<10	<10	<50	10	10	<.12
Maximum		<10	<10	<10	<10	<50	10	10	<.12
n	8	8	8	8	8	8	8	8	8

Statistics	P49225	P34581	P34586	P34657	P30195	P34591	P34631	P78300
Minimum	<0.12	<10	<10	<50	<50	<10	<50	<50
Mean	<.12	<10	<10	<50	<50	<10	<50	<50
Median	<.12	<10	<10	<50	<50	<10	<50	<50
Maximum	<.12	<10	<10	<50	<50	<10	<50	<50
n	8	8	8	8	8	8	8	8

Statistics	P34636	P34452	P50312	P34641	P30196	P34646	P34381	P34205	P34200
Minimum	<10	<10	<10	<10	<50	<50	<10	<10	<10
Mean	<10	<10	<10	<10	<50	<50	<10	<10	<10
Median	<10	<10	<10	<10	<50	<50	<10	<10	<10
Maximum	<10	<10	<10	<10	<50	<50	<10	<10	<10
n	8	8	8	8	8	8	8	8	8

Statistics	P34220	P34526	P34247	P34230	P34521	P34242	P34292	P39338	P34278
Minimum	<10	<10	<10	<10	<10	<10	<10	<0.05	<10
Mean	<10	<10	<10	<10	<10	<10	<10	<.05	<10
Median	<10	<10	<10	<10	<10	<10	<10	<.05	<10
Maximum	<10	<10	<10	<10	<10	<10	<10	<.05	<10
n	8	8	8	8	8	8	8	8	8

Statistics	P34273	P34283	P39100	P77571	P34320	P34259	P34556	P81302	P34336
Minimum	<10	<10	<10	<10	<10	<0.05	<10	<10	<10
Mean	<10	<10	<10	<10	<10	<.05	<10	<10	<10
Median	<10	<10	<10	<10	<10	<.05	<10	<10	<10
Maximum	<10	<10	<10	<10	<10	<.05	<10	<10	<10
n	8	8	8	8	8	8	8	8	8

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P34341	P39110	P34596	P34376	P39700	P34386	P34403	P34408	P34428
Minimum	<10	<10	<10	<10	<10	<50	<10	<10	<10
Mean	<10	<10	<10	<10	<10	<50	<10	<10	<10
Median	<10	<10	<10	<10	<10	<50	<10	<10	<10
Maximum	<10	<10	<10	<10	<10	<50	<10	<10	<10
n	8	8	8	8	8	8	8	8	8

Statistics	P34433	P62268	P39032	P34461	P34694	P32730	P34469	P77057	P77562
Minimum	<10	<10	<50	<10	<10	<0.02	<10	<2	<1
Mean	<10	<10	<50	<10	<10	<.02	<10	<2	<1
Median	<10	<10	<50	<10	<10	<.02	<10	<2	<1
Maximum	<10	<10	<50	<10	<10	<.02	<10	<2	<1
n	8	8	8	8	8	8	8	8	8

Statistics	P34506	P34516	P34511	P34496	P34501	P77443	P34551	P34536	P32103
Minimum	<1	<1	<1	<1	<1	<1	<10	<10	<1
Mean	<1	<1	<1	<1	<1	<1	<10	<10	<1
Median	<1	<1	<1	<1	<1	<1	<10	<10	<1
Maximum	<1	<1	<1	<1	<1	<1	<10	<10	<1
n	8	8	8	8	8	8	8	8	8

Statistics	P34541	P34566	P34571	P81552	P34030	P32101	P34413	P77041	P34301
Minimum	<1	<10	<10	<10	<1	<1	<2	<1	<1
Mean	<1	<10	<10	<10	<1	<1	<2	<1	<1
Median	<1	<10	<10	<10	<1	<1	<2	<1	<1
Maximum	<1	<10	<10	<10	<1	<1	<2	<1	<1
n	8	8	8	8	8	8	8	8	8

Statistics	P34311	P34418	P77093	P34704	P32105	P34423	P81595	P34371	P39702
Minimum	<2	<2	<1	<1	<1	<1	<5	<1	<10
Mean	<2	<2	<1	<1	<1	<1	<5	<1	<10
Median	<2	<2	<1	<1	<1	<1	<5	<1	<10
Maximum	<2	<2	<1	<1	<1	<1	<5	<1	<10
n	8	8	8	8	8	8	8	8	8

Statistics	P34396	P78133	P85795	P34696	P77103	P77135	P77128	P78032	P34475
Minimum	<10	<5	<2	<10	<5	<1	<1	<5	<1
Mean	<10	<5	<2	<10	<5	<1	<1	<5	<1
Median	<10	<5	<2	<10	<5	<1	<1	<5	<1
Maximum	<10	<5	<2	<10	<5	<1	<1	<5	<1
n	8	8	8	8	8	8	8	8	8

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P32102	P34010	P34546	P34699	P32104	P39180	P32106	P39175
Minimum	<1	<1	<0.5	<1	<1	<1	<1	<1
Mean	<1	<1	<.5	<1	<1	<1	<1	<1
Median	<1	<1	<.5	<1	<1	<1	<1	<1
Maximum	<1	<1	<.5	<1	<1	<1	<1	<1
n	8	8	8	8	8	8	8	8

Station number 01573497

Statistics	P81024	P77687	P34621	P34601	P34606	P34616	P34611	P34626	P49225
Median	3.06	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P34581	P34586	P34657	P30195	P34591	P34631	P78300	P49224	P34636
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P34452	P50312	P34641	P30196	P34646	P34381	P34205	P34200	P34220
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P34526	P34247	P34230	P34521	P34242	P34292	P39338	P34278	P34273
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P34283	P39100	P77571	P34320	P34259	P34556	P81302	P34336	P34341
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P39110	P34596	P34376	P39700	P34386	P34403	P34408	P34428	P34433
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P62268	P39032	P34461	P34694	P32730	P34469	P77057	P77562	P34506
Median	N/D	N/D	N/D	N/D	0.02	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P34516	P34511	P34496	P34501	P77443	P34551	P34536	P32103	P34541
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P34566	P34571	P81552	P34030	P32101	P34413	P77041	P34301	P34311
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Appendix 2c. Semi-volatile and volatile organics.

[Pxxxxx, parameter code–see appendix 1 for name of parameter; n, number of samples; N/D, not detected]

Statistics	P34418	P77093	P34704	P32105	P34423	P81595	P34371	P39702	P34396
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P78133	P85795	P34696	P77103	P77135	P77128	P78032	P34475	P32102
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1	1	1

Statistics	P34010	P34546	P34699	P32104	P39180	P32106	P39175
Median	N/D	N/D	N/D	N/D	N/D	N/D	N/D
n	1	1	1	1	1	1	1

Appendix 3—Sample Habitat Assessment Forms

U.S. GEOLOGICAL SURVEY, WRD, SURFACE-WATER QUALITY FIELD NOTES BQA-1 3/92 (3rd printing, 1st ed.)

Proj. Name, No. FIG Unn Trib @ Ft. Indiantown Gap PA Date 7/30/02

Station Indiantown Run ab ~~Metearle~~ ~~Ft Indiantown Gap PA~~ Sta.No. ir-015 01572924

Sampled By RAB Mean Time 1300 SMS Cntrl. No. ______

Record No. 00202141 Sample Purpose (71999) :

SAMPLES COLLECTED

Nutrients ☐ TOC ☐
Major Ions ☐ DOC ☐
SOC ☐ Vol. Filt. ______ mL
BOD ☐ Turbidity ☐
COD ☐ ______ ☐
______ ☐

ORGANICS — Pesticide ☐, VOC ☐, BNA ☐, ______ ☐
TR. ELEMENTS — Unfiltered ☐, Filtered ☐, Suspended ☐, Bottom ☐

Sediment Conc. ☐
Sediment Size ☐
Sed. Bct. Material ☐
Sand Split/Break ☐
Radiochemical ☐
Isotope ☐
☐

LABORATORY SCHEDULES
Lab Schedules Req. (or copy of lab request form attached ☐)

Lab Codes Add (A) Delete (D) :

FIELD MEASUREMENTS

Q. Inst. (00061)	______	cfs meas. rating est.	Alkalinity ( )	______	mg/L
Gage Ht (00065)	______	ft.	Bicarbonate ( )	______	mg/L
Temp. Water (00010)	22.9	°C	Carbonate ( )	______	mg/L
Temp. Air (00020)	31	°C	Hydroxide ( )	______	mg/L
pH (00400)	6.6	units	E. Coli (31633)	______	col./100 mL; Rmk ______
Sp. Cond. (00095)	23	µS/cm 25 °C	FC (31625)	______	col./100 mL; Rmk ______
Dis. Oxy. (00300)	6.4	mg/L	FS (31673)	______	col./100 mL; Rmk ______
DO Sat. (00301)	77	%	Other:		
Bar. Press. (00025)	740	mm Hg			

SAMPLING CONDITIONS

Location: Wading, cable, ice, boat, bridge, upstr., downstr., side bridge ______ ft mile, above, below gage, and

Sampling site: Pool Riffle Open Channel Braided Backwater Sampler Type hydrolab

Sample Method: EWI EDI OTHER R M L Sampler ID ______

Nozzle size ______ Nozzle Made of ______ Bottle type, size ______

Sample Split: Churn Cone Other ______ Made of ______

LB ______ RB ______ Stream Width ______ Sampling Pts. ______

Bottom: Bedrock Rock Cobble Gravel Sand Mud Concrete Other ______

Stage Conditions:
A Not Determined
4 Stable, low
9 Stable, normal
5 Falling
6 Stable, high
7 Peak
8 Rising

Hydrologic Event: 9 Routine samp. A Spg. breakup B Ice Cover
1 Drought 2 Spill 3 Reg. Flow 4 Snowmelt 7 Flood
Other ______ Ice Thickness ______ Ice cover ______

Stream color(s) brown green blue gray other ______

Stream Mixing: Excellent Good Fair Poor Clarity/Turbidity: Clear

Weather: Clear Partly Cloudy Cloudy Light Medium Heavy Snow Rain
Calm Light Breeze Very Gusty Windy Very Cold Warm Hot Other

Observations:
(Codes: 0-none 1-mild 2-moderate 3-serious 4-extreme)
(option: LEAVE BLANK IF NONE)

Floating debris	(01345) :	
Floating garbage	(01320) :	
Floating algae mats	(01325) :	
Fish kill	(01340) :	
Detergent suds	(01305) :	
Turbidity	(01350) :	
Atms. Odor	(01330) :	
Oil-grease	(01300) :	

Other Observations

	T°C	pH	Cond	DO	% DO
R	22.9	6.5	23	6.4	77
M	22.9	6.6	23	6.6	80
L	22.9	6.6	22	6.4	74
ave	22.9	6.6	23	6.4	77

Sampling		GHT
Start Time	______	______
	______	______
Mean Time =	______	______
	______	______
End Time	______	______

(Cont. p. 3,4)

Checked by ______ Date ______

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HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME Indiantown Run ab Unn Trib @	LOCATION ~~McLean Rd~~ Ft Indiantown Gap PA
STATION # ir-0.6 RIVERMILE ______	STREAM CLASS 01572924
LAT ~~[illegible]~~ LONG ~~[illegible]~~	RIVER BASIN
STORET # 402656 763739	AGENCY USGS
INVESTIGATORS Bilger, Brightbill	
FORM COMPLETED BY RAB	DATE 7/30/02 TIME 1243 AM PM — REASON FOR SURVEY FIG Eco assessment

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE 7	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
SCORE 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category: Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cem[illegible] over 80% of the [illegible]ach channelized [illegible] disrupted. I[illegible] habitat greatly altered removed entirely.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE 19	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 2 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank s[illegible] covered by v[illegible] disruption of [illegible] vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 6 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 10 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 10 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score 119

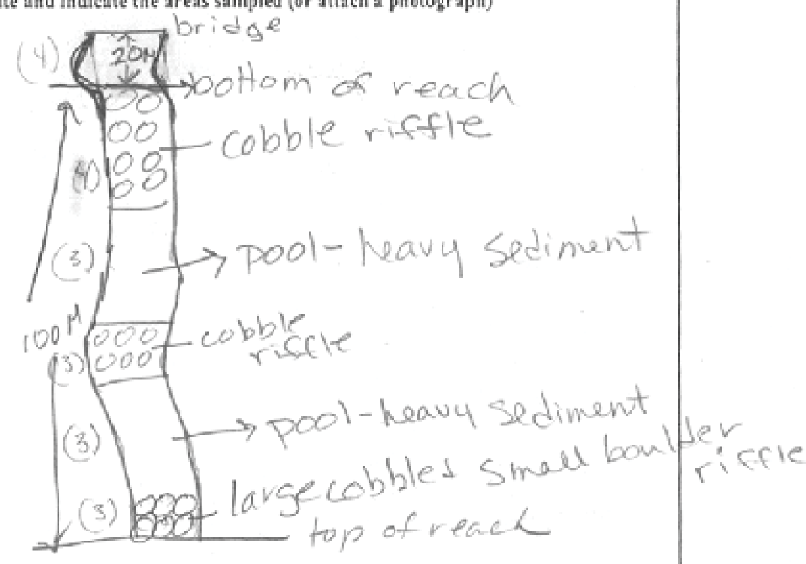
PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME ~~Indiantown Run~~ Unn Trib	LOCATION above ~~Hebron Road~~ on Fort Indiantown Gap PA
STATION # ir-D.5 RIVERMILE_______	STREAM CLASS 01572924
LAT ~~76.3744~~ LONG ~~40.2650~~	RIVER BASIN
STORET # 402656 763739	AGENCY USGS
INVESTIGATORS Bilger, Brightbill	
FORM COMPLETED BY RAB	DATE 7/30/02 TIME 1230 AM PM
	REASON FOR SURVEY FIG Eco assessment

WEATHER CONDITIONS	Now		Past 24 hours	
H/H/H	☐	storm (heavy rain)	☐	Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No spotty
	☐	rain (steady rain)	☐	Air Temperature 31 °C
	☐	showers (intermittent)	☐	Other_______
	___%☐	%cloud cover	☑ 60%	
	☑	clear/sunny	☐	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



both banks show undercutting - 70% vegetated banks

STREAM CHARACTERIZATION

Stream Subsystem
☑ Perennial ☐ Intermittent ☐ Tidal

Stream Type
☑ Coldwater ☐ Warmwater

Stream Origin
☐ Glacial
☐ Non-glacial montane
☐ Swamp and bog
☑ Spring-fed
☐ Mixture of origins
☐ Other_________

Catchment Area_________km²

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☑ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other ______ ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☑ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☐ None ☑ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous **dominant species present** elm, maple, hemlock
INSTREAM FEATURES	**Estimated Reach Length** 100 m **Estimated Stream Width** 5 m **Sampling Reach Area** 500 m² **Area in km² (m²x1000)** 0.5 km² **Estimated Stream Depth** 0.3 m **Surface Velocity (at thalweg)** NA m/sec **Canopy Cover** ☐ Partly open ☐ Partly shaded ☑ Shaded **High Water Mark** NA m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle 50 % ☐ Run 0 % ☐ Pool 50 % **Channelized** ☐ Yes ☑ No **Dam Present** ☐ Yes ☑ No
LARGE WOODY DEBRIS	**LWD** 0 m² **Density of LWD** 0 m²/km² (LWD/ reach area)
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae **dominant species present** none **Portion of the reach with aquatic vegetation** 0 %
WATER QUALITY See water quality sheet	**Temperature** ____ °C **Specific Conductance** ____ **Dissolved Oxygen** ____ **pH** ____ **Turbidity** ____ **WQ Instrument Used** ____ **Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other ____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☑ None ☐ Other ____ **Turbidity (if not measured)** ☑ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other ____
SEDIMENT/ SUBSTRATE NA	**Odors** ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other ____ **Oils** ☐ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other ____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock		0	Detritus	sticks, wood, coarse plant materials (CPOM)	5
Boulder	> 256 mm (10")	0			
Cobble	64-256 mm (2.5"-10")	64	Muck-Mud	black, very fine organic (FPOM)	2
Gravel	2-64 mm (0.1"-2.5")	25			
Sand	0.06-2mm (gritty)	1	Marl	grey, shell fragments	0
Silt	0.004-0.06 mm	10			
Clay	< 0.004 mm (slick)	0			

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME Indiantown Run	LOCATION ab ~~McLean Rd~~ Unn Trib on Ft Indiantown Gap PA
STATION # ir-0.5 RIVERMILE	STREAM CLASS
LAT ~~403744~~ LONG ~~402650~~	RIVER BASIN 01572924
STORET # 402656 763739	AGENCY USGS
INVESTIGATORS Bilger, Brightbill	LOT NUMBER
FORM COMPLETED BY RAB /MDB	DATE 7/30/02 TIME 1332 AM PM
	REASON FOR SURVEY BIG Eco assessment

HABITAT TYPES	Indicate the percentage of each habitat type present ☑ Cobble 50 % ☑ Snags 5 % ☑ Vegetated Banks 70 % ☑ Sand 0 % ☑ Submerged Macrophytes 0 % ☐ Other ( ) ___ %
SAMPLE COLLECTION	Gear used ☑ D-frame ☐ kick-net ☐ Other ______ How were the samples collected? ☑ wading ☐ from bank ☐ from boat Indicate the number of jabs/kicks taken in each habitat type. qual ☐ Cobble 10 ☐ Snags ___ ☐ Vegetated Banks ___ ☐ Sand ___ ☐ Submerged Macrophytes ___ ☑ Other (10) ___
GENERAL COMMENTS	2-quantative kicks 20-qualitative jabs

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0 1 2 3 4	Slimes	0 1 2 3 4
Filamentous Algae	0 1 2 3 4	Macroinvertebrates	0 1 2 3 4
Macrophytes	0 1 2 3 4	Fish	0 1 2 3 4

<one stalk elodea

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0 1 2 3 4	Anisoptera	0 1 2 3 4	Chironomidae	0 1 2 3 4
Hydrozoa	0 1 2 3 4	Zygoptera	0 1 2 3 4	Ephemeroptera	0 1 2 3 4
Platyhelminthes	0 1 2 3 4	Hemiptera	0 1 2 3 4	Trichoptera	0 1 2 3 4
Turbellaria	0 1 2 3 4	Coleoptera	0 1 2 3 4	Other	0 1 2 3 4
Hirudinea	0 1 2 3 4	Lepidoptera	0 1 2 3 4		
Oligochaeta	0 1 2 3 4	Sialidae	0 1 2 3 4		
Isopoda	0 1 2 3 4	Corydalidae	0 1 2 3 4		
Amphipoda	0 1 2 3 4	Tipulidae	0 1 2 3 4		
Decapoda	0 1 2 3 4	Empididae	0 1 2 3 4		
Gastropoda	0 1 2 3 4	Simuliidae	0 1 2 3 4		
Bivalvia	0 1 2 3 4	Tabinidae	0 1 2 3 4		
		Culcidae	0 1 2 3 4		

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition - Form 1 A-25

Appendix 4—Aquatic Invertebrates: Summary of Site-Assessment Results

Aries Run at Fort Indiantown Gap, Pa. (ar-1)

Aries Run at Fort Indiantown Gap was in the cantonment area of the Fort Indiantown Gap facility in a narrow riparian buffer zone. The average stream width was about 2 meters, and the depth was 0.1 meter. Over the 4 years of sampling, this site was very stable; taxa richness ranged from 25 to 30, the EPT values from 6 to 11, and the HBI scores from 3.91 to 4.22. The caddisfly *Chimarra* and elmid beetle *Optioservus* were the dominant taxa. The dominance of these animals was indicative of a slightly impacted water-quality condition.

Aries Run above Qureg Run at Fort Indiantown Gap, Pa. (ar-2)

Aries Run above Qureg Run was in the vicinity of the filtration plant in a narrow riparian buffer zone. The average stream width was about 2 meters, and the depth was 0.1 meter. This site was highly affected by high-water events in 2003 and the placement of a rip-rap structure upstream in 2004. The taxa richness ranged from 20 to 29, the EPT values from 7 to 11, and the HBI scores from 4.10 to 4.35. The dominant taxa were the same as Aries Run at Fort Indiantown Gap (ar-1), *Chimarra* and *Optioservus* (2002-2004), and the beetle *Psephenus* in 2005. The invertebrate community was indicative of a slightly impacted water-quality condition.

Bow Creek at Grantville, Pa. (bcRef-1)

Bow Creek at Grantville was near an interstate highway interchange within a very thin riparian buffer zone containing a few residences. The stream width was about 2 meters, and the depth was 0.1 meter. The dominant bottom material was mostly gravel. The pH value near 7.5, specific conductance of 400 µS/cm, and the occurrence of gammaridean amphipods were evidence of water quality influenced by limestone. The taxa richness ranged from 16 to 28, the EPT values from 4 to 13, and the HBI scores from 4.87 to 5.08. The dominant taxa were the elmid beetles *Optioservus* and *Stenelmis*. The invertebrate community was indicative of a slightly impacted to moderately impacted water-quality condition.

Bear Hole Run at Suedberg, Pa. (bhRef-1)

Bear Hole Run at Suedberg flowed from a heavily forested ridge on state game lands; the stream width was 1.5 meters, and the depth was 0.1 meter. The pH was near 6, and the specific conductance values were about 15 µS/cm. The invertebrate community was indicative of a highly non-impacted condition; taxa richness ranged from 22 to 32, EPT values from 12 to 15, and HBI scores from 2.22 to 3.18. The mayflies *Paraleptophlebia* and *Stenonema*, the stonefly *Leuctra*, and hydropsychid caddisflies dominated. This stream was reflective of a non-impacted condition.

Evening Branch above Gold Mine Run near Tower City, Pa. (ebMRef-1)

Evening Branch above Gold Mine Run was in a heavily forested (mostly coniferous) area near state game lands. The stream width was about 6 meters, and the depth was 0.3 meter. Water quality was representative of a slightly acidic dark water condition; pH was near 6.5, and specific conductance was near 30 µS/cm. The dominant bottom material was boulder, making collection difficult. Taxa richness ranged from 23 to 37, EPT values from 8 to 13, and HBI scores from 3.49 to 4.85. The invertebrate community was mostly chironomids (*Tanytarsus*) in composition, which resulted in a slightly impacted designation. The site may have better water quality than the invertebrate community indicates, because the EPT taxa may have been present but difficult to collect because of the boulders.

Forge Creek near Lickdale, Pa. (fc-1)

Forge Creek near Lickdale is on the boundary of the Fort Indiantown Gap facility and flows off a ridge through mostly forested areas. The water chemistry was representative of the area; pH values were near 6.5 and specific conductance values were near 30 µS/cm. The dominant substrate was sand, and riffle habitat made up less than 10 percent of the sampling reach. The stream width was 1 meter, and depth was 0.1 meter. The invertebrate community metrics and water-quality assessment varied greatly over the 4-year period. In 2002, the severe drought condition may have caused the slightly impacted water-quality condition because flow was reduced and ambient water temperatures were higher. In 2002, the tubificid worms (tolerance value 10) were dominant. In 2003 and 2004, worms were replaced by the stonefly *Leuctra* (tolerance value 0). Perhaps these stoneflies were simply absent in 2002 or may have been in a state of diapause. The fact that the HBI score was 6.21 in 2002, the highest at any site in 4 years, 1.79 in 2004, the lowest in 4 years, and 4.43 in 2005 is not easily explained. The site ranks as slightly impacted.

Gold Mine Run near Tower City, Pa. (GoldMineRunRef-1)

Gold Mine Run near Tower City is in a forested area that is also part of state game lands. The stream width was about 2 meters, and the depth was 0.3 meters. This high gradient stream had pH values around 5 and a low specific conductance of around 30 µS/cm. There was a good riffle-run-pool sequence with a boulder-rubble-cobble substrate. Taxa richness ranged from 22 to 28, EPT values from 10 to 11, and HBI scores from 2.05 to 4.26. Although the stonefly *Leuctra* and blackfly *Simulium* were dominant, the numbers of enchytraeid worms and chironomids raised the biotic index score in 2003. The invertebrate community was indicative of a non-impacted water-quality condition.

Indiantown Run below Hatchery at Fort Indiantown Gap, Pa. (HatImpact)

Indiantown Run below Hatchery was in a low-gradient area, heavily forested, and below the GAP trout hatchery. The water chemistry was indicative of the land use; the stream exhibited a slight tea color, a pH near 6, and low specific conductance. Taxa richness ranged from 24 to 32, EPT values from 4 to 11, and HBI scores from 4.06 to 4.99. In 2002 and 2003, the metrics reflected a slightly impacted condition, but in 2004, the scoring was more representative of a non-impacted condition. It appears that the large percentage of midges in 2002 and 2003 (60 percent) was influential in lowering the scores. However, in 2004, high numbers of *Stenonema* mayflies raised the overall condition ranking. In 2005, the midges increased again in number and were (35 percent) of the taxa richness again raising the HBI score to 4.88. Although no single taxa present, with the exception of the midge *Micropsectra*, pointed to enrichment from the hatchery operations, there was some evidence of that possibility, and the HBI scores were indicative of this slight impact. The invertebrate community was indicative of a non-impacted water-quality condition.

Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa. (ir-0.5)

Indiantown Run above Unnamed Tributary was a low-gradient site in a mostly forested area with some beaver activity. The stream width averaged 5 meters, and depth was 0.5 meter. Taxa richness ranged from 29 to 37, EPT values from 10 to 13, and HBI scores from 4.17 to 4.87. In 2002, large numbers of fingernail clams, *Sphaerium*, were collected, and in 2003 and 2004, large numbers of chironomids increased the HBI scores. In 2005, an increase in the numbers of Heptageniid mayflies and Hydropsychid caddisflies resulted in a lower HBI score. The invertebrate community was just within the non-impacted classification.

Indiantown Run at Fort Indiantown Gap (ir-1)

Indiantown Run at Fort Indiantown Gap was a higher-gradient forested area just downstream of Route 443. The stream width averaged 5 meters, and the depth was 0.3 meter. The taxa richness ranged from 28 to 34, EPT values from 13 to 18, and HBI scores from 2.31 to 3.92. The presence of chironomids and worms in 2003 raised the HBI score, but overall, the invertebrate community was indicative of a non-impacted water-quality condition.

Indiantown Run above Memorial Lake near Indiantown, Pa. (ir-2)

Indiantown Run above Memorial Lake was off Boundary Road in a mostly forested area. The stream width was about 5 meters, and the depth was 0.3 meter. The taxa richness ranged from 22 to 26, EPT values from 7 to 11, and HBI scores from 3.89 to 4.31. Mayflies and hydropsychid caddisflies made up the dominant taxa. The invertebrate community was indicative of a slightly impacted water-quality condition, and the scores rose slowly with time showing more impact over the years.

Indiantown Run above Vesle Run (ir-3)

Indiantown Run above Vesle Run displayed a highly bedrock substrate and was within a moderately wide riparian buffer zone. The stream width was about 3 meters, and the depth was 0.3 meter. Taxa richness ranged from 20 to 28, EPT values from 5 to 9, and HBI scores from 4.35 to 5.40. Hydropsychid caddisflies and elmid beetles were the dominant taxa. The invertebrate community was indicative of a slightly impacted water-quality condition.

Manada Creek along McLean Road near Manada Gap, Pa. (mc-1)

Manada Creek along McLean Road site is within a forested area. The stream width was about 5 meters, and the depth was 0.5 meter. During the 4 years of study, a beaver was active in the area. The taxa richness ranged from 33 to 36, EPT values from 12 to 16, and the HBI scores from 3.64 to 4.96. It appears some of the increase in biotic index score was due to the presence of oligochaetes and chironomids such as *Micropsectra*. Over time, the percentage of chironomids decreased and the numbers of mayflies increased, lowering the HBI score and reflecting better water quality over time. The invertebrate community was indicative of a non-impacted water-quality condition.

Manada Creek near Manada Gap. Pa. (mc-1.5)

Manada Creek near Manada Gap was of a forested land use within a delayed harvest trout area. The stream width was about 10 meters, and the depth was 0.3 meter. The reach included a good mix of riffle-run-pool habitat. The taxa richness ranged from 25 to 36, EPT values from 8 to 12, and HBI scores from 3.10 to 4.13. The dominant taxon was the stonefly *Leuctra* for the first 3 years of collection; the fourth year was dominated by the hydropsychid caddisfly, *Cheumatopsyche*, which raised the HBI score. The invertebrate community was indicative of non-impacted water-quality conditions.

Manada Creek below Manada Gap at Manada Gap, Pa. (mc-2)

Manada Creek below Manada Gap was the widest and deepest stream sampled. The stream width was 15 meters, and the depth was 1 meter. The area was mostly forested, with a few residences in sight; the reach contained a delayed harvest trout designation. The dominant taxon was the hydropsychid caddisflie *Cheumatopsyche* in 2002 and 2004. Taxa richness ranged from 27 to 35, EPT values from 9 to 13, and HBI scores from 3.31 to 4.27. The invertebrate community was indicative of a non-impacted water-quality condition as the EPT numbers increased over time.

Qureg Run at Fort Indiantown Gap, Pa. (qr-1)

Qureg Run at Fort Indiantown Gap was in a narrow riparian buffer zone in the base cantonment area. Stream width was about 2 meters, and the depth was 0.1 meter. Water chemistry yielded pH near 7 and specific conductance around 200 µS/cm. Taxa richness ranged from 19 to 32, EPT values from 2 to 10, and HBI scores ranged from 4.52 to 5.12. The beetles *Stenelmis* (2002 and 2005) and *Optioservus* (2003-2005) and *Psephenus* (2002) were the dominant taxa. Between sampling events in 2003 and 2004, a rip-rap dam was constructed and shoreline vegetation was removed immediately above the reach. The aquatic-invertebrate community in 2002 may have been influenced by drought conditions. The invertebrate community was indicative of a slightly impacted water-quality condition.

Aires Run below Qureg Run at Fort Indiantown Gap, Pa. (qr-2)

Aries Run below Qureg Run was upstream of the confluence with Reeds Run where a mix of trees and shrubs comprised the riparian zone. The stream width was about 3 meters, and the depth was 0.1 meter. The pH was 7.5 and the specific conductance was 250 µS/cm. The taxa richness ranged from 17 to 33, EPT values from 6 to 11, and HBI scores from 4.28 to 4.44. The dominant taxa were the beetles *Psephenus* and *Optioservus* and the blackfly *Simulium* (2003 only). The 2002 sample appeared to be influenced by drought conditions. The invertebrate community was indicative of a slightly impacted water-quality condition.

Stony Creek near Fort Indiantown Gap, Pa. (ScMRef-1)

Stony Creek near Fort Indiantown Gap was a tea-colored stream in a highly forested area. The stream width was around 10 meters, and the depth was 1 meter. The pH was around 6 and specific conductance was near 30 µS/cm. Taxa richness ranged from 22 to 33, EPT values from 9 to 14, and the HBI scores from 2.78 to 4.28. Collection of invertebrates at this site was difficult because of the high number of large boulders. The dominant taxon for the first 3 years was the pollution sensitive elmid beetle *Promoresia*, which is in agreement with the non-impacted water-quality assessment. In 2005, the more tolerant midge, Micropsectra, increased in number and the site started showing the beginnings of some impact.

St. Joseph's Spring outflow at Fort Indiantown Gap, Pa. (sjs-1)

St. Joseph's Spring outflow was in a high-gradient, heavily forested area. Stream width was around 1.5 meters, and the depth was 0.1 meter. Taxa richness ranged from 29 to 37, EPT values from 11 to 17, and HBI scores from 2.71 to 3.87. The dominant taxa were mayflies, stoneflies, and caddisflies. The invertebrate community was indicative of a non-impacted water-quality condition.

Trout Run at Fort Indiantown Gap, Pa. (tr-1)

Trout Run at Fort Indiantown Gap was in a heavily forested, high-gradient area. Stream width was about 1 meter, and the depth was 0.1 meter. The pH was around 6 and the specific conductance was near 30 µS/cm. Taxa richness ranged from 31 to 36, EPT values from 9 to 14, and HBI scores from 2.78 to 4.29. In 2002, there was barely enough water depth to sample because of the lack of riffle areas caused by the drought. The mayfly *Maccaffertium* and the stonefly Leuctra were the dominant taxa. The invertebrate community was indicative of a non-impacted water-quality condition.

Trout Run near Inwood, Pa. (tr-2)

Trout Run near Inwood was in a narrow riparian buffer zone and between several residences. The stream width was about 3 meters, and the depth was 0.2 meter. A good riffle-run-pool sequence was present. Taxa richness ranged from 32 to 36, EPT values from 12 to 16, and HBI scores from 3.06 to 4.03. The dominant taxa were the mayfly *Maccaffertium* and the caddisfly *Dolophilodes*. This stream had a noticeable high-quality invertebrate community and was indicative of a non-impacted water-quality condition.

UNT Indiantown Run at Fort Indiantown Gap, Pa. (utir-1)

Unnamed Tributary to Indiantown Run stream reach was immediately below a wetland in a forested area. Because this was a short tributary, the collection reach was not 100 meters in length. The stream width was about 1 meter, and the depth was 0.1 meter. There was a large sand-silt component to the substrate. Taxa richness ranged from 24 to 41, EPT values from 8 to 16, and HBI scores from 4.31 to 5.34. Large numbers of tubificid and naidid worms in 2003 and 2004 raised the HBI. Although this stream had good percentage of EPT values, the presence of oligochaetes and the silt load resulted in a water-quality condition of slightly impacted.

UNT Manada Creek near Manada Gap, Pa. (utmcm-1)

Unnamed Tributary near Manada Gap was in a mixed forested, low-brush area heavily canopied with shrubs. Stream width was about 1 meter, and the depth was 0.1 meter. The pH was around 6, specific conductance around 20 µS /cm, and water temperatures near 16.5°C. Taxa richness ranged from 22 to 46, EPT values from 9 to 17, and HBI scores from 3.15 to 4.55. The stream was not visible from the access road and exhibited a variety of habitats. The beetle *Promoresia* and mayfly *Maccaffertium* were dominant. This reach also yielded the highest number of taxa richness collected at all 27 sites over 4 years. The HBI for 2002 and 2004 was likely because of the more tolerant chironomid abundance. The invertebrate community was indicative of a non-impacted to slightly impacted water-quality condition.

Unnamed Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa. (utmcm-2)

Unnamed Tributary along Horseshoe Trail was in a nearly impassable forested area with much overhanging vegetation. The stream width was around 1.5 meters, and the depth was 0.2 meter. The substrate was high in silt composition. The taxa richness ranged from 26 to 43, EPT values from 11 to 15, and HBI scores from 2.64 to 4.44. The dominant taxa were the stonefly *Leuctra* and pollution-sensitive caddisfly *Diplectrona* until 2005 when chironomids became the dominant animal showing the beginnings of impact. The invertebrate community was indicative of a non-impacted water-quality condition until 2005 and was then indicative of a slightly impacted condition.

Unnamed Tributary to Manada Creek at Route 443 near Manada Gap, Pa. (utmcm-3)

This unnamed tributary to Manada Creek directly paralleled Route 443 and flowed within a narrow band of thick shrubs and trees. Stream width was around 2 meters, and the depth was 0.3 meter. Taxa richness ranged from 26 to 34, EPT values from 9 to 14, and HBI scores from 3.22 to 5.40. A large number of naidid worms in 2004 raised the biotic index. In 2003, the midge *Rheotanytarsus* was dominant. The water-quality condition varied from a non-impacted to a slightly impacted condition.

Unnamed Tributary to Manada Creek near Sand Beach, Pa. (utmcvRef-1)

This unnamed tributary to Manada Creek near Sand Beach was in a narrow forested riparian buffer zone, below a large diameter culvert pipe and near a housing development. The stream width was around 3 meters, and the depth was 0.3 meter. A pH about 7 was recorded and a specific conductance near 300 µS/cm. Taxa richness ranged from 17 to 24, EPT values from 4 to 9, and HBI scores from 4.56 to 4.95. The dominant taxa were the elmid beetle *Stenelmis* and the caddisfly *Chimarra*. The site was heavily influenced by the suburban land use with part of the reach stabilized by rip-rap and showed definite effects of siltation. The water-quality condition was slightly impacted.

Vesle Run at Indiantown, Pa. (vr-1)

Vesle Run at Indiantown was in a mostly forested area and had a dominant substrate of bedrock. The stream width was around 5 meters, and the depth was 0.3 meter. Average measurements of pH were 7.5 and specific conductance were 250 µS/cm. The taxa richness ranged from 20 to 27, EPT from 6 to 9, and HBI scores from 3.81 to 5.04. The dominant taxa *Psephenus* (beetle) and *Cheumatopsyche* (caddisfly) were reflective of a slightly impacted water-quality condition.

Appendix 5—Fish Sampling Data: Summary of Site-Assessment Results

Station name: Bear Hole Run at Suedberg, Pa.

Station identifier: bhRef-1

Lat/Long: 40°30’43”/76°28’23”

Sampling gear code: backpack electroshocker

Water temperature (°C): 17.41

Conductance (µS/cm @ 25°C): 23.2

Date of collection: 08/18/2004

Station number: 01572124

Number of species at site: 6

Time/Pass (min.): 23+ (shocker unit unplugged before time was noted)

pH (units): 5.45

Discharge (cubic feet per second): 1.54

Investigators: Bilger, Brightbill, Eggleston, Galeone, Schreffler, Embeck, Hammond

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	74	45	81	1	1–3	4	49	30–62
Longnose dace *Rhinichthys cataractae*	2	1	22	11	11–11	1	101	96–106
Creek chub *Semotilus atromaculatus*	1	1	12	12	12	1	101	101
Brook trout *Salvelinus fontinalis*	76	47	1,913	25	1–93	91	121	51–210
Sculpin *Cottus spp.*	9	5	56	6	1–11	3	71	47–88
Bluegill sunfish *Lepomis macrochirus*	1	1	21	21	21	1	109	109
Total	163		2,105					

Anomalies: Brook trout—1 percent with deformed spine

Station name: Evening Branch above Gold Mine Run near Tower City, Pa.
Station identifier: ebMRef-1
Lat/Long: 40°31’30”/76°32’30”
Sampling gear code: backpack electroshocker
Water temperature (°C): 17.71
Conductance (µS/cm @ 25°C): 20.8
Date of collection: 08/18/2004
Station number: 01572112
Number of species at site: 4
Time/Pass (min.): 36
pH (units): 5.57
Discharge (cubic feet per second): 2.06
Investigators: Bilger, Brightbill, Eggleston, Galeone, Schreffler, Embeck, Hammond

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Chain pickerel *Esox niger*	1	4	49	49	49	5	193	193
Brook trout *Salvelinus fontinalis*	10	45	775	78	22–257	81	179	129–285
Green sunfish *Lepomis cyanellus*	2	9	107	54	47–60	11	138	134–142
Tessellated darter *Etheostoma olmstedi*	9	41	29	3	2–4	3	65	52–73
Total	22		960					

Anomalies: none

Station name: Gold Mine Run near Tower City, Pa.
Station identifier: GoldMineRunRef-1
Lat/Long: 40°31’33”/76°32’41”
Sampling gear code: backpack electroshocker
Water temperature (°C): 15.73
Conductance (µS/cm @ 25°C): 26.9
Date of collection: 08/18/2004
Station number: 01572113
Number of species at site: 1
Time/Pass (min.): 24
pH (units): 5.30
Discharge (cubic feet per second): 1.22
Investigators: Bilger, Brightbill, Eggleston, Galeone, Schreffler, Embeck, Hammond

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Brook trout *Salvelinus fontinalis*	29	100	632	22	90	100	113	60–198
Totals	29		632					

Anomalies: none

Station name: Manada Creek below Manada Gap at Manada Gap, Pa.
Date of collection: 08/25/2004
Station identifier: mc-2
Station number: 01573501
Lat/Long: 40°23'32"/76°42'38"
Number of species at site: 13
Sampling gear code: backpack electroshocker
Time/Pass (min.): 36
Water temperature (°C): 17.00
pH (units): 5.92
Conductance (µS/cm @ 25°C): 45.4
Discharge (cubic feet per second): 13.14
Investigators: Bilger, Brightbill, Eggleston, O'Brien, Schreffler, Schott, Botts

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Cutlips minnow *Exoglossum maxillingua*	7	5	73	10	1–21	5	85	61–116
River chub *Nocomis micropogon*	2	1	77	38	6–71	5	130	85–176
Spottail shiner *Notropis hudsonius*	4	3	7	2	1–4	1	56	44–78
Blacknose dace *Rhinichthys atratulus*	64	45	123	2	1–4	8	53	40–65
Longnose dace *Rhinichthys cataractae*	12	9	105	8	1–17	7	82	30–107
Creek chub *Semotilus atromaculatus*	26	18	152	6	1–29	9	69	30–134
White sucker *Catostomus commersoni*	9	6	347	38	1–113	22	118	40–216
Northern hog sucker *Hypentelium nigricans*	4	3	97	24	8–63	6	115	85–177
Margined madtom *Noturus insignis*	2	1	32	16	16	2	112	110–113
Rainbow trout *Oncorhynchus mykiss*	2	1	441	220	211–230	27	292	180–303
Brown trout *Salmo trutta*	6	4	105	17.5	8–57	7	106	86–186
Rock bass *Ambloplites rupestris*	1	1	46	46	46	3	120	120
Tessellated darter *Etheostoma olmstedi*	2	1	4	2	2	1	46	45–47
Totals	141		1,609					

Anomalies: none

Station name: Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.

Date of collection: 08/25/2004

Station identifier: HatImpact

Station number: 01572944

Lat/Long: 40°26'40"/76°36'48"

Number of species at site: 6

Sampling gear code: backpack electroshocker

Time/Pass (min.): 42

Water temperature (°C): 18.21

pH (units): 6.44

Conductance (µS/cm @ 25°C): 32

Discharge (cubic feet per second): 5.09

Investigators: Bilger, Brightbill, Eggleston, Low, O'Brien, Schott, Hepp

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	134	65	231	2	1–4	10	51	31–63
Creek chub *Semotilus atromaculatus*	31	15	214	7	1–43	10	71	32–150
White sucker *Catostomus commersoni*	9	4	394	44	1–103	15	130	40–201
Brown trout *Salmo trutta*	23	11	1,273	55	2–236	54	147	55–281
Brook trout *Salvelinus fontinalis*	1	1	213	213	213	9	282	282
Tessellated darter *Etheostoma olmstedi*	7	3	16	2	1–3	1	57	47–65
Totals	205		2,341					

Anomalies: none

Station name: Indiantown Run above Memorial Lake near Indiantown, Pa.

Date of collection: 08/25/2004

Station identifier: ir-2

Station number: 01572956

Lat/Long: 40°25’32”/76°36’01”

Number of species at site: 8

Sampling gear code: backpack electroshocker

Time/Pass (min.): 30

Water temperature (°C): 21.64

pH (units): 6.55

Conductance (µS/cm @ 25°C): 57.5

Discharge (cubic feet per second): 7.67

Investigators: Bilger, Brightbill, Eggleston, Low, O’Brien, Schott, Hepp

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Spotfin shiner *Cyprinella spiloptera*	5	3	23	5	2–7	3	75	60–95
River chub Nocomis micropogon	21	14	235	11	1–51	27	87	45–164
Blacknose dace *Rhinichthys atratulus*	49	33	90	2	1–2	10	49	35–60
Longnose dace *Rhinichthys cataractae*	19	13	114	6	1–11	13	75	45–91
Yellow bullhead *Ameiurus natalis*	2	1	8	4	1–7	1	60	41–78
Margined madtom *Noturus insignis*	6	4	54	9	5–11	6	98	84–107
Green sunfish *Lepomis cyanellus*	39	26	332	9	1–27	38	62	40–117
Tessellated darter *Etheostoma olmstedi*	7	5	9	1	1–2	1	44	31–51
Total	148		865					

Anomalies: none

Station name: Manada Gap near Manada Gap, Pa.
Date of collection: 08/23/2004
Station identifier: mc-1.5
Station number: 01573482
Lat/Long: 40°24’24”/76°42’34”
Number of species at site: 10
Sampling gear code: backpack electroshocker
Time/Pass (min.): 72
Water temperature (°C): 14.85
pH (units): 7.35
Conductance (µS/cm @ 25°C): 33.2
Discharge (cubic feet per second): 11.23
Investigators: Bilger, Brightbill, Eggleston, Schreffler, O’Brien, Botts, Hepp

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Cutlips minnow *Exoglossum maxillingua*	3	2	11	4	3–4	1	66	62–70
Blacknose dace *Rhinichthys atratulus*	99	59	183	2	1–3	15	52	36–62
Longnose dace *Rhinichthys cataractae*	9	5	95	11	4–16	8	92	71–111
Creek chub *Semotilus atromaculatus*	29	17	146	5	1–15	12	70	33–102
White sucker *Catostomus commersoni*	3	2	127	42	18–78	10	149	114–197
Northern hog sucker *Hypentelium nigricans*	1	1	25	25	25	2	127	127
Brown trout *Salmo trutta*	19	11	573	30	2–217	47	104	51–279
Brook trout *Salvelinus fontinalis*	1	1	53	53	53	4	175	175
Bluegill *Lepomis macrochirus*	1	1	3	3	3	1	51	51
Tessellated darter *Etheostoma olmstedi*	2	1	3	2	1–2	1	50	49–50
Total	167		1,219					

Anomalies: none

Station name: Manada Creek above McLean Road near Manada Gap, Pa.
Date of collection: 08/23/2004
Station identifier: mc-1
Station number: 01573472
Lat/Long: 40°25'06"/76°41'36"
Number of species at site: 9
Sampling gear code: backpack electroshocker
Time/Pass (min.): 42
Water temperature (°C): 16.74
pH (units): 6.57
Conductance (µS/cm @ 25°C): 30.2
Discharge (cubic feet per second): 7.35
Investigators: Bilger, Brightbill, Eggleston, Schreffler, O'Brien, Botts, Hepp

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Cutlips minnow *Exoglossum maxillingua*	4	2	37	9	4–22	1	83	68–119
Spottail shiner *Notropis hudsonius*	3	1	11	4	3–4	1	70	70–71
Blacknose dace *Rhinichthys atratulus*	82	39	155	2	1–4	6	50	26–67
Creek chub *Semotilus atromaculatus*	75	36	588	8	1–327	21	74	26–190
White sucker *Catostomus commersoni*	16	8	1,041	65	5–177	37	158	77–257
Brown trout *Salmo trutta*	14	7	527	38	3–121	19	139	68–235
Brook trout *Salvelinus fontinalis*	2	1	243	122	23–220	9	206	132–280
Smallmouth bass *Micropterus dolomieu*	1	1	153	153	153	5	228	228
Tessellated darter *Etheostoma olmstedi*	14	7	36	3	1–4	1	53	45–65
Total	211		2,791					

Anomalies: Creek chub—7 percent with blackspot, Smallmouth bass—100 percent with leeches

Station name: Trout Run near Inwood, Pa.
Date of collection: 08/24/2004
Station identifier: tr-2
Station number: 01572150
Lat/Long: 40°28’52”/76°33’13”
Number of species at site: 17
Sampling gear code: backpack electroshocker
Time/Pass (min.): 40
Water temperature (°C): not taken
pH (units): not taken
Conductance (µS/cm @ 25°C): not taken
Discharge (cubic feet per second): 7.06
Investigators: Bilger, Brightbill, Eggleston, Schreffler, O’Brien, Botts, Schott

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Central stoneroller *Campostoma anomalum*	4	3	78	20	18–22	5	113	112–115
Cutlips minnow *Exoglossum maxillingua*	2	1	12	6	6	1	71	70–72
River chub *Nocomis micropogon*	1	1	73	73	73	4	183	183
Blacknose dace *Rhinichthys atratulus*	20	14	39	2	1–4	2	53	33–70
Longnose dace *Rhinichthys cataractae*	7	5	61	9	1–17	4	82	40–111
Creek chub *Semotilus atromaculatus*	24	16	218	9	1–76	13	70	32–195
Fallfish *Semotilus corporalis*	5	3	301	60	4–182	18	152	76–218
White sucker *Catostomus commersoni*	3	2	128	43	3–69	7	168	141–187
Northern hog sucker *Hypentelium nigricans*	1	1	11	11	11	1	95	95
Brown bullhead *Ameiurus nebulosus*	2	1	12	6	6	1	72	69–74
Margined madtom *Noturus insignis*	3	2	44	15	8–24	3	114	92–135
Brook trout *Salvelinus fontinalis*	2	1	233	116	49–184	14	216	166–265
Sculpin *Cottus spp.*	66	45	301	5	1–10	18	68	45–89
Pumpkinseed *Lepomis gibbosus*	1	1	11	11	11	1	87	87
Smallmouth bass *Micropterus dolomieu*	2	1	176	88	56–120	10	182	160–205
Tessellated darter *Etheostoma olmstedi*	2	1	3	2	1–2	1	46	34–59
Shield darter *Percina peltata*	2	1	9	4	4–5	1	73	70–76
Total	147		1,710					

Anomalies: Blacknose dace—5 percent with blackspot.

Station name: Stony Creek near Fort Indiantown Gap, Pa.
Date of collection: 08/24/2004
Station identifier: ScMRef-1
Station number: 01568693
Lat/Long: 40°28'34"/76°37'51"
Number of species at site: 6
Sampling gear code: backpack electroshocker
Time/Pass (min.): 30
Water temperature (°C): 14.64
pH (units): 6.94
Conductance (µS/cm @ 25°C): 32.9
Discharge (cubic feet per second): 7.40
Investigators: Bilger, Brightbill, Eggleston, Schreffler, O'Brien, Botts, Schott

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	2	7	6	3	3	1	68	66–71
Creek chub *Semotilus atromaculatus*	1	4	1	1	1	1	27	27
White sucker *Catostomus commersoni*	5	18	792	158	4–350	22	214	68–313
Chain pickerel *Esox niger*	1	4	60	60	60	2	212	212
Brown trout *Salmo trutta*	13	46	2,193	169	113–239	62	252	223–285
Brook trout *Salvelinus fontinalis*	6	21	470	78	32–206	13	176	130–270
Total	28		3,522					

Anomalies: none.

Station name: Indiantown Run in Gap at Fort Indiantown Gap, Pa.
Date of collection: 08/24/2004
Station identifier: ir-1
Station number: 01572948
Lat/Long: 40°26'40"/76°36'09"
Number of species at site: 5
Sampling gear code: backpack electroshocker
Time/Pass (min.): 30
Water temperature (°C): 17.49
pH (units): 6.76
Conductance (µS/cm @ 25°C): 46.2
Discharge (cubic feet per second): 1.00
Investigators: Bilger, Brightbill, Eggleston, Schreffler, O'Brien, Botts, Schott

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	114	79	216	2	1–4	37	52	22–60
Creek chub *Semotilus atromaculatus*	9	6	41	5	1–8	7	65	30–86
Rainbow trout *Oncorhynchus mykiss*	1	1	19	19	19	3	123	123
Brown trout *Salmo trutta*	20	14	301	15	2–44	52	101	63–164
Tessellated darter *Etheostoma olmstedi*	1	1	2	2	2	1	49	49
Total	145		579					

Anomalies: none.

Station name: Unnamed Tributary to Manada Creek at Route 443 near Manada Gap, Pa.
Date of collection: 09/07/2004
Station identifier: utmcm-3
Station number: 01573496
Lat/Long: 40°24'10"/76°43'45"
Number of species at site: 7
Sampling gear code: backpack electroshocker
Time/Pass (min.): 33
Water temperature (°C): 19.35
pH (units): 7.09
Conductance (µS/cm @ 25°C): 61.1
Discharge (cubic feet per second): 1.16
Investigators: Bilger, Brightbill, Eggleston, Hainly

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Cutlips minnow *Exoglossum maxillingua*	2	6	8	4	4	1	68	66–70
Blacknose dace *Rhinichthys atratulus*	18	53	46	3	1–4	3	58	36–70
Creek chub *Semotilus atromaculatus*	7	21	54	8	1–14	3	86	50–114
White sucker *Catostomus commersoni*	4	12	248	62	1–140	15	157	47–244
Rainbow trout *Oncorhynchus mykiss*	1	3	236	236	236	15	302	302
Brown trout *Salmo trutta*	1	3	1,027	1,027	1,027	63	445	445
Tessellated darter *Etheostoma olmstedi*	1	3	1	1	1	1	48	48
Total	34		1,620					

Anomalies: none.

Station name: Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.
Date of collection: 09/07/2004
Station identifier: ir-0.5
Station number: 01572924
Lat/Long: 40°26'56"/76°37'39"
Number of species at site: 3
Sampling gear code: backpack electroshocker
Time/Pass (min.): 43
Water temperature (°C): 19.89
pH (units): 7.21
Conductance (µS/cm @ 25°C): 31.0
Discharge (cubic feet per second): 1.00
Investigators: Bilger, Brightbill, Eggleston, Hainly

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	60	37	106	2	1–8	25	55	22–93
Creek chub *Semotilus atromaculatus*	78	48	242	3	1–19	56	65	30–123
White sucker *Catostomus commersoni*	25	15	81	3	1–49	19	54	45–164
Total	163		429					

Anomalies: none

Station name: Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.
Date of collection: 09/07/2004
Station identifier: utir-01
Station number: 01572928
Lat/Long: 40°26’54”/76°37’14”
Number of species at site: 5
Sampling gear code: backpack electroshocker
Time/Pass (min.): 28
Water temperature (°C): 17.72
pH (units): 7.37
Conductance (µS/cm @ 25°C): 34.2
Discharge (cubic feet per second): 1.16
Investigators: Bilger, Brightbill, Eggleston, Hainly

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	37	42	45	1	1–2	32	41	25–60
Creek chub *Semotilus atromaculatus*	44	49	83	2	1–6	60	45	25–81
White sucker *Catostomus commersoni*	1	1	1	1	1	1	50	50
Brook trout *Salvelinus fontinalis*	1	1	3	3	3	2	69	69
Tessellated darter *Etheostoma olmstedi*	6	7	7	1	1–2	5	45	35–62
Total	89		139					

Anomalies: none.

Station name: St. Joseph’s Springs Outflow at Fort Indiantown Gap, Pa.
Date of collection: 09/07/2004
Station identifier: sjs-01
Station number: 01572940
Lat/Long: 40°26’40”/76°36’51”
Number of species at site: 2
Sampling gear code: backpack electroshocker
Time/Pass (min.): 30
Water temperature (°C): 16.12
pH (units): 7.70
Conductance (µS/cm @ 25°C): 84.1
Discharge (cubic feet per second): 7.40
Investigators: Bilger, Brightbill, Eggleston, Hainly

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	68	97	129	2	1–4	65	51	22–71
Brown trout *Salmo trutta*	2	3	69	34	22–47	35	148	128–169
Total	70		198					

Anomalies: none

Station name: Aires Run above Qureg Run at Fort Indiantown Gap, Pa.
Date of collection: 09/13/2004
Station identifier: ar-2
Station number: 01572814
Lat/Long: 40°25’55”/76°33’13”
Number of species at site: 8
Sampling gear code: backpack electroshocker
Time/Pass (min.): 48
Water temperature (°C): 17.77
pH (units): 7.00
Conductance (µS/cm @ 25 °C): 252
Discharge (cubic feet per second): 0.61
Investigators: Bilger, Brightbill, Eggleston, Hainly, Schott

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Central stoneroller *Campostoma anomalum*	20	3	36	2	1–4	4	50	39–92
Common shiner *Luxilus cornutus*	1	1	5	5	5	1	79	79
Blacknose dace *Rhinichthys atratulus*	366	50	430	1	1–3	44	47	26–62
Longnose dace *Rhinichthys cataractae*	93	13	149	2	1–7	15	48	30–82
Creek chub *Semotilus atromaculatus*	155	21	225	4	1–20	23	45	30–118
Fallfish *Semotilus corporalis*	1	1	41	41	41	4	170	170
White sucker *Catostomus commersoni*	40	6	50	1	1–3	5	46	35–62
Tessellated darter *Etheostoma olmstedi*	49	7	46	1	1–3	5	35	22–60
Total	725		982					

Anomalies: none

Station name: Aires Run below Qureg Run at Fort Indiantown Gap, Pa. **Date of collection:** 09/13/2004
Station identifier: qr-2 **Station number:** 01572844
Lat/Long: 40°25’32”/76°33’37” **Number of species at site:** 20
Sampling gear code: backpack electroshocker **Time/Pass (min.):** 63
Water temperature (°C): 20.76 **pH (units):** 7.79
Conductance (µS/cm @ 25 °C): 284 **Discharge (cubic feet per second):** 1.14
Investigators: Bilger, Brightbill, Eggleston, Hainly, Schott

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Central stoneroller *Campostoma anomalum*	75	10	207	3	1–6	14	54	44–70
Cutlips minnow *Exoglossum maxillingua*	5	.5	24	5	2–11	2	67	55–93
Common shiner *Luxilus cornutus*	8	1	26	3	2–5	2	69	64–87
Pearl dace *Margariscus margarita*	6	.5	8	1	1–3	.5	45	38–64
River chub *Nocomis micropogon*	2	.5	2	1	1	.5	35	34–36
Spottail shiner *Notropis hudsonius*	9	1	13	1	1–3	1	49	36–68
Swallowtail shiner *Notropis procne*	1	.5	1	1	1	.5	51	51
Bluntnose minnow *Pimephales notatus*	10	1	15	2	1–3	1	51	39–66
Blacknose dace *Rhinichthys atratulus*	256	34	296	1	1–3	20	46	22–69
Longnose dace *Rhinichthys cataractae*	98	13	242	8	1–9	16	51	30–89
Creek chub *Semotilus atromaculatus*	104	14	337	3	1–12	22	53	31–101
Fallfish *Semotilus corporalis*	19	3	57	3	1–29	4	47	30–147
White sucker *Catostomus commersoni*	47	6	69	1	1–3	5	50	40–60
Margined madtom *Noturus insignis*	6	.5	67	11	4–19	4	100	65–126
Green sunfish *Lepomis cyanellus*	1	.5	4	4	4	.5	55	55
Pumpkinseed *Lepomis gibbosus*	1	.5	4	4	4	.5	57	57
Bluegill *Lepomis macrochirus*	1	.5	2	2	2	.5	42	42
Smallmouth bass *Micropterus dolomieu*	1	.5	33	33	33	2	132	132
Largemouth bass *Micropterus salmoides*	1	.5	6	6	6	.5	73	73
Tessellated darter *Etheostoma olmstedi*	100	13	103	1	1–3	7	40	25–60
Total	751		1,516					

Anomalies: none

Station name: Indiantown Run above Vesle Run at Indiantown, Pa.
Date of collection: 09/14/2004
Station identifier: ir-3
Station number: 01572975
Lat/Long: 40°24’56”/75°35’12”
Number of species at site: 17
Sampling gear code: backpack electroshocker
Time/Pass (min.): 52
Water temperature (°C): 22.48
pH (units): 6.98
Conductance (µS/cm @ 25 °C): 96.5
Discharge (cubic feet per second): 3.66
Investigators: Bilger, Brightbill, Eggleston, Hainly, Schott

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Central stoneroller *Campostoma anomalum*	23	12	552	24	5–43	11	119	72–146
Spotfin shiner *Cyprinella spiloptera*	1	.5	4	4	4	.5	70	70
River chub *Nocomis micropogon*	69	36	605	9	1–67	12	78	51–182
Golden shiner *Notemigonus crysoleucas*	1	.5	12	12	12	.5	107	107
Longnose dace *Rhinichthys cataractae*	5	3	44	9	2–16	1	80	55–105
Fallfish *Semotilus corporalis*	11	6	691	63	44–130	14	191	171–240
White sucker *Catostomus commersoni*	8	4	1,172	146	105–191	23	234	210–262
Yellow bullhead *Ameiurus natalis*	14	7	667	48	5–175	13	138	69–222
Margined madtom *Noturus insignis*	14	7	136	10	1–15	3	95	47–117
Rock bass *Ambloplites rupestris*	4	2	229	57	34–88	5	139	118–158
Redbreast sunfish *Lepomis auritus*	14	7	531	38	17–64	11	124	96–148
Green sunfish *Lepomis cyanellus*	2	1	31	16	12–19	1	91	84–98
Pumpkinseed *Lepomis gibbosus*	3	2	42	14	12–16	1	88	83–94
Bluegill *Lepomis macrochirus*	22	11	169	8	1–23	3	68	34–100
Smallmouth bass *Micropterus dolomieu*	1	.5	143	143	143	3	225	225
Largemouth bass *Micropterus salmoides*	1	.5	7	7	7	.5	81	81
Tessellated darter *Etheostoma olmstedi*	1	.5	1	1	1	.5	39	39
Total	194		5,036					

Anomalies: none

Station name: Vesle Run at Indiantown, Pa.
Station identifier: vr-1
Lat/Long: 40°24’56”/76°35’09”
Sampling gear code: backpack electroshocker
Water temperature (°C): 19.33
Conductance (µS/cm @ 25 °C): 313
Investigators: Bilger, Brightbill, Eggleston, Hainly, Schott

Date of collection: 09/14/2004
Station number: 01572986
Number of species at site: 13
Time/Pass (min.): 42
pH (units): 7.88
Discharge (cubic feet per second): 0.68

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Central stoneroller *Campostoma anomalum*	44	17	110	2	1–6	13	56	39–78
River chub *Nocomis micropogon*	2	1	5	2	2–3	.5	54	48–60
Blacknose dace *Rhinichthys atratulus*	47	18	66	1	1–3	8	40	22–59
Longnose dace *Rhinichthys cataractae*	45	17	178	4	1–9	22	65	32–91
Creek chub *Semotilus atromaculatus*	73	28	214	3	1–7	26	57	32–85
White sucker *Catostomus commersoni*	6	2	7	1	1–2	.5	42	36–50
Yellow bullhead *Ameiurus natalis*	1	.5	30	30	30	4	130	130
Margined madtom *Noturus insignis*	11	4	76	7	4–9	9	86	66–96
Rock bass *Ambloplites rupestris*	1	.5	57	57	57	7	157	157
Green sunfish *Lepomis cyanellus*	1	.5	8	8	8	1	77	77
Bluegill *Lepomis macrochirus*	1	.5	1	1	1	.5	40	40
Largemouth bass *Micropterus salmoides*	5	2	47	9	3–15	6	85	60–104
Tessellated darter *Etheostoma olmstedi*	22	8	25	1	1–2	3	40	28–55
Total	259		824					

[1]**Anomalies:** Green sunfish—100 percent with fin erosion.

Station name: Qureg Run at Fort Indiantown Gap, Pa.
Date of collection: 09/14/2004
Station identifier: qr-1
Station number: 01572834
Lat/Long: 40°26’02”/76°32’36”
Number of species at site: 14
Sampling gear code: backpack electroshocker
Time/Pass (min.): 42
Water temperature (°C): 21.40
pH (units): 7.68
Conductance (µS/cm @ 25 °C): 199
Discharge (cubic feet per second): 0.35
Investigators: Bilger, Brightbill, Eggleston, Hainly

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Common shiner *Luxilus cornutus*	2	2	31	15	5–26	2	103	73–133
Bluntnose minnow *Pimephales notatus*	3	4	8	3	1–6	.5	65	45–94
Blacknose dace *Rhinichthys atratulus*	3	4	3	1	1	.5	42	32–49
Longnose dace *Rhinichthys cataractae*	11	13	27	2	1–6	.5	57	40–81
Creek chub *Semotilus atromaculatus*	20	24	241	12	1–38	13	87	35–152
Fallfish *Semotilus corporalis*	6	7	412	69	40–142	23	193	167–250
White sucker *Catostomus commersoni*	3	4	284	95	67–135	16	209	194–235
Yellow bullhead *Ameiurus natalis*	8	10	371	46	6–108	20	134	59–195
Rock bass *Ambloplites rupestris*	2	2	177	88	21–156	10	145	101–189
Redbreast sunfish *Lepomis auritus*	3	4	66	22	13–29	4	101	82–114
Green sunfish *Lepomis cyanellus*	3	4	44	15	12–16	2	87	80–90
Smallmouth bass *Micropterus dolomieu*	3	4	97	32	23–40	5	135	121–145
Largemouth bass *Micropterus salmoides*	8	10	57	7	3–18	3	74	55–100
Tessellated darter *Etheostoma olmstedi*	7	9	8	1	1–2	.5	42	23–58
Total	82		1,826					

Anomalies: none

Station name: Unnamed Tributary to Manada Creek near Manada Gap, Pa.

Date of collection: 09/15/2004

Station identifier: utmcm-1

Station number: 01573480

Lat/Long: 40°24'48"/76°42'16"

Number of species at site: 5

Sampling gear code: backpack electroshocker

Time/Pass (min.): 53

Water temperature (°C): 21.40

pH (units): 7.68

Conductance (µS/cm @ 25 °C): 199

Discharge (cubic feet per second): 1.16

Investigators: Bilger, Brightbill, Eggleston, Hainly

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	116	64	188	2	1–4	27	50	38–66
Creek chub *Semotilus atromaculatus*	23	13	175	8	1–34	25	80	40–150
Brown trout *Salmo trutta*	34	19	267	8	1–98	38	72	47–216
Brook trout *Salvelinus fontinalis*	7	4	67	10	4–22	10	90	64–136
Tessellated darter *Etheostoma olmstedi*	1	1	6	6	6	1	58	58
Total	181		703					

Anomalies: none

Station name: Aires Run at Fort Indiantown Gap, Pa.
Date of collection: 09/15/2004
Station identifier: ar-1
Station number: 01572804
Lat/Long: 40°25’53”/76°33’55”
Number of species at site: 9
Sampling gear code: backpack electroshocker
Time/Pass (min.): 63
Water temperature (°C): 18.88
pH (units): 7.16
Conductance (µS/cm @ 25 °C): 140
Discharge (cubic feet per second): 0.27
Investigators: Bilger, Brightbill, Eggleston, Hainly

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Central stoneroller *Campostoma anomalum*	1	0.5	18	18	18	1	122	122
Common shiner *Luxilus cornutus*	6	3	50	8	4–14	3	92	77–115
Blacknose dace *Rhinichthys atratulus*	43	18	54	1	1–18	3	44	25–62
Longnose dace *Rhinichthys cataractae*	10	4	28	3	1–8	2	60	40–86
Creek chub *Semotilus atromaculatus*	162	69	1,287	8	1–970	80	71	22–188
Fallfish *Semotilus corporalis*	2	1	37	18	12–25	2	129	117–141
White sucker *Catostomus commersoni*	2	1	99	50	22–77	6	160	133–188
Rock bass *Ambloplites rupestris*	1	.5	27	27	27	2	112	112
Tessellated darter *Etheostoma olmstedi*	9	4	11	1	1–3	1	38	30–61
Total	236		1,611					

Anomalies: none

Station name: Trout Run at Fort Indiantown Gap, Pa.
Date of collection: 09/15/2004
Station identifier: tr-1
Station number: 01572145
Lat/Long: 40°27’53”/76°35’54”
Number of species at site: 3
Sampling gear code: backpack electroshocker
Time/Pass (min.): 27
Water temperature (°C): 16.43
pH (units): 6.99
Conductance (µS/cm @ 25 °C): 33.2
Discharge (cubic feet per second): 7.06
Investigators: Bilger, Brightbill, Eggleston, Hainly

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (millimeters)	Range of total lengths (millimeters)
Blacknose dace *Rhinichthys atratulus*	33	70	57	2	1–3	49	51	30–66
Creek chub *Semotilus atromaculatus*	2	4	18	9	3–15	15	88	76–100
Brook trout *Salvelinus fontinalis*	12	26	42	4	2–6	36	68	57–80
Total	47		117					

Anomalies: none

Station name: Bow Creek at Grantville, Pa.
Date of collection: 09/16/2004
Station identifier: bcRef-1
Station number: 01573300
Lat/Long: 40°23’01”/76°39’54”
Number of species at site: 10
Sampling gear code: backpack electroshocker
Time/Pass (min.): 56
Water temperature (°C): 17.72
pH (units): 6.93
Conductance (µS/cm @ 25 °C): 459
Discharge (cubic feet per second): 7.99
Investigators: Bilger, Brightbill, Eggleston, Hainly, Schott

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Cutlips minnow *Exoglossum maxillingua*	2	0.5	13	6	3–10	0.5	72	59–86
Spottail shiner *Notropis hudsonius*	13	4	95	7	6–9	5	89	85–97
Bluntnose minnow *Pimephales notatus*	7	2	20	3	2–5	1	63	57–81
Blacknose dace *Rhinichthys atratulus*	150	47	264	2	1–4	14	50	31–71
Longnose dace *Rhinichthys cataractae*	30	9	80	3	1–9	4	58	37–84
Creek chub *Semotilus atromaculatus*	89	28	863	10	1–45	45	80	40–161
White sucker *Catostomus commersoni*	13	4	513	39	2–137	27	135	58–229
Pumpkinseed *Lepomis gibbosus*	1	.5	11	11	11	.5	76	76
Largemouth bass *Micropterus salmoides*	3	1	16	5	3–10	1	66	52–85
Tessellated darter *Etheostoma olmstedi*	13	4	29	2	1–4	2	55	42–68
Total	321		1,904					

Anomalies: none

Station name: Unnamed Tributary to Manada Creek near Sand Beach, Pa.

Date of collection: 09/15/2004

Station identifier: utmcvRef-1

Station number: 01573535

Lat/Long: 40°20'36"/76°41'02"

Number of species at site: 9

Sampling gear code: backpack electroshocker

Time/Pass (min.): 65

Water temperature (°C): 19.24

pH (units): 7.62

Conductance (µS/cm @ 25 °C): 350

Discharge (cubic feet per second): 4.11

Investigators: Bilger, Brightbill, Eggleston, Hainly, Schott

Species name	Total number per species	Percent of total number	Total weight of species (grams)	Average weight (grams)	Range of weights (grams)	Percent total weight	Average total length (milli-meters)	Range of total lengths (milli-meters)
Cutlips minnow *Exoglossum maxillingua*	14	5	99	7	1–16	7	76	47–101
Bluntnose minnow *Pimephales notatus*	7	3	14	2	1–4	1	54	44–75
Blacknose dace *Rhinichthys atratulus*	111	43	164	1	1–3	12	48	25–62
Longnose dace *Rhinichthys cataractae*	6	2	27	4	1–11	2	69	43–101
Creek chub *Semotilus atromaculatus*	97	37	946	10	1–68	71	84	30–168
White sucker *Catostomus commersoni*	11	4	38	3	1–21	3	53	35–121
Green sunfish *Lepomis cyanellus*	1	1	19	19	19	1	97	97
Largemouth bass *Micropterus salmoides*	2	1	7	3	3–4	1	65	58–72
Tessellated darter *Etheostoma olmstedi*	11	4	16	1	1–3	1	42	25–56
Total	260		1,330					

Anomalies: none

Appendix 6—Final Taxa List

Taxonomy	Tolerance score	Aires Run at Fort Indiantown Gap, Pa.				Aires Run above Qureg Run at Fort Indiantown Gap, Pa.				Bow Creek at Grantville, Pa.			
		7/31/02	8/25/03	8/4/04	8/4/05	8/13/02	8/25/03	8/4/04	8/4/05	8/14/02	8/13/03	7/29/04	8/5/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	—	2	—	1	1	2	4	2	1	—	2	—
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	—	—	—	—	—	—	—
NEMATODA	5	—	—	—	—	—	—	—	—	2	—	—	—
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	—	—	—	—	—	—	—	—
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculidae	5	—	—	2	—	—	1	1	1	3	—	2	—
Eclipidrilus	5	—	—	—	—	—	—	—	1	—	—	—	—
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	—
TUBIFICIDA													
Enchytraeidae	10	—	—	—	—	—	—	—	—	—	—	2	—
Naididae	8	1	2	2	1	—	—	—	—	1	1	—	—
Nais	8	—	—	—	2	—	—	—	1	—	—	—	—
N. behningi	6	—	—	—	—	—	—	—	—	—	—	—	—
Pristina	8	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	—	—	—	—	2
Tubificidae w/ capilliform setae	10	—	—	1	—	—	1	—	—	—	2	3	—
Tubificidae w/o capilliform setae	10	—	—	3	—	—	1	1	—	3	1	16	—
LUMBRICINA	6	—	—	—	—	1	2	1	—	—	—	1	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	—	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	2	—	—	—	—	—	—	—	2	—	—	—
Physidae													
Physa	8	—	1	—	—	—	—	1	—	—	—	—	—
Planorbidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	—	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	—	—	—	—
Pisidiidae	6	—	—	—	—	—	1	—	—	—	—	—	—
Pisidium	6	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Aires Run at Fort Indiantown Gap, Pa.				Aires Run above Qureg Run at Fort Indiantown Gap, Pa.				Bow Creek at Grantville, Pa.			
		7/31/02	8/25/03	8/4/04	8/4/05	8/13/02	8/25/03	8/4/04	8/4/05	8/14/02	8/13/03	7/29/04	8/5/05
Sphaerium	6	—	—	1	—	—	—	—	—	—	—	—	—
CHELICERATA													
ORIBATEI	8	—	—	—	—	—	—	—	—	—	—	—	—
HYDRACHNIDIA	8	—	—	—	—	—	—	—	—	1	—	1	1
Hygrobatidae													
Atractides	8	—	—	—	—	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	1
Sperchonidae													
Sperchon	6	—	—	—	—	—	—	—	—	—	—	—	1
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticola	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	—
Lebertiidae													
Lebertia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	—	—	—	—
Lirceus	8	—	—	—	—	—	—	—	—	—	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	—	—	—	—
Gammaridae													
Gammarus	6	—	—	—	—	—	—	—	—	8	12	9	8
DECAPODA													
Cambaridae	6	1	—	—	—	—	—	—	—	—	—	—	—
Cambarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Orconectes	6	—	—	—	—	—	—	—	—	—	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	—	—	—	—	—	—	—	—	—
Entomobryidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Isotomidae	5	—	—	—	—	—	—	—	—	—	—	1	1
Isotomurus	5	—	—	—	—	—	—	—	—	—	—	—	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebia	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebiodes	6	—	—	—	—	—	—	—	—	—	—	—	—
Paraleptophlebia	1	—	—	—	—	—	—	—	—	—	—	—	—
Ephemeridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Ephemera	2	—	—	—	—	—	—	—	—	—	—	—	—
Litobrancha recurvata	2	—	—	—	—	—	—	—	—	—	—	—	—
Caenidae													

Taxonomy	Tolerance score	Aires Run at Fort Indiantown Gap, Pa.				Aires Run above Qureg Run at Fort Indiantown Gap, Pa.				Bow Creek at Grantville, Pa.			
		7/31/02	8/25/03	8/4/04	8/4/05	8/13/02	8/25/03	8/4/04	8/4/05	8/14/02	8/13/03	7/29/04	8/5/05
Caenis	6	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerellidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Attenella	1	—	—	—	—	—	—	—	—	—	—	—	—
Drunella	0	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	—	—	—	—	—
Eurylophella	2	—	—	—	—	1	—	—	—	—	—	—	—
Serratella	2	—	—	—	—	—	—	—	—	—	—	—	—
Baetidae	5	—	—	—	2	—	—	—	—	—	—	—	—
Acentrella	4	—	—	—	—	—	—	—	—	—	—	—	—
Acerpenna	5	—	—	—	3	—	—	1	1	—	—	1	2
Baetis	6	15	3	7	3	15	10	8	5	8	16	10	6
Baetis flavistriga	4	—	—	—	—	—	—	—	—	—	—	—	—
Plauditus	4	—	—	—	—	—	—	—	—	—	—	—	—
Isonychiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isonychia	2	1	—	1	—	—	—	4	1	—	—	—	—
Heptageniidae	4	—	—	—	2	—	—	—	—	—	—	—	—
Epeorus	0	—	—	—	—	—	—	—	—	—	—	—	—
Leucrocuta	1	17	2	8	6	6	9	6	2	—	—	—	—
Stenacron	7	—	—	—	—	—	—	—	—	—	—	—	—
Maccaffertium	3	—	—	1	2	—	—	—	2	—	—	—	—
Maccaffertium modestum	1	—	—	—	—	—	—	—	—	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	—	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	—	—	—	—	—	—	—	—	—	—	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	—	—	—	—	—	—	—	—
Gomphidae	4	—	—	—	—	—	—	—	—	—	—	—	1
Lanthus	5	3	1	—	—	—	4	—	—	—	1	—	—
Stylogomphus	1	—	—	—	—	—	—	1	—	—	—	—	—
Libellulidae	2	—	—	—	—	—	—	—	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Calopteryx	6	—	—	—	—	—	—	—	—	—	—	—	—
Hetaerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Coenagrionidae	8	—	—	—	—	—	—	—	—	—	—	—	—
Argia	6	—	—	—	—	—	—	—	—	—	—	—	—
HEMIPTERA	6	—	—	—	—	—	—	—	—	—	—	—	—
Veliidae													
Microvelia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	—	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	—	—	—	—	—
Capniidae	3	—	—	—	—	—	—	—	—	—	—	—	—
Paracapnia	1	—	—	—	—	—	—	—	—	—	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	—	—	—	—	—
Leuctra	0	—	1	—	—	—	—	—	—	—	—	—	—
Nemouridae	2	—	—	—	—	—	—	—	—	—	—	—	—
Amphinemura	3	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Aires Run at Fort Indiantown Gap, Pa.				Aires Run above Qureg Run at Fort Indiantown Gap, Pa.				Bow Creek at Grantville, Pa.			
		7/31/02	8/25/03	8/4/04	8/4/05	8/13/02	8/25/03	8/4/04	8/4/05	8/14/02	8/13/03	7/29/04	8/5/05
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Chloroperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Alloperla	0	—	—	—	—	—	—	—	—	—	—	—	—
Sweltsa	0	—	—	—	—	—	—	—	—	—	—	—	—
Peltoperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Tallaperla	0	—	—	—	—	—	—	—	—	—	—	—	—
Perlidae	3	—	—	—	4	—	—	—	4	—	—	—	2
Acroneuria	0	4	3	10	—	3	3	4	—	1	—	—	—
A. carolinensis	0	—	—	—	—	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	—	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	—	—	—	—	1
Neoperla	3	—	—	—	—	—	—	—	—	—	—	—	—
Perlesta	4	—	—	—	—	—	—	1	—	—	—	—	—
Perlodidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isoperla	2	—	—	—	—	—	—	—	—	—	—	—	—
Pteronarcyidae													
Pteronarcys	0	—	—	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	—	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenus	4	17	8	4	12	8	19	14	27	2	5	6	5
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	—
Elmidae	5	—	—	—	—	—	—	—	—	—	—	—	3
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	—
Dubiraphia	6	—	—	—	—	—	—	—	—	—	—	—	1
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	3
Macronychus	5	—	—	—	—	—	—	—	—	—	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	—	—	—	—	—
Optioservus	4	25	10	26	25	21	27	38	24	35	29	42	8
Oulimnius	4	1	1	—	—	—	—	1	—	—	—	—	—
Promoresia	2	—	—	—	—	—	—	—	—	1	—	—	—
Stenelmis	5	11	6	12	9	5	25	19	10	25	20	45	16
Ptilodactylidae													
Anchytarsus	5	—	—	—	1	—	—	—	—	—	—	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	—	—	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Corydalidae													
Corydalus	4	—	—	—	—	—	—	—	—	—	—	—	—
Nigronia	4	—	—	—	—	—	—	—	—	—	—	—	—
Sialidae													
Sialis	4	2	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Aires Run at Fort Indiantown Gap, Pa.				Aires Run above Qureg Run at Fort Indiantown Gap, Pa.				Bow Creek at Grantville, Pa.			
		7/31/02	8/25/03	8/4/04	8/4/05	8/13/02	8/25/03	8/4/04	8/4/05	8/14/02	8/13/03	7/29/04	8/5/05
TRICHOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	—	—	—	—	—	—	—	—	—	—	—	—
Hydroptilidae	6	—	—	—	—	—	—	—	—	—	—	—	1
Hydroptila	6	—	—	—	—	—	—	—	—	—	—	—	—
Leucotrichia	6	—	—	—	—	—	—	—	1	—	—	—	—
Ochrotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Glossosoma	0	—	—	—	2	—	—	3	1	—	—	2	2
Philopotamidae	4	—	—	—	—	—	—	—	—	—	—	—	1
Chimarra	4	13	16	26	34	22	7	7	—	4	2	6	23
C. aterrima	4	—	—	—	—	—	—	—	8	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	—
Dolophilodes	4	—	5	4	—	—	—	—	—	—	—	—	1
Wormaldia	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Lype	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	1	—
Dipseudopsidae													
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropodidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	1
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropus	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	—	—	—	—	—	—	—	—	—	—	4
Cheumatopsyche	5	8	11	12	3	10	4	3	2	11	23	12	2
Diplectrona	5	—	3	3	—	—	—	—	—	—	—	—	—
Hydropsyche	4	—	3	14	3	2	2	5	1	1	3	7	6
Hydropsyche morosa gr.	6	—	—	—	—	—	—	1	—	—	—	—	—
Phryganeidae													
Oligostomis	2	—	—	—	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	—	—	—	—	—	—	—	—	—	—
Lepidostomatidae													
Lepidostoma	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	—	—	—	—	—	—	—
Pycnopsyche	4	—	—	1	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	—	—	—	—	1	—	—	—	—	1	—
Goeridae	3	—	—	—	—	—	—	—	—	—	—	—	—
Goera	3	—	—	—	—	—	—	—	—	—	—	—	—
Leptoceridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Oecetis	5	—	—	—	—	—	—	—	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	—	—	—	—	—	—	—	—
Calamoceratidae													
Heteroplectron	3	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Aires Run at Fort Indiantown Gap, Pa.				Aires Run above Qureg Run at Fort Indiantown Gap, Pa.				Bow Creek at Grantville, Pa.			
		7/31/02	8/25/03	8/4/04	8/4/05	8/13/02	8/25/03	8/4/04	8/4/05	8/14/02	8/13/03	7/29/04	8/5/05
Odontoceridae													
Psilotreta	0	—	—	—	—	—	—	—	—	—	—	—	—
LEPIDOPTERA	5	—	—	—	—	—	—	—	—	—	—	—	—
Tortricidae													
Archips	5	—	—	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	—	—	—	—	—
Ceratopogonidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	—	1	—	—	—	—
Probezzia	6	—	—	—	—	—	—	—	—	—	—	—	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	—	—	—	—	—
Chironomidae													
Tanypodinae	7	—	—	—	—	—	—	—	—	—	—	—	1
Macropelopiini	6	—	—	—	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopia	6	—	—	—	—	—	—	—	—	—	—	—	—
Natarsiini													
Natarsia	8	—	—	—	—	—	—	—	—	—	—	—	—
Pentaneurini													
Ablabesmyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	—	—	—	—	—	—	2	—	—	—	6
Nilotanypus	6	—	—	—	—	—	—	—	—	—	—	—	—
Paramerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	—	—	—	—	—	—	—	—	—
Thienemannimyia gr.	6	3	—	—	—	1	—	—	—	5	—	1	—
Zavrelimyia	8	1	—	—	—	—	—	—	—	—	—	—	—
Diamesini													
Diamesa	5	—	4	4	—	—	1	—	—	—	—	—	—
Pagastia	1	—	—	—	1	—	—	—	1	—	—	—	—
Potthastia longimana	2	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiinae	5	—	—	—	—	—	—	—	—	—	—	—	—
Corynoneurini													
Corynoneura	4	—	—	—	—	—	—	—	—	—	—	—	2
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	2
Orthocladiini	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia flaviforms	5	—	—	—	—	—	—	—	—	—	—	—	3
Cricotopus	7	—	—	—	1	—	—	—	—	—	—	—	—
Cricotopus/Orthocladius	7	—	—	—	—	—	1	—	—	—	—	—	—
Cricotopus bicinctus	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	—	—	—	—	—	—
Diplocladius	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	—	—	—	—	1	—	—	—	—	—	—
Eukiefferiella brehmi gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella pseudomontana gr.	8	—	—	—	—	—	—	—	—	—	—	—	—
Heleniella	3	—	—	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Aires Run at Fort Indiantown Gap, Pa.				Aires Run above Qureg Run at Fort Indiantown Gap, Pa.				Bow Creek at Grantville, Pa.			
		7/31/02	8/25/03	8/4/04	8/4/05	8/13/02	8/25/03	8/4/04	8/4/05	8/14/02	8/13/03	7/29/04	8/5/05
Krenosmittia	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnophyes	8	—	—	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladius lignicola	6	—	—	—	—	—	—	—	—	—	—	—	—
Parachaetocladius	2	—	—	—	—	—	—	—	—	—	—	—	—
Paracricotopus	4	1	—	—	—	—	—	—	—	—	—	—	—
Parametriocnemus	5	1	1	1	1	—	—	—	—	1	—	—	4
Rheocricotopus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	—	—	—	—	—	—	—
Tvetenia bavarica gr.	4	2	1	1	1	1	1	—	—	—	—	—	2
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	—	—
Chironominae	5	—	—	—	3	—	—	—	—	—	—	—	4
Chironomini													
Chironomus	10	—	—	—	—	—	—	—	—	—	—	—	—
Cryptochironomus	8	—	—	—	—	—	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	—	—	—	—
Microtendipes pedellus gr.	6	—	—	—	—	—	—	—	—	—	1	1	—
Microtendipes rydalensis gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Paralauterborniella	8	—	—	—	—	—	—	—	—	—	—	—	—
Paratendipes albimanus	6	—	—	—	—	—	—	—	—	—	—	—	—
Phaenopsectra	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum	6	1	2	—	—	1	—	—	—	—	—	—	—
Polypedilum aviceps	4	—	—	2	4	—	—	—	12	—	1	2	11
Polypedilum fallax	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum flavum	6	—	—	—	—	—	—	—	—	—	3	—	—
Polypedilum illinoense	7	—	1	1	—	—	—	—	—	—	—	—	—
Polypedilum laetum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	—	—	—	—	—	—	2	—
Polypedilum tritum	6	—	—	—	—	—	—	1	—	—	—	—	—
Stenochironomus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	—	—	—	—	—	—	—	—	—	—	—	—
Tribelos	7	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	—	—	—
Cladotanytarsus	5	—	—	—	—	—	—	—	1	—	—	—	—
Micropsectra	7	—	—	—	1	1	—	—	—	—	—	—	—
Micropsectra sp. A	7	—	—	—	—	—	—	—	—	—	—	—	—
Paratanytarsus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheotanytarsus	6	4	—	—	6	3	—	—	9	1	—	—	—
Rheotanytarsus exiguus gr.	6	1	2	2	—	1	1	1	—	—	—	—	—
Rheotanytarsus pellucidus	4	—	—	—	—	—	1	—	—	—	—	—	—
Stempellina	2	—	—	—	—	—	—	—	—	—	—	—	—
Stempellina sp. C	4	—	—	—	—	—	—	—	—	—	—	—	—
Stempellinella	4	—	—	—	2	—	5	2	1	1	—	2	2
Sublettea coffmani	4	—	—	—	—	—	—	3	1	—	—	—	—
Tanytarsus	6	—	—	—	5	1	1	1	5	—	—	4	4
Zavrelia	4	—	—	—	—	—	—	—	—	—	—	—	—
Dixidae													
Dixa	1	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Aires Run at Fort Indiantown Gap, Pa.				Aires Run above Qureg Run at Fort Indiantown Gap, Pa.				Bow Creek at Grantville, Pa.			
		7/31/02	8/25/03	8/4/04	8/4/05	8/13/02	8/25/03	8/4/04	8/4/05	8/14/02	8/13/03	7/29/04	8/5/05
Simuliidae													
Simulium	5	—	14	—	—	—	—	—	—	—	1	—	—
Tipulidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Tipula	6	1	—	—	—	—	—	—	—	2	—	1	—
Antocha	3	—	—	—	1	—	3	1	—	—	—	—	1
Dicranota	3	—	—	3	—	—	—	1	—	—	—	—	—
Hexatoma	2	2	—	—	—	—	—	—	—	—	—	—	—
Limnophila	3	—	—	—	—	—	—	—	—	—	—	—	—
Limonia	6	—	—	—	—	—	—	—	—	—	—	—	—
Molophilus	4	—	—	—	—	—	—	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	—	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	—	—	—	—
Empididae	6	—	—	—	—	1	—	—	—	—	—	—	—
Chelifera	6	—	—	—	—	—	1	—	—	—	—	—	—
Clinocera	6	—	—	—	—	—	—	—	—	—	—	—	—
Hemerodromia	6	—	—	—	1	—	3	2	—	—	—	—	—
Stratiomyidae	7	—	—	—	—	—	—	—	—	—	—	—	—
Tabanidae													
Chrysops	5	—	1	—	—	—	—	—	—	—	—	1	—
Ephydridae	6	—	—	—	—	—	—	—	2	—	—	—	—
Psychodidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Total taxa		25	25	26	30	20	28	29	28	22	16	28	38
Total number		138	104	152	142	105	138	136	129	119	121	184	145
Percent dominant taxa (single)		18	15	17	29	21	20	28	28	29	24	24	22
Total EPT Taxa		6	9	11	11	7	7	11	11	5	4	8	13
Total EPT		58	47	87	64	59	36	43	28	25	44	40	52
Percent EPT		42.03	45.19	57.24	45.07	56.19	26.09	31.62	21.71	21.01	36.36	21.74	35.86
HBI		4.1	4.11	3.91	4.22	4.34	4.35	4.1	4.33	4.96	5.08	4.87	4.79
Number Chironomidae taxa		8	6	6	10	7	8	5	8	4	3	6	11
Percent Chironomidae		10.14	10.58	7.24	17.61	8.57	8.70	5.88	24.81	6.72	4.13	6.52	28.28

Taxonomy	Tolerance score	Bear Hole Run at Suedberg, Pa.				Evening Branch above Gold Mine Run near Tower City, Pa.				Forge Creek near Lickdale, Pa.			
		8/27/02	8/26/03	8/9/04	8/10/05	8/27/02	8/14/03	8/9/04	8/10/05	8/15/02	8/20/03	8/3/04	8/15/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	—	—	1	—	—	—	—	—	—	2	2	—
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	—	—	—	—	—	—	—
NEMATODA	5	—	—	—	—	—	—	—	—	—	—	—	—
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	1	—	—	—	—	—	—	—
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculidae	5	—	—	—	—	—	1	3	—	—	—	—	—
Eclipidrilus	5	—	—	—	—	—	—	—	2	—	—	—	—
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	—
TUBIFICIDA													
Enchytraeidae	10	—	—	—	—	—	2	—	1	—	—	—	—
Naididae	8	—	3	—	—	—	2	9	—	—	5	—	1
Nais	8	—	—	—	—	—	—	—	1	—	—	—	—
N. behningi	6	—	—	—	—	—	—	—	—	—	—	—	—
Pristina	8	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae w/ capilliform setae	10	—	—	—	—	—	1	—	—	13	5	1	—
Tubificidae w/o capilliform setae	10	—	—	—	—	—	—	—	—	—	—	—	—
LUMBRICINA	6	—	—	—	—	—	3	—	—	—	—	—	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	—	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	—	—	—	—	—	—	—	—	—	—	—	—
Physidae													
Physa	8	—	—	—	—	—	—	—	—	—	—	—	—
Planorbidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	1	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	—	—	—	—
Pisidiidae	6	—	1	2	—	—	2	4	1	—	1	—	—
Pisidium	6	—	—	—	—	1	—	—	—	—	—	—	—
Sphaerium	6	—	—	—	—	—	—	—	—	1	—	4	—
CHELICERATA													
ORIBATEI	8	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Bear Hole Run at Suedberg, Pa.				Evening Branch above Gold Mine Run near Tower City, Pa.				Forge Creek near Lickdale, Pa.			
		8/27/02	8/26/03	8/9/04	8/10/05	8/27/02	8/14/03	8/9/04	8/10/05	8/15/02	8/20/03	8/3/04	8/15/05
HYDRACHNIDIA	8	—	—	—	—	—	—	3	—	—	1	—	—
Hygrobatidae													
Atractides	8	—	—	—	—	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	—
Sperchonidae													
Sperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticola	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	—
Lebertiidae													
Lebertia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	3	5	4	1
Lirceus	8	—	—	—	—	—	—	—	—	—	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	—	—	—	—
Gammaridae													
Gammarus	6	—	—	—	—	—	—	—	—	—	—	—	—
DECAPODA													
Cambaridae	6	2	—	—	—	—	—	—	—	—	—	—	—
Cambarus	6	—	—	—	—	—	—	1	—	—	1	1	—
Orconectes	6	—	—	—	—	—	—	—	—	—	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	—	—	—	—	—	—	—	—	—
Entomobryidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Isotomidae	5	—	—	—	—	1	—	—	—	—	—	—	—
Isotomurus	5	—	—	—	—	—	—	—	—	—	—	—	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebia	4	—	—	—	—	6	8	20	—	—	—	—	—
Habrophlebiodes	6	—	3	5	—	—	—	—	—	—	2	1	—
Paraleptophlebia	1	12	2	—	7	—	—	—	—	3	—	10	3
Ephemeridae	4	—	—	—	1	—	—	—	—	—	—	—	—
Ephemera	2	1	—	—	—	—	—	—	—	—	—	—	—
Litobrancha recurvata	2	—	—	—	—	—	—	—	—	—	—	—	—
Caenidae													
Caenis	6	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerellidae	1	—	—	—	1	—	—	—	—	—	—	—	1
Attenella	1	—	—	—	—	—	—	—	—	—	1	—	—

Taxonomy	Tolerance score	Bear Hole Run at Suedberg, Pa.				Evening Branch above Gold Mine Run near Tower City, Pa.				Forge Creek near Lickdale, Pa.			
		8/27/02	8/26/03	8/9/04	8/10/05	8/27/02	8/14/03	8/9/04	8/10/05	8/15/02	8/20/03	8/3/04	8/15/05
Drunella	0	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	—	—	—	—	—
Eurylophella	2	1	1	—	5	5	3	1	1	2	—	—	1
Serratella	2	—	—	—	—	—	—	—	—	—	—	—	—
Baetidae	5	—	—	1	5	—	—	—	—	—	—	—	8
Acentrella	4	—	—	—	—	—	—	—	—	—	—	—	—
Acerpenna	5	2	—	—	—	—	—	—	—	—	—	—	—
Baetis	6	—	7	6	—	—	—	2		2	6	6	2
Baetis flavistriga	4	—	—	—	—	—	—	—	—	—	—	—	—
Plauditus	4	—	—	—	—	—	—	—	—	—	—	—	—
Isonychiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isonychia	2	—	—	—	—	—	—	—	—	—	—	1	—
Heptageniidae	4	—	—	—	1	—	—	2	—	—	—	—	—
Epeorus	0	—	—	—	—	—	—	—	—	—	—	—	—
Leucrocuta	1	—	—	—	—	—	—	—	—	—	—	—	—
Stenacron	7	—	—	—	—	—	—	—	—	4	—	—	—
Maccaffertium	3	8	4	12	9	14	4	22	5	4	3	12	10
Maccaffertium modestum	1	—	—	—	—	—	—	—	—	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	—	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	—	—	—	—	1	1	—	1	—	1	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	—	—	—	—	—	—	—	—
Gomphidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Lanthus	5	2	—	1	—	—	1	—	—	—	—	—	—
Stylogomphus	1	—	—	—	—	—	—	—	—	—	—	—	—
Libellulidae	2	—	—	—	—	—	—	—	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Calopteryx	6	—	—	—	—	1	—	—	1	—	—	—	—
Hetaerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Coenagrionidae	8	—	—	—	—	—	1	—	—	—	—	—	—
Argia	6	—	—	—	—	—	—	—	—	—	—	—	—
HEMIPTERA	6	—	—	—	—	—	—	—	—	—	—	—	—
Veliidae													
Microvelia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	—	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	1	—	—	—	—
Capniidae	3	—	—	2	—	—	—	—	—	—	—	—	—
Paracapnia	1	—	—	—	—	—	—	—	—	—	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	—	—	—	—	—
Leuctra	0	9	10	11	18	11	13	13	6	2	25	61	21
Nemouridae	2	—	—	—	3	—	—	—	—	—	—	—	—
Amphinemura	3	—	—	—	—	—	—	—	—	—	—	—	—
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Chloroperlidae	0	2	1	—	—	1	1	—	—	—	1	—	—
Alloperla	0	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Bear Hole Run at Suedberg, Pa.				Evening Branch above Gold Mine Run near Tower City, Pa.				Forge Creek near Lickdale, Pa.			
		8/27/02	8/26/03	8/9/04	8/10/05	8/27/02	8/14/03	8/9/04	8/10/05	8/15/02	8/20/03	8/3/04	8/15/05
Sweltsa	0	—	—	3	—	—	—	2	—	—	—	—	—
Peltoperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Tallaperla	0	—	2	6	1	—	—	—	—	—	1	1	1
Perlidae	3	—	—	—	1	—	—	—	—	—	—	—	—
Acroneuria	0	2	9	4	—	2	2	6	—	—	10	—	—
A. carolinensis	0	—	—	—	—	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	—	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	1	—	—	—	—
Neoperla	3	—	—	—	—	—	—	—	—	—	—	—	—
Perlesta	4	—	—	—	—	—	—	—	—	—	—	—	—
Perlodidae	2	—	—	—	—	—	—	—	—	—	—	—	3
Isoperla	2	—	—	—	—	—	—	—	—	—	—	—	—
Pteronarcyidae													
Pteronarcys	0	—	—	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	—	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	—	6	—	1	—	—	—	—	—	—	—	—
Psephenus	4	1	—	—	—	—	—	—	—	—	—	—	—
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	1
Elmidae	5	—	—	—	—	—	—	—	—	—	—	—	4
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	—
Dubiraphia	6	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus	5	—	—	—	—	—	—	—	—	—	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	1	—	—	—	—
Optioservus	4	—	—	—	2	—	—	—	—	—	2	2	—
Oulimnius	4	1	3	5	8	—	1	3	—	—	—	1	—
Promoresia	2	—	2	7	—	1	—	2	2	1	—	—	2
Stenelmis	5	—	—	—	—	—	—	—	—	—	—	—	—
Ptilodactylidae													
Anchytarsus	5	—	—	—	—	—	2	1	—	—	—	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	—	—	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Corydalidae													
Corydalus	4	—	—	—	—	—	—	—	—	—	—	—	—
Nigronia	4	1	2	1	—	—	2	1	1	—	—	—	—
Sialidae													
Sialis	4	—	—	—	—	—	—	—	—	4	—	—	1
TRICHOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	4	6	9	7	—	—	1	1	—	1	1	—

Taxonomy	Tolerance score	Bear Hole Run at Suedberg, Pa.				Evening Branch above Gold Mine Run near Tower City, Pa.				Forge Creek near Lickdale, Pa.			
		8/27/02	8/26/03	8/9/04	8/10/05	8/27/02	8/14/03	8/9/04	8/10/05	8/15/02	8/20/03	8/3/04	8/15/05
Hydroptilidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydroptila	6	—	—	—	—	—	—	—	—	—	—	—	—
Leucotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Ochrotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Glossosoma	0	—	—	—	—	—	—	—	—	—	—	—	—
Philopotamidae	4	—	—	—	2	—	—	—	—	—	—	—	—
Chimarra	4	—	—	—	—	—	—	—	—	1	—	—	—
C. aterrima	4	—	—	—	—	—	—	—	—	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	—
Dolophilodes	4	1	9	6	4	—	1	10	—	—	7	1	6
Wormaldia	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	—	1	—	—	—	—	—
Lype	2	—	—	—	—	—	—	—	1	—	—	—	—
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	—	—
Dipseudopsidae													
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropodidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	—
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropus	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	—	—	8	—	—	—	3	—	—	—	17
Cheumatopsyche	5	4	4	2	—	—	—	—	—	—	—	—	—
Diplectrona	5	—	16	11	—	2	1	3	—	—	19	17	—
Hydropsyche	4	—	5	12	20	4	6	16	9	—	—	—	—
Hydropsyche morosa gr.	6	—	—	—	—	—	—	—	—	—	—	—	—
Phryganeidae													
Oligostomis	2	—	—	—	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	—	—	—	—	—	—	—	—	—	—
Lepidostomatidae													
Lepidostoma	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	—	—	—	—	—	—	—
Pycnopsyche	4	—	—	—	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	1	—	—	—	—	—	—	—	—	—	—
Goeridae	3	—	—	—	—	—	—	—	—	—	—	—	—
Goera	3	—	—	—	—	—	—	—	—	—	—	—	—
Leptoceridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Oecetis	5	—	—	—	—	—	1	—	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	—	—	—	—	—	—	—	—
Calamoceratidae													
Heteroplectron	3	—	—	—	—	—	—	—	—	—	—	—	—
Odontoceridae													
Psilotreta	0	1	—	—	—	—	—	—	—	—	1	1	—
LEPIDOPTERA	5	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Bear Hole Run at Suedberg, Pa.				Evening Branch above Gold Mine Run near Tower City, Pa.				Forge Creek near Lickdale, Pa.			
		8/27/02	8/26/03	8/9/04	8/10/05	8/27/02	8/14/03	8/9/04	8/10/05	8/15/02	8/20/03	8/3/04	8/15/05
Tortricidae													
Archips	5	—	—	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	—	—	—	—	—
Ceratopogonidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	—	—	—	—	—	—
Probezzia	6	—	—	—	—	—	—	—	—	—	—	—	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	—	—	—	—	1
Chironomidae													
Tanypodinae	7	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopiini	6	—	—	—	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	—	—	—	—	—	—	—	5	—	—	1
Macropelopia	6	—	—	—	—	—	—	—	—	1	—	—	—
Natarsiini													
Natarsia	8	—	—	—	—	—	—	—	—	—	—	—	—
Pentaneurini													
Ablabesmyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	—	—	—	—	3	1	3	—	—	—	16
Nilotanypus	6	—	—	—	—	—	—	—	—	—	—	—	—
Paramerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	—	—	—	—	—	—	—	—	—
Thienemannimyia gr.	6	2	1	2	—	1	9	2	—	2	2	2	—
Zavrelimyia	8	—	—	—	—	—	—	—	—	1	—	1	1
Diamesini													
Diamesa	5	—	—	—	—	—	—	—	—	—	—	—	—
Pagastia	1	—	—	—	—	—	—	—	—	—	—	—	—
Potthastia longimana	2	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiinae	5	—	—	—	—	—	—	—	—	—	—	—	—
Corynoneurini													
Corynoneura	4	—	—	—	—	—	—	1	1	—	—	—	3
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	4
Orthocladiini	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia flaviforms	5	—	—	—	—	—	—	—	—	—	—	—	5
Cricotopus	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus/Orthocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus bicinctus	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	—	—	—	—	—	—
Diplocladius	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella brehmi gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella pseudomontana gr.	8	—	—	—	—	—	—	—	—	—	—	—	—
Heleniella	3	—	1	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Krenosmittia	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnophyes	8	—	—	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Bear Hole Run at Suedberg, Pa.				Evening Branch above Gold Mine Run near Tower City, Pa.				Forge Creek near Lickdale, Pa.			
		8/27/02	8/26/03	8/9/04	8/10/05	8/27/02	8/14/03	8/9/04	8/10/05	8/15/02	8/20/03	8/3/04	8/15/05
Orthocladius lignicola	6	—	—	—	1	—	1	1	—	—	—	—	—
Parachaetocladius	2	1	—	2	—	—	—	1	1	—	—	—	—
Paracricotopus	4	—	—	—	—	—	—	—	—	—	—	—	—
Parametriocnemus	5	1	3	—	—	1	1	—	1	—	2	1	19
Rheocricotopus	6	—	—	—	—	—	—	—	2	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	—	—	—	—	—	—	—
Tvetenia bavarica gr.	4	—	1	2	1	—	—	1	2	—	1	2	9
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	—	—
Chironominae	5	—	—	—	—	—	—	—	—	—	—	—	—
Chironomini													
Chironomus	10	—	—	—	—	—	—	—	—	—	—	—	—
Cryptochironomus	8	—	—	—	—	—	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	—	—	—	—
Microtendipes pedellus gr.	6	—	—	2	—	—	—	—	1	—	—	1	—
Microtendipes rydalensis gr.	4	1	2	—	1	—	—	—	—	—	—	—	—
Paralauterborniella	8	—	—	—	—	—	—	—	—	9	—	—	—
Paratendipes albimanus	6	—	—	—	—	—	—	—	—	—	—	—	—
Phaenopsectra	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum	6	—	—	—	—	1	—	—	—	7	—	—	—
Polypedilum aviceps	4	—	6	6	7	—	—	—	5	—	6	3	150
Polypedilum fallax	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum flavum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum illinoense	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum laetum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum tritum	6	—	—	—	—	—	—	1	—	—	—	—	—
Stenochironomus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	—	—	—	—	—	—	—	—	—	—	—	—
Tribelos	7	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	—	—	—
Cladotanytarsus	5	—	—	—	—	—	—	—	—	—	—	—	—
Micropsectra	7	—	6	—	8	1	—	4	13	12	4	—	51
Micropsectra sp. A	7	—	—	—	—	—	—	—	—	—	—	—	—
Paratanytarsus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheotanytarsus	6	—	—	—	—	5	—	—	37	2	—	—	5
Rheotanytarsus exiguus gr.	6	1	1	3	—	1	4	2	—	—	—	1	—
Rheotanytarsus pellucidus	4	—	—	—	—	4	—	—	—	—	—	—	—
Stempellina	2	—	—	—	—	—	—	—	—	—	—	—	—
Stempellina sp. C	4	—	—	—	—	—	—	—	—	—	—	—	—
Stempellinella	4	—	3	—	—	19	2	3	14	6	—	—	—
Sublettea coffmani	4	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsus	6	—	—	2	—	7	14	3	—	5	—	—	—
Zavrelia	4	—	—	—	—	—	—	—	—	—	—	—	—
Dixidae													
Dixa	1	—	—	—	—	—	—	—	—	—	—	—	1
Simuliidae													
Simulium	5	—	2	—	—	—	6	6	7	—	6	—	—
Tipulidae	4	—	—	—	—	—	—	—	1	—	—	—	—

Taxonomy	Tolerance score	Bear Hole Run at Suedberg, Pa.				Evening Branch above Gold Mine Run near Tower City, Pa.				Forge Creek near Lickdale, Pa.			
		8/27/02	8/26/03	8/9/04	8/10/05	8/27/02	8/14/03	8/9/04	8/10/05	8/15/02	8/20/03	8/3/04	8/15/05
Tipula	6	—	1	—	—	—	1	—	—	1	—	—	1
Antocha	3	—	—	—	—	—	—	—	—	—	—	—	—
Dicranota	3	—	—	—	—	—	2	1	—	—	1	—	—
Hexatoma	2	—	—	1	2	—	1	—	—	—	—	—	—
Limnophila	3	—	—	—	—	—	—	—	—	1	—	—	—
Limonia	6	—	—	—	—	—	—	—	—	—	—	—	—
Molophilus	4	—	—	—	—	—	1	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	1	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	—	—	—	—
Empididae	6	—	—	—	1	—	—	—	1	—	—	—	1
Chelifera	6	—	—	—	—	—	—	1	2	—	—	—	—
Clinocera	6	—	—	—	—	—	1	1	—	—	1	—	1
Hemerodromia	6	—	—	—	—	—	—	—	1	—	—	—	1
Stratiomyidae	7	—	—	—	—	—	—	—	—	—	—	—	—
Tabanidae													
Chrysops	5	—	—	—	—	—	—	—	—	—	3	1	—
Ephydridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Psychodidae	10	—	—	—	1	—	—	—	—	—	—	—	—
Total taxa		22	32	28	27	23	36	37	34	24	31	26	34
Total number		60	124	127	126	91	106	155	131	92	127	139	353
Percent dominant taxa (single)		20	13	9	20	21	13	14	18	14	20	44	24
Total EPT Taxa		12	15	14	16	8	10	13	9	7	12	11	11
Total EPT		47	80	90	93	45	40	99	27	18	77	112	73
Percent EPT		78.33	64.52	69.29	73.81	49.45	37.74	63.87	20.61	19.57	60.63	80.58	20.68
HBI		2.22	2.77	2.6	3.18	3.53	4.19	3.49	4.85	6.21	2.89	1.79	4.43
Number Chironomidae taxa		5	9	7	5	9	7	11	11	10	5	7	11
Percent Chironomidae		10.00	19.35	14.96	14.29	43.96	32.08	12.90	61.07	54.35	11.81	7.91	74.79

Taxonomy	Tolerance score	Gold Mine Run near Tower City, Pa.				Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.				Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.			
		8/27/02	8/14/03	8/9/04	8/10/05	8/13/02	8/6/03	8/2/04	8/8/05	7/30/02	8/6/03	8/2/04	8/8/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	—	—	—	—	—	—	—	—	—	—	—	—
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	—	—	—	—	—	—	—
NEMATODA	5	—	—	—	—	—	—	—	—	1	—	—	—
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	—	—	—	—	4	—	1	1
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculidae	5	1	—	17	—	—	—	—	—	2	—	—	—
Eclipidrilus	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	—
TUBIFICIDA													
Enchytraeidae	10	—	13	1	—	—	1	—	—	—	—	—	—
Naididae	8	4	5	4	—	3	2	6	—	—	—	—	3
Nais	8	—	—	—	21	—	—	—	22	—	—	—	—
N. behningi	6	—	—	—	—	—	—	—	—	—	—	—	—
Pristina	8	—	—	—	—	—	—	—	10	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae w/ capilliform setae	10	—	—	—	—	—	—	4	—	1	4	—	—
Tubificidae w/o capilliform setae	10	—	—	—	—	—	—	—	—	2	—	1	—
LUMBRICINA	6	—	—	—	—	—	—	—	—	—	—	—	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	—	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	—	—	—	—	—	—	—	—	—	—	—	—
Physidae													
Physa	8	—	—	—	—	—	—	—	—	—	—	—	—
Planorbidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	—	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	—	—	—	—
Pisidiidae	6	—	—	—	—	—	—	—	6	—	—	—	1
Pisidium	6	—	—	—	—	—	—	—	—	—	—	—	—
Sphaerium	6	—	—	—	—	3	4	22	—	120	22	13	
CHELICERATA													
ORIBATEI	8	—	—	—	1	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Gold Mine Run near Tower City, Pa.				Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.				Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.			
		8/27/02	8/14/03	8/9/04	8/10/05	8/13/02	8/6/03	8/2/04	8/8/05	7/30/02	8/6/03	8/2/04	8/8/05
HYDRACHNIDIA	8	1	—	—	1	—	—	2	—	1	—	—	—
Hygrobatidae													
Atractides	8	—	—	—	—	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	—
Sperchonidae													
Sperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticola	6	—	—	—	—	—	—	—	1	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	1
Lebertiidae													
Lebertia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	—	—	—	—
Lirceus	8	—	—	—	—	—	—	—	—	2	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	—	—	—	—
Gammaridae													
Gammarus	6	—	—	—	—	—	—	—	—	—	—	—	—
DECAPODA													
Cambaridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cambarus	6	—	1	1	1	—	—	—	—	1	1	—	—
Orconectes	6	—	—	—	—	—	—	—	—	—	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	1	—	—	—	—	—	—	—	—
Entomobryidae	10	—	1	—	—	—	—	—	—	—	—	—	—
Isotomidae	5	—	—	2	—	—	—	—	—	—	—	—	—
Isotomurus	5	—	—	—	—	—	—	—	—	—	—	—	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	1	—	—	—	—	—	—	—	—
Habrophlebia	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebiodes	6	—	—	—	—	—	2	—	—	—	—	—	—
Paraleptophlebia	1	—	—	—	—	—	2	—	—	6	1	1	2
Ephemeridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Ephemera	2	—	—	—	—	1	—	—	—	1	—	—	—
Litobrancha recurvata	2	—	—	—	—	—	—	—	—	—	—	—	—
Caenidae													
Caenis	6	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerellidae	1	—	—	—	—	—	—	—	—	—	—	—	1
Attenella	1	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Gold Mine Run near Tower City, Pa.				Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.				Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.			
		8/27/02	8/14/03	8/9/04	8/10/05	8/13/02	8/6/03	8/2/04	8/8/05	7/30/02	8/6/03	8/2/04	8/8/05
Drunella	0	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	—	—	—	—	—
Eurylophella	2	2	—	—	2	—	—	—	—	—	—	—	—
Serratella	2	—	—	—	—	—	—	—	—	—	—	—	—
Baetidae	5	—	—	—	—	—	—	—	1	—	—	—	—
Acentrella	4	—	—	—	—	—	—	—	—	—	—	—	—
Acerpenna	5	—	—	—	—	—	—	—	—	—	—	1	1
Baetis	6	—	1	1	—	—	1	3	—	—	—	—	2
Baetis flavistriga	4	—	—	—	—	—	—	—	—	—	—	—	—
Plauditus	4	—	—	—	—	—	—	—	—	—	—	—	—
Isonychiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isonychia	2	—	—	—	—	6	—	10	—	—	—	—	—
Heptageniidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Epeorus	0	—	—	—	—	—	—	—	—	—	—	—	—
Leucrocuta	1	—	—	—	—	—	—	—	—	—	—	—	—
Stenacron	7	—	—	—	—	—	—	—	—	—	—	1	—
Maccaffertium	3	—	—	—	—	28	9	61	22	34	17	28	42
Maccaffertium modestum	1	—	—	—	—	—	—	—	5	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	—	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	—	—	—	—	—	—	—	—	—	—	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	—	—	—	—	—	—	—	—
Gomphidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Lanthus	5	—	1	—	1	—	3	—	—	—	1	—	—
Stylogomphus	1	—	—	—	—	—	—	—	—	—	—	—	—
Libellulidae	2	—	—	—	—	—	—	1	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	2
Calopteryx	6	—	—	—	—	—	—	—	—	—	—	—	—
Hetaerina	6	—	—	—	—	—	—	—	—	—	—	1	—
Coenagrionidae	8	—	—	—	—	—	—	—	—	—	—	—	—
Argia	6	—	—	—	—	—	—	—	—	—	1	—	—
HEMIPTERA	6	—	—	—	—	—	—	—	—	—	—	—	—
Veliidae													
Microvelia	6	—	—	—	1	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	—	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	—	—	—	—	—
Capniidae	3	—	—	—	—	—	—	—	—	—	—	—	—
Paracapnia	1	—	—	—	—	—	—	—	—	—	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	—	—	—	—	1
Leuctra	0	19	14	26	59	—	5	5	10	18	5	3	—
Nemouridae	2	—	1	3	2	—	—	—	—	—	—	—	—
Amphinemura	3	—		3	—	—	—	—	—	—	—	—	—
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	1	—	—
Chloroperlidae	0	9	3	10	—	—	—	—	1	—	—	—	—
Alloperla	0	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Gold Mine Run near Tower City, Pa.				Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.				Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.			
		8/27/02	8/14/03	8/9/04	8/10/05	8/13/02	8/6/03	8/2/04	8/8/05	7/30/02	8/6/03	8/2/04	8/8/05
Sweltsa	0	8	5	4	4	—	—	—	—	—	—	—	—
Peltoperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Tallaperla	0	2	—	—	—	—	—	—	—	2	—	—	—
Perlidae	3	—	—	—	—	—	—	—	—	—	—	—	1
Acroneuria	0	—	8	—	—	—	1	—	—	2	1	1	—
A. carolinensis	0	—	—	—	—	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	—	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	—	—	—	—	—
Neoperla	3	—	—	—	—	—	—	—	—	—	—	—	—
Perlesta	4	—	—	—	—	—	—	—	—	—	—	—	—
Perlodidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isoperla	2	—	—	—	—	—	—	—	—	—	—	—	—
Pteronarcyidae													
Pteronarcys	0	—	—	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	—	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	1	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenus	4	—	—	—	—	—	—	—	—	—	—	—	—
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	—
Elmidae	5	—	—	—	—	—	—	—	1	—	—	—	—
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	—
Dubiraphia	6	—	—	—	1	—	—	—	—	—	—	—	—
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus	5	—	—	—	—	—	—	—	—	—	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	—	—	—	—	—
Optioservus	4	—	—	—	—	—	—	—	—		—	1	—
Oulimnius	4	—	—	—	—	1	4	8	—	3	—	2	—
Promoresia	2	1	—	—	1	—	—	—	—	2	2	3	5
Stenelmis	5	—	—	—	—	1	—	1	—	7	—	5	3
Ptilodactylidae													
Anchytarsus	5	—	—	—	—	—	—	—	—	—	—	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	—	—	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Corydalidae													
Corydalus	4	—	—	—	—	—	—	—	—	—	—	—	—
Nigronia	4	—	—	—	—	2	1	7	3	5	3	1	4
Sialidae													
Sialis	4	—	—	—	—	—	—	—	—	1	—	—	—
TRICHOPTERA	4	—	—	—	2	—	—	—	—	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	4	5	25	—	—	—	1	4	1	2	—	—

Taxonomy	Tolerance score	Gold Mine Run near Tower City, Pa.				Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.				Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.			
		8/27/02	8/14/03	8/9/04	8/10/05	8/13/02	8/6/03	8/2/04	8/8/05	7/30/02	8/6/03	8/2/04	8/8/05
Hydroptilidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydroptila	6	—	—	—	—	—	—	—	—	—	—	—	1
Leucotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Ochrotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Glossosoma	0	—	—	—	—	—	—	—	—	—	—	—	—
Philopotamidae	4	—	—	—	1	—	—	—	1	—	—	—	—
Chimarra	4	—	1	—	—	—	—	—	2	—	—	—	8
C. aterrima	4	—	—	—	—	—	—	—	—	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	—
Dolophilodes	4	1	1	8	1	—	1	1	—	—	—	—	—
Wormaldia	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	—	1	—	—	—	—	—
Lype	2	—	—	—	—	—	—	—	—	—	—	1	2
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	—	—
Dipseudopsidae													
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	1	—
Polycentropodidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	—
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	1	—
Polycentropus	6	1	—	—	2	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	—	—	2	—	—	—	8	1	—	—	16
Cheumatopsyche	5	—	—	—	—	1	1	7	9	43	—	2	3
Diplectrona	5	10	3	6	—	—	—	—	—	3	1	—	—
Hydropsyche	4	2	—	1	—	—	1	19	3	1	1	1	20
Hydropsyche morosa gr.	6	—	—	—	—	—	—	3	—	—	—	—	—
Phryganeidae													
Oligostomis	2	—	—	—	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	—	—	—	—	—	—	—	—	—	—
Lepidostomatidae													
Lepidostoma	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	—	—	—	—	—	—	—
Pycnopsyche	4	—	—	—	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	—	—	—	—	—	—	—	—	—	—	—
Goeridae	3	—	—	—	—	—	—	—	—	—	—	—	—
Goera	3	—	—	—	—	—	—	—	—	—	—	—	—
Leptoceridae	4	—	1	—	—	—	—	—	—	—	—	—	—
Oecetis	5	1	—	—	—	—	—	—	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	—	—	—	—	—	1	—	—
Calamoceratidae													
Heteroplectron	3	—	—	—	—	—	—	—	—	—	—	—	—
Odontoceridae													
Psilotreta	0	—	—	—	—	—	—	—	—	—	1	—	—
LEPIDOPTERA	5	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Gold Mine Run near Tower City, Pa.				Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.				Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.			
		8/27/02	8/14/03	8/9/04	8/10/05	8/13/02	8/6/03	8/2/04	8/8/05	7/30/02	8/6/03	8/2/04	8/8/05
Tortricidae													
Archips	5	—	—	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	—	—	—	—	—
Ceratopogonidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	—	—	—	—	—	—
Probezzia	6	—	—	—	—	1	—	—	—	—	—	2	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	—	—	—	—	—
Chironomidae													
Tanypodinae	7	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopiini	6	—	—	—	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopia	6	—	—	—	—	—	—	—	—	—	—	—	—
Natarsiini													
Natarsia	8	—	—	—	—	—	—	—	—	—	—	1	—
Pentaneurini													
Ablabesmyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	—	—	1	—	—	—	1	—	—	—	4
Nilotanypus	6	—	—	—	—	—	—	—	—	—	—	—	—
Paramerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	—	—	—	—	2	—	—	—	—
Thienemannimyia gr.	6	—	4	—	—	2	5	2	—	7	1	6	—
Zavrelimyia	8	—	1	—	—	—	—	—	—	1	—	3	—
Diamesini													
Diamesa	5	—	—	—	—	—	—	—	—	—	—	—	—
Pagastia	1	—	—	—	—	—	—	—	—	—	—	—	1
Potthastia longimana	2	—	—	—	—	—	—	1	1	—	—	—	—
Orthocladiinae	5	—	—	—	—	—	—	—	1	—	—	—	—
Corynoneurini													
Corynoneura	4	1	—	—	—	—	—	—	—	—	—	—	—
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiini	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia	5	—	1	—	—	—	—	—	—	1	—	—	—
Brillia flaviforms	5	—	—	—	—	—	—	—	1	—	—	—	—
Cricotopus	7	—	—	—	—	—	—	—	5	—	—	—	—
Cricotopus/Orthocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus bicinctus	7	—	—	—	—	3	—	1	1	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	—	—	—	—	—	—
Diplocladius	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	1	1	—	—	—	—	—	—	—	—	—
Eukiefferiella brehmi gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	1	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella pseudomontana gr.	8	—	—	—	—	—	—	—	—	—	—	—	—
Heleniella	3	—	—	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	1	—	—	—	—	—	—	—	—	—	—	—
Krenosmittia	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnophyes	8	—	1	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Gold Mine Run near Tower City, Pa.				Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.				Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.			
		8/27/02	8/14/03	8/9/04	8/10/05	8/13/02	8/6/03	8/2/04	8/8/05	7/30/02	8/6/03	8/2/04	8/8/05
Orthocladius lignicola	6	—	—	—	—	—	—	—	—	—	—	—	—
Parachaetocladius	2	—	1	4	2	—	—	—	—	1	—	1	—
Paracricotopus	4	—	—	—	—	—	1	—	—	—	—	—	—
Parametriocnemus	5	3	—	—	1	14	5	1	12	—	1	1	1
Rheocricotopus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	—	—	—	—	—	—	—
Tvetenia bavarica gr.	4	—	1	—	—	—	1	1	1	—	1	—	3
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	1	—
Chironominae	5	—	—	—	—	—	—	—	1	—	—	—	—
Chironomini													
Chironomus	10	—	—	—	—	—	—	—	—	—	—	—	—
Cryptochironomus	8	—	—	—	—	—	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	—	—	—	—
Microtendipes pedellus gr.	6	—	—	—	—	—	—	—	—	—	—	13	—
Microtendipes rydalensis gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Paralauterborniella	8	—	—	—	—	—	—	—	—	—	—	—	—
Paratendipes albimanus	6	—	—	—	—	—	—	—	—	—	—	—	—
Phaenopsectra	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum	6	5	—	—	1	5	2	—	—	—	—	—	1
Polypedilum aviceps	4	—	—	—	—	6	9	3	17	1	1	8	—
Polypedilum fallax	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum flavum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum illinoense	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum laetum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	1	—	—	—	—	—	4	—
Polypedilum tritum	6	—	—	—	—	—	—	—	—	—	—	—	—
Stenochironomus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	—	—	—	—	—	—	—	1	—	—	—	—
Tribelos	7	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	1	—	—
Cladotanytarsus	5	—	—	—	—	—	—	—	11	—	—	—	—
Micropsectra	7	13	17	1	4	5	25	—	4	—	26	1	—
Micropsectra sp. A	7	—	—	—	—	—	—	—	—	27	—	—	—
Paratanytarsus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheotanytarsus	6	—	—	1	—	17	—	—	12	—	—	—	17
Rheotanytarsus exiguus gr.	6	—	—	—	—	2	5	13	—	3	3	10	—
Rheotanytarsus pellucidus	4	—	—	—	—	—	1	3	—	5	3	5	—
Stempellina	2	—	—	—	—	1	—	—	—	—	—	—	—
Stempellina sp. C	4	—	—	—	—	—	—	5	—	—	—	—	—
Stempellinella	4	7	15	5	13	13	5	—	—	—	2	1	—
Sublettea coffmani	4	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsus	6	2	—	—	—	8	3	—	3	—	—	17	—
Zavrelia	4	—	—	—	—	—	—	—	—	—	—	—	—
Dixidae													
Dixa	1	—	—	—	—	—	—	—	—	1	—	—	—
Simuliidae													
Simulium	5	—	19	2	3	—	2	6	15	1	4	1	1
Tipulidae	4	—	—	—	—	—	—	—	—	—	—	—	2

Taxonomy	Tolerance score	Gold Mine Run near Tower City, Pa.				Indiantown Run below Hatchery at Fort Indiantown Gap, Pa.				Indiantown Run above Unnamed Tributary at Fort Indiantown Gap, Pa.			
		8/27/02	8/14/03	8/9/04	8/10/05	8/13/02	8/6/03	8/2/04	8/8/05	7/30/02	8/6/03	8/2/04	8/8/05
Tipula	6	—	—	—	—	—	—	—	—	—	—	—	—
Antocha	3	—	—	—	—	—	—	2	1	—	—	—	—
Dicranota	3	—	3	1	3	1	—	—	1	4	—	—	—
Hexatoma	2	—	—	—	—	—	—	1	—	—	1	—	—
Limnophila	3	—	—	—	—	—	—	—	—	1	—	—	—
Limonia	6	—	—	—	—	—	—	—	—	—	—	—	—
Molophilus	4	—	—	1	—	—	—	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	1	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	—	—	—	—
Empididae	6	—	—	—	—	—	—	—	—	—	—	—	—
Chelifera	6	—	—	2	—	1	—	2	—	—	—	—	—
Clinocera	6	—	—	—	—	—	—	—	3	—	—	—	—
Hemerodromia	6	—	—	—	—	—	—	1	6	—	1	1	—
Stratiomyidae	7	—	—	—	—	—	—	—	—	—	—	—	—
Tabanidae													
Chrysops	5	—	—	—	—	—	—	—	—	—	—	—	—
Ephydridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Psychodidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Total taxa		22	27	24	28	24	29	32	38	37	29	37	29
Total number		98	128	130	134	126	104	204	209	317	110	145	150
Percent dominant taxa (single)		19	15	20	53	22	24	30	20	38	24	19	34
Total EPT Taxa		11	11	10	10	4	9	10	11	11	10	11	13
Total EPT		59	43	87	74	36	23	111	66	112	31	41	100
Percent EPT		60.20	33.59	66.92	54.48	28.57	22.12	54.41	31.58	35.33	28.18	28.28	66.67
HBI		2.61	4.26	2.05	3	4.63	4.99	4.06	4.88	4.81	4.87	4.88	4.17
Number Chironomidae taxa		7	9	5	7	12	11	9	16	8	9	14	6
Percent Chironomidae		32.65	32.81	9.23	17.16	61.11	59.62	14.71	35.41	14.51	35.45	49.66	18.00

Taxonomy	Tolerance score	Indiantown Run in Gap at Fort Indiantown Gap, Pa.				Indiantown Run above Memorial Lake near Indiantown, Pa.				Indiantown Run above Vesle Run at Indiantown, Pa.			
		7/30/02	8/2/03	8/3/04	8/9/05	7/31/02	8/7/03	7/29/04	8/3/05	7/31/02	8/1//03	7/29/04	8/3/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	—	—	1	—	—	—	—	—	—	—	3	4
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	1	1	9	—	—	—	1
NEMATODA	5	1	—	—	—	2	—	2	1	—	—	—	—
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	—	—	—	—	—	—	—	—
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculidae	5	—	—	—	—	—	—	—	1	—	1	1	—
Eclipidrilus	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	—
TUBIFICIDA													
Enchytraeidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Naididae	8	—	2	—	—	2	—	2	—	20	3	—	—
Nais	8	—	—	—	—	—	—	—	—	—	—	—	1
N. behningi	6	—	—	—	—	—	—	—	—	—	—	—	—
Pristina	8	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae w/ capilliform setae	10	1	2	—	—	—	—	—	—	—	—	—	—
Tubificidae w/o capilliform setae	10	—	2	4	—	1	—	—	—	2	—	—	—
LUMBRICINA	6	—	—	—	—	4	1	—	—	—	1	—	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	—	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	—	—	—	—	1	1	—	—	2	—	—	—
Physidae													
Physa	8	—	—	—	—	—	—	—	—	—	—	—	—
Planorbidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	—	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	3	—	4	
Pisidiidae	6	1	—	—	—	5	—	—	2	2	—	—	1
Pisidium	6	—	—	—	—	—	—	—	—	—	—	—	—
Sphaerium	6	—	2	1	—	—	3	7	—	—	—	—	—
CHELICERATA													
ORIBATEI	8	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Indiantown Run in Gap at Fort Indiantown Gap, Pa.				Indiantown Run above Memorial Lake near Indiantown, Pa.				Indiantown Run above Vesle Run at Indiantown, Pa.			
		7/30/02	8/2/03	8/3/04	8/9/05	7/31/02	8/7/03	7/29/04	8/3/05	7/31/02	8/1//03	7/29/04	8/3/05
HYDRACHNIDIA	8	1	—	1	—	1	—	2	—	—	—	—	—
Hygrobatidae													
Atractides	8	—	—	—	—	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	—
Sperchonidae													
Sperchon	6	—	—	—	—	—	—	—	—	—	—	—	1
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticola	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	—
Lebertiidae													
Lebertia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	1	—	—	—
Lirceus	8	—	—	—	—	—	—	—	—	—	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	3	—	—	—
Gammaridae													
Gammarus	6	—	—	—	—	—	—	—	—	—	—	—	—
DECAPODA													
Cambaridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cambarus	6	—	3	—	—	—	—	—	—	—	—	—	—
Orconectes	6	—	—	—	—	—	—	—	—	—	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	1	—	—	—	—	—	—	—	—
Entomobryidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Isotomidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Isotomurus	5	—	—	—	—	—	—	1	—	—	—	—	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	3	—	—	—	—	—	—	—	—
Habrophlebia	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebiodes	6	—	11	—	—	—	—	—	—	—	—	—	—
Paraleptophlebia	1	—	—	12	—	—	—	—	—	—	—	—	—
Ephemeridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Ephemera	2	—	1	—	—	—	—	—	—	—	—	—	—
Litobrancha recurvata	2	—	—	—	—	—	—	—	—	—	—	—	—
Caenidae													
Caenis	6	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerellidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Attenella	1	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Indiantown Run in Gap at Fort Indiantown Gap, Pa.				Indiantown Run above Memorial Lake near Indiantown, Pa.				Indiantown Run above Vesle Run at Indiantown, Pa.			
		7/30/02	8/2/03	8/3/04	8/9/05	7/31/02	8/7/03	7/29/04	8/3/05	7/31/02	8/1//03	7/29/04	8/3/05
Drunella	0	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	1	—	—	—	—
Eurylophella	2	—	—	1	—	—	—	—	—	—	—	—	—
Serratella	2	1	—	—	—	—	—	—	—	—	—	—	—
Baetidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Acentrella	4	—	—	—	—	1	—	6	3	—	—	—	—
Acerpenna	5	—	—	—	—	—	—	—	—	—	—	—	—
Baetis	6	8	7	5	8	6	2	1	2	1	8	17	15
Baetis flavistriga	4	—	—	—	1	—	—	—	—	—	—	—	14
Plauditus	4	—	—	—	—	—	—	—	—	—	—	—	—
Isonychiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isonychia	2	3	7	34	24	11	12	13	—	—	6	—	1
Heptageniidae	4	—	—	1	7	—	—	—	—	—	—	—	10
Epeorus	0	3	—	—	—	1	—	—	—	—	—	1	—
Leucrocuta	1	—	1	—	—	3	—	—	—	—	—	—	—
Stenacron	7	—	—	—	—	—	—	—	—	—	—	—	—
Maccaffertium	3	9	25	14	6	9	21	20	22	17	2	17	9
Maccaffertium modestum	1	—	—	—	—	—	—	—	—	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	1	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	—	—	—	—	—	—	—	—	—	—	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	—	—	—	—	—	—	—	—
Gomphidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Lanthus	5	2	1	1	—	—	—	—	—	—	—	—	—
Stylogomphus	1	—	—	—	—	—	—	—	—	—	2	—	—
Libellulidae	2	—	—	—	—	—	—	—	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Calopteryx	6	—	—	—	—	—	—	—	—	—	—	—	—
Hetaerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Coenagrionidae	8	—	—	—	—	—	1	—	—	1	—	—	—
Argia	6	—	—	—	—	—	1	—	—	—	—	2	—
HEMIPTERA	6	—	—	—	—	—	—	—	—	—	—	—	—
Veliidae													
Microvelia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	—	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	—	—	—	—	—
Capniidae	3	—	—	—	—	—	—	—	—	—	—	—	—
Paracapnia	1	—	—	—	—	—	—	—	—	—	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	—	—	—	—	—
Leuctra	0	5	1	4	—	—	—	—	—	—	—	—	—
Nemouridae	2	—	—	—	—	—	—	—	—	—	—	—	—
Amphinemura	3	—	—	—	—	—	—	—	—	—	—	—	—
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Chloroperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Alloperla	0	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Indiantown Run in Gap at Fort Indiantown Gap, Pa.				Indiantown Run above Memorial Lake near Indiantown, Pa.				Indiantown Run above Vesle Run at Indiantown, Pa.			
		7/30/02	8/2/03	8/3/04	8/9/05	7/31/02	8/7/03	7/29/04	8/3/05	7/31/02	8/1//03	7/29/04	8/3/05
Sweltsa	0	—	—	1	—	—	—	—	—	—	—	—	—
Peltoperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Tallaperla	0	13	1	1	3	—	—	—	—	—	—	—	—
Perlidae	3	—	—	—	2	—	—	—	—	—	—	—	—
Acroneuria	0	2	1	4	—	4	3	1	2	—	5	—	—
A. carolinensis	0	—	—	—	1	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	1	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	—	—	—	—	—
Neoperla	3	—	—	—	—	—	—	—	—	—	—	—	—
Perlesta	4	—	—	—	—	—	—	—	—	—	—	—	—
Perlodidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isoperla	2	—	—	—	—	—	—	—	—	—	—	—	—
Pteronarcyidae													
Pteronarcys	0	—	—	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	1	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	—	—	—	—	—	1	—	—	—	—	—	—
Psephenus	4	—	—	1	1	1	1	—	1	3	21	2	5
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	—
Elmidae	5	—	—	—	—	—	—	—	—	—	—	—	1
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	—
Dubiraphia	6	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus	5	—	—	—	—	—	—	—	—	1	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	—	—	—	—	—
Optioservus	4	1	3	—	3	—	—	—	3	3	14	2	—
Oulimnius	4	8	8	17	—	—	—	1	—	—	—	1	—
Promoresia	2	—	—	4	—	—	—	—	—	—	—	—	—
Stenelmis	5	—	—	—	—	—	—	—	—	3	33	1	2
Ptilodactylidae													
Anchytarsus	5	—	—	—	—	—	—	—	—	—	—	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	—	1	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	1	—	—	—	—
Corydalidae													
Corydalus	4	—	—	—	—	2	1	—	—	—	—	—	—
Nigronia	4	1	1	2	2	3	—	1	4	—	—	1	—
Sialidae													
Sialis	4	—	—	—	—	—	—	—	—	—	—	—	—
TRICHOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	2	9	5	4	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Indiantown Run in Gap at Fort Indiantown Gap, Pa.				Indiantown Run above Memorial Lake near Indiantown, Pa.				Indiantown Run above Vesle Run at Indiantown, Pa.			
		7/30/02	8/2/03	8/3/04	8/9/05	7/31/02	8/7/03	7/29/04	8/3/05	7/31/02	8/1//03	7/29/04	8/3/05
Hydroptilidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydroptila	6	—	—	—	—	—	—	—	—	—	—	—	—
Leucotrichia	6	—	—	—	—	—	—	—	—	—	—	6	9
Ochrotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Glossosoma	0	2	—	1	—	—	—	—	—	—	—	—	—
Philopotamidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Chimarra	4	—	—	—	—	4	14	12	—	1	1	1	—
C. aterrima	4	—	—	—	—	—	—	—	10	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	1
Dolophilodes	4	27	8	23	11	—	—	—	—	—	—	—	—
Wormaldia	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Lype	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	—	—
Dipseudopsidae		—	—	—	—	—	—	—	—	—	—	—	—
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropodidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	—
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropus	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	—	—	6	—	—	—	6	—	—	—	2
Cheumatopsyche	5	6	6	7	5	30	16	20	16	37	1	16	—
Diplectrona	5	—	—	4	—	—	—	—	—	—	—	—	—
Hydropsyche	4	3	6	16	21	7	2	12	32	12	1	20	35
Hydropsyche morosa gr.	6	—	—	7	—	—	—	—	—	—	—	31	—
Phryganeidae													
Oligostomis	2	—	—	—	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	1	—	—	—	—	—	—	—	—	—
Lepidostomatidae													
Lepidostoma	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	—	—	—	—	—	—	—
Pycnopsyche	4	—	—	—	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	—	—	—	—	—	—	—	—	1	—	—
Goeridae	3	—	—	—	1	—	—	—	—	—	—	—	—
Goera	3	—	—	—	—	—	—	—	—	—	—	—	—
Leptoceridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Oecetis	5	—	—	—	—	—	—	1	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	—	—	—	—	—	—	—	—
Calamoceratidae													
Heteroplectron	3	—	—	—	—	—	—	—	—	—	—	—	—
Odontoceridae													
Psilotreta	0	—	—	—	—	—	—	—	—	—	—	—	—
LEPIDOPTERA	5	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Indiantown Run in Gap at Fort Indiantown Gap, Pa.				Indiantown Run above Memorial Lake near Indiantown, Pa.				Indiantown Run above Vesle Run at Indiantown, Pa.			
		7/30/02	8/2/03	8/3/04	8/9/05	7/31/02	8/7/03	7/29/04	8/3/05	7/31/02	8/1//03	7/29/04	8/3/05
Tortricidae													
Archips	5	—	—	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	—	—	—	—	—
Ceratopogonidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	—	—	—	—	—	—
Probezzia	6	—	—	—	—	—	—	—	—	—	—	—	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	—	—	—	—	—
Chironomidae													
Tanypodinae	7	—	—	—	—	—	—	—	2	—	—	—	—
Macropelopiini	6	—	—	—	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopia	6	—	—	—	—	—	—	—	—	—	—	—	—
Natarsiini													
Natarsia	8	—	—	—	—	—	—	—	—	—	—	—	—
Pentaneurini													
Ablabesmyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	—	—	—	—	1	—	1	—	—	—	—
Nilotanypus	6	—	—	—	—	—	—	—	—	—	—	—	—
Paramerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	—	—	—	—	—	—	—	—	—
Thienemannimyia gr.	6	—	1	1	—	—	—	—	—	4	3	—	—
Zavrelimyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Diamesini													
Diamesa	5	—	—	—	—	—	—	5	—	—	—	—	—
Pagastia	1	—	—	—	1	—	—	—	—	—	—	—	—
Potthastia longimana	2	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiinae	5	—	—	—	1	—	—	—	1	—	—	—	1
Corynoneurini													
Corynoneura	4	—	—	—	—	—	—	—	—	—	—	—	—
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiini	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia	5	1	1	—	—	—	1	—	—	—	—	—	—
Brillia flaviforms	5	—	—	—	1	—	—	1	—	—	—	—	—
Cricotopus	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus/Orthocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus bicinctus	7	—	—	—	1	—	—	—	—	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	—	—	—	—	—	—
Diplocladius	8	—	1	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella brehmi gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella pseudomontana gr.	8	—	—	—	—	—	—	—	—	—	—	—	—
Heleniella	3	—	—	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Krenosmittia	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnophyes	8	—	—	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Indiantown Run in Gap at Fort Indiantown Gap, Pa.				Indiantown Run above Memorial Lake near Indiantown, Pa.				Indiantown Run above Vesle Run at Indiantown, Pa.			
		7/30/02	8/2/03	8/3/04	8/9/05	7/31/02	8/7/03	7/29/04	8/3/05	7/31/02	8/1//03	7/29/04	8/3/05
Orthocladius lignicola	6	—	—	—	—	—	—	—	—	—	—	—	—
Parachaetocladius	2	—	—	1	—	—	—	—	—	—	—	—	—
Paracricotopus	4	—	—	—	—	—	—	—	—	—	—	—	—
Parametriocnemus	5	1	1	1	—	—	—	—	—	2	—	—	1
Rheocricotopus	6	—	—	—	—	1	—	—	—	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	—	—	—	—	1	—	—
Tvetenia bavarica gr.	4	—	3	3	3	—	1	—	—	—	—	—	—
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	—	—
Chironominae	5	—	—	—	—	—	—	—	—	—	—	—	—
Chironomini													
Chironomus	10	—	—	—	—	—	—	—	—	—	—	—	—
Cryptochironomus	8	—	—	—	—	—	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	1	—	—	—
Microtendipes pedellus gr.	6	—	—	—	—	—	—	—	—	1	—	—	—
Microtendipes rydalensis gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Paralauterborniella	8	—	—	—	—	—	—	—	—	—	—	—	—
Paratendipes albimanus	6	—	—	—	—	—	—	—	—	—	—	—	—
Phaenopsectra	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum	6	—	—	—	1	—	—	—	—	—	—	—	—
Polypedilum aviceps	4	1	6	14	2	1	15	7	8	3	1	—	1
Polypedilum fallax	6	—	—	—	—	—	—	1	—	—	—	—	—
Polypedilum flavum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum illinoense	7	—	—	—	—	—	—	—	—	2	—	—	—
Polypedilum laetum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	—	2	—	—	—	—	—	—
Polypedilum tritum	6	—	—	—	—	—	—	—	—	—	—	—	—
Stenochironomus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	—	—	—	—	—	—	—	—	—	—	—	—
Tribelos	7	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	—	—	—
Cladotanytarsus	5	—	—	1	—	—	—	—	—	—	—	—	—
Micropsectra	7	—	3	—	—	—	—	—	—	1	—	—	—
Micropsectra sp. A	7	2	—	—	—	—	—	—	—	—	—	—	—
Paratanytarsus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheotanytarsus	6	—	—	—	—	2	—	1	7	6	—	—	5
Rheotanytarsus exiguus gr.	6	1	3	—	—	—	—	7	—	—	—	6	—
Rheotanytarsus pellucidus	4	—	2	—	—	2	—	—	—	3	—	—	—
Stempellina	2	—	—	—	—	—	—	—	—	—	—	—	—
Stempellina sp. C	4	—	—	—	—	—	—	—	—	—	—	—	—
Stempellinella	4	1	1	—	—	—	—	—	—	2	—	—	—
Sublettea coffmani	4	—	—	—	—	—	—	—	2	—	—	—	—
Tanytarsus	6	—	—	—	—	—	—	—	—	—	—	—	—
Zavrelia	4	—	—	—	—	—	—	—	—	—	—	—	—
Dixidae													
Dixa	1	—	—	—	—	—	—	—	—	—	—	—	—
Simuliidae													
Simulium	5	3	2	2	2	—	—	1	—	—	—	2	—
Tipulidae	4	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Indiantown Run in Gap at Fort Indiantown Gap, Pa.				Indiantown Run above Memorial Lake near Indiantown, Pa.				Indiantown Run above Vesle Run at Indiantown, Pa.			
		7/30/02	8/2/03	8/3/04	8/9/05	7/31/02	8/7/03	7/29/04	8/3/05	7/31/02	8/1//03	7/29/04	8/3/05
Tipula	6	—	—	—	—	—	—	—	—	—	—	—	—
Antocha	3	—	—	—	—	3	2	4	2	—	—	—	—
Dicranota	3	2	—	—	—	—	—	—	—	—	—	—	—
Hexatoma	2	—	1	—	—	—	—	—	—	—	—	—	—
Limnophila	3	—	—	—	—	—	—	—	—	—	—	—	—
Limonia	6	—	—	—	—	—	—	—	—	—	—	—	—
Molophilus	4	—	—	—	—	—	—	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	—	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	—	—	—	—
Empididae	6	—	—	—	—	—	—	—	—	—	—	—	—
Chelifera	6	—	—	—	—	—	—	—	—	—	—	—	—
Clinocera	6	—	—	—	—	—	—	—	—	—	—	—	—
Hemerodromia	6	—	—	—	1	—	—	2	—	4	3	1	1
Stratiomyidae	7	—	—	—	—	—	—	—	—	—	—	—	—
Tabanidae													
Chrysops	5	—	—	—	—	—	—	—	—	—	—	—	—
Ephydridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Psychodidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Total taxa		29	34	34	28	26	22	26	25	28	20	21	22
Total number		112	133	196	123	108	103	132	140	141	109	136	121
Percent dominant taxa (single)		24	19	17	21	28	20	15	27	27	30	23	31
Total EPT Taxa		13	13	18	15	11	7	9	9	5	8	8	9
Total EPT		84	84	141	103	77	70	86	94	68	25	109	96
Percent EPT		75.00	63.16	71.94	81.30	71.30	67.96	65.15	67.86	48.23	22.94	80.15	79.34
HBI		2.31	3.92	2.77	3.64	4.12	3.89	4.2	4.31	5.4	4.35	4.99	4.46
Number Chironomidae taxa		6	10	6	7	4	5	6	6	10	3	1	4
Percent Chironomidae		6.25	16.54	10.71	8.13	5.56	19.42	16.67	15.00	17.73	4.59	4.41	6.61

Taxonomy	Tolerance score	Manada Creek along McLean Road near Manada Gap, Pa.				Manada Creek near Manada Gap, Pa.				Manada Creek below Manada Gap at Manada Gap, Pa.			
		8/12/02	8/15/03	7/28/04	8/15/05	8/1/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/6/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	—	—	1	—	—	—	2	—	—	—	1	—
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	—	—	—	—	—	—	—
NEMATODA	5	—	—	—	—	—	—	—	—	—	1	—	1
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	—	—	—	—	—	—	—	1
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculidae	5	—	1	—	—	—	—	—	—	13	15	19	—
Eclipidrilus	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	4
TUBIFICIDA													
Enchytraeidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Naididae	8	4	1	7	—	—	—	13	—	—	3	8	—
Nais	8	—	—	—	—	—	—	—	—	—	—	—	—
N. behningi	6	—	—	—	—	—	—	—	—	—	—	—	—
Pristina	8	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	—	—	—	—	3
Tubificidae w/ capilliform setae	10	—	—	—	—	—	2	—	—	2	2	—	—
Tubificidae w/o capilliform setae	10	—	—	—	—	—	—	1	—	—	—	—	—
LUMBRICINA	6	—	—	—	—	—	—	—	—	1	5	—	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	—	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	—	—	—	—	—	—	—	—	1	—	2	—
Physidae													
Physa	8	—	—	—	—	—	—	—	—	—	—	—	—
Planorbidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	—	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	—	—	—	—
Pisidiidae	6	—	1	1	—	—	5	—	—	—	—	—	—
Pisidium	6	—	—	—	—	—	—	—	—	—	—	—	—
Sphaerium	6	—	—	—	—	—	—	—	—	—	—	1	—
CHELICERATA													
ORIBATEI	8	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Manada Creek along McLean Road near Manada Gap, Pa.				Manada Creek near Manada Gap, Pa.				Manada Creek below Manada Gap at Manada Gap, Pa.			
		8/12/02	8/15/03	7/28/04	8/15/05	8/1/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/6/05
HYDRACHNIDIA	8	2	—	—	—	1	—	1	—	2	1	—	—
Hygrobatidae													
Atractides	8	—	—	—	—	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	—
Sperchonidae													
Sperchon	6	—	—	—	1	—	—	—	—	—	—	—	1
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticola	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	—
Lebertiidae													
Lebertia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	—	—	—	—
Lirceus	8	—	—	—	—	—	—	—	—	—	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	—	—	—	—
Gammaridae													
Gammarus	6	—	—	—	—	—	—	—	—	—	—	—	—
DECAPODA													
Cambaridae	6	—	—	—	—	1	—	—	—	—	—	—	—
Cambarus	6	—	—	—	—	—	1	1	—	—	—	—	—
Orconectes	6	—	—	—	—	—	—	—	—	—	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	—	—	—	—	—	—	—	—	—
Entomobryidae	10	—	—	—	—	—	—	—	—	—	1	—	—
Isotomidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Isotomurus	5	—	—	—	—	—	—	—	—	—	—	—	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebia	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebiodes	6	—	—	—	—	—	—	—	—	—	—	—	—
Paraleptophlebia	1	—	—	—	—	—	—	—	—	—	—	—	—
Ephemeridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Ephemera	2	—	—	—	—	—	—	—	—	—	—	—	—
Litobrancha recurvata	2	—	—	—	—	—	—	—	—	—	—	—	—
Caenidae													
Caenis	6	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerellidae	1	2	2	6	7	—	—	—	1	—	1	—	1
Attenella	1	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Manada Creek along McLean Road near Manada Gap, Pa.				Manada Creek near Manada Gap, Pa.				Manada Creek below Manada Gap at Manada Gap, Pa.			
		8/12/02	8/15/03	7/28/04	8/15/05	8/1/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/6/05
Drunella	0	—	—	—	—	—	—	1	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	—	—	—	3	—
Eurylophella	2	—	—	—	—	—	—	1	—	—	—	—	—
Serratella	2	—	—	—	—	—	—	—	—	—	1	—	—
Baetidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Acentrella	4	—	—	—	1	—	—	1	7	—	—	1	10
Acerpenna	5	—	—	—	—	—	—	—	—	—	—	—	—
Baetis	6	19	23	4	4	2	9	10	3	6	9	4	10
Baetis flavistriga	4	—	—	—	1	—	—	—	—	—	—	—	—
Plauditus	4	1	—	—	—	—	—	—	—	—	—	—	—
Isonychiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isonychia	2	2	6	13	20	15	3	7	18	4	3	7	9
Heptageniidae	4	—	—	—	2	—	—	—	—	—	—	—	1
Epeorus	0	—	—	—	—	1	—	—	—	—	—	—	—
Leucrocuta	1	1	—	—	—	—	—	—	—	1	1	—	—
Stenacron	7	—	—	—	—	—	—	—	—	—	—	—	—
Maccaffertium	3	4	—	—	—	—	—	—	—	—	—	—	—
Maccaffertium modestum	1	—	—	—	—	—	—	—	—	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	1	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	—	—	—	—	—	2	2	—	—	—	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	—	—	—	—	—	—	—	—
Gomphidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Lanthus	5	2	—	1	—	1	5	—	—	—	1	1	—
Stylogomphus	1	—	—	—	—	—	—	—	—	—	—	—	—
Libellulidae	2	—	—	—	—	—	—	—	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Calopteryx	6	—	—	—	—	—	—	—	—	—	—	—	—
Hetaerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Coenagrionidae	8	—	—	—	1	—	—	—	2	—	—	—	—
Argia	6	—	—	—	—	—	—	—	—	—	—	—	—
HEMIPTERA	6	—	—	—	—	—	—	—	—	—	—	—	—
Veliidae													
Microvelia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	1	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	—	—	—	—	—
Capniidae	3	—	—	—	—	—	—	—	—	—	—	—	—
Paracapnia	1	—	—	—	—	—	—	—	—	—	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	—	—	—	—	—
Leuctra	0	1	3	9	2	18	13	34	3	2	18	7	2
Nemouridae	2	—	—	—	—	—	—	—	—	—	—	—	—
Amphinemura	3	—	—	—	—	—	—	—	—	—	—	—	—
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Chloroperlidae	0	—	—	—	1	—	—	—	—	—	—	—	1
Alloperla	0	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Manada Creek along McLean Road near Manada Gap, Pa.				Manada Creek near Manada Gap, Pa.				Manada Creek below Manada Gap at Manada Gap, Pa.			
		8/12/02	8/15/03	7/28/04	8/15/05	8/1/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/6/05
Sweltsa	0	2	3	—	—	—	—	—	—	—	1	1	—
Peltoperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Tallaperla	0	1	1	2	—	—	—	—	—	1	—	—	—
Perlidae	3	—	—	—	2	—	—	—	6	—	—	—	2
Acroneuria	0	—	1	4	—	7	6	10	1	11	4	11	—
A. carolinensis	0	—	—	—	—	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	—	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	—	—	—	—	—
Neoperla	3	—	—	—	—	—	—	—	—	—	—	—	—
Perlesta	4	—	—	1	—	—	—	—	—	—	—	—	—
Perlodidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isoperla	2	—	—	—	—	—	—	—	—	—	—	—	—
Pteronarcyidae													
Pteronarcys	0	—	—	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	—	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	—	—	—	1	—	—	—	—	1	—	—	—
Psephenus	4	1	1	1	3	—	1	—	1	4	2	1	1
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	—
Elmidae	5	—	—	—	9	—	—	—	7	—	—	—	3
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	—
Dubiraphia	6	—	—	—	—	—	2	—	—	—	—	—	—
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus	5	—	—	—	—	—	—	—	—	—	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	—	—	—	—	—
Optioservus	4	3	5	1	4	1	5	1	2	3	4	4	5
Oulimnius	4	13	4	1	—	1	5	4	—	5	1	6	—
Promoresia	2	4	—	1	—	—	3	19	7	—	1	2	—
Stenelmis	5	6	1	10	7	—	—	—	1	—	—	2	—
Ptilodactylidae													
Anchytarsus	5	—	1	—	—	—	—	—	—	—	—	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	—	—	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	1
Corydalidae													
Corydalus	4	—	—	—	—	—	—	—	—	—	—	—	—
Nigronia	4	—	1	2	—	—	—	—	—	—	8	3	—
Sialidae													
Sialis	4	—	—	—	—	—	—	—	—	—	—	—	—
TRICHOPTERA	4	—	—	—	2	—	—	—	—	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	—	1	—	1	—	2	4	2	—	6	5	2

Taxonomy	Tolerance score	Manada Creek along McLean Road near Manada Gap, Pa.				Manada Creek near Manada Gap, Pa.				Manada Creek below Manada Gap at Manada Gap, Pa.			
		8/12/02	8/15/03	7/28/04	8/15/05	8/1/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/6/05
Hydroptilidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydroptila	6	—	—	—	—	—	—	—	—	—	—	—	—
Leucotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Ochrotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	2
Glossosoma	0	—	1	—	2	—	—	—	—	—	—	—	—
Philopotamidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Chimarra	4	—	—	—	—	—	—	—	—	—	—	—	—
C. aterrima	4	—	—	—	—	—	—	—	—	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	—
Dolophilodes	4	—	10	—	6	3	11	1	16	12	5	11	15
Wormaldia	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Lype	2	—	—	1	—	—	—	—	—	—	3	—	—
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	—	—
Dipseudopsidae													
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropodidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	—
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropus	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	—	—	18	—	—	—	11	—	—	—	3
Cheumatopsyche	5	63	28	32	7	9	3	8	65	18	8	9	—
Diplectrona	5	—	—	—	—	—	—	—	—	—	—	1	—
Hydropsyche	4	9	17	12	19	3	1	24	11	4	—	31	30
Hydropsyche morosa gr.	6	—	—	—	—	—	—	—	—	—	—	—	—
Phryganeidae													
Oligostomis	2	—	—	—	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	—	—	—	—	—	—	—	—	—	—
Lepidostomatidae													
Lepidostoma	1	—	1	—	—	—	—	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	—	—	—	—	—	—	—
Pycnopsyche	4	—	—	—	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	—	—	—	—	—	—	—	—	—	—	—
Goeridae	3	—	—	—	—	—	—	—	—	—	—	—	—
Goera	3	1	—	1	—	—	—	—	—	—	1	—	—
Leptoceridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Oecetis	5	—	—	—	—	—	—	—	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	—	3	—	—	—	—	—	—
Calamoceratidae													
Heteroplectron	3	—	—	1	—	—	—	—	—	—	—	—	—
Odontoceridae													
Psilotreta	0	—	1	—	—	—	—	—	—	—	—	—	—
LEPIDOPTERA	5	—	—	—	1	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Manada Creek along McLean Road near Manada Gap, Pa.				Manada Creek near Manada Gap, Pa.				Manada Creek below Manada Gap at Manada Gap, Pa.			
		8/12/02	8/15/03	7/28/04	8/15/05	8/1/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/6/05
Tortricidae													
Archips	5	—	—	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	—	—	—	—	—
Ceratopogonidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	—	—	—	—	—	—
Probezzia	6	—	—	—	—	—	—	—	—	—	—	—	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	—	—	—	—	—
Chironomidae													
Tanypodinae	7	1	—	1	1	—	—	—	—	1	—	—	—
Macropelopiini	6	—	—	—	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopia	6	—	—	—	—	—	—	—	—	—	—	—	—
Natarsiini													
Natarsia	8	—	—	—	—	—	—	—	—	—	—	—	—
Pentaneurini													
Ablabesmyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	—	—	—	—	—	—	—	—	—	—	5
Nilotanypus	6	—	—	—	—	—	—	—	—	—	—	—	—
Paramerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	—	—	—	—	1	—	—	—	—
Thienemannimyia gr.	6	4	—	—	—	12	7	—	—	7	3	3	—
Zavrelimyia	8	—	—	—	—	—	—	—	—	—	1	—	—
Diamesini													
Diamesa	5	—	—	—	—	—	—	—	—	—	—	—	—
Pagastia	1	—	—	—	—	—	—	—	—	—	1	—	1
Potthastia longimana	2	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiinae	5	—	—	—	—	—	—	—	—	—	—	—	1
Corynoneurini													
Corynoneura	4	—	1	—	—	—	—	—	—	1	—	—	—
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiini	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia	5	—	—	—	—	—	2	—	—	—	—	—	—
Brillia flaviforms	5	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus	7	—	—	1	—	—	—	—	1	—	—	—	1
Cricotopus/Orthocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus bicinctus	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	—	—	—	—	—	—
Diplocladius	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	—	—	—	—	—	—	—	—	1	—	—
Eukiefferiella brehmi gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella pseudomontana gr.	8	—	—	—	—	—	—	—	—	—	—	—	4
Heleniella	3	—	—	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Krenosmittia	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnophyes	8	—	—	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Manada Creek along McLean Road near Manada Gap, Pa.				Manada Creek near Manada Gap, Pa.				Manada Creek below Manada Gap at Manada Gap, Pa.			
		8/12/02	8/15/03	7/28/04	8/15/05	8/1/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/6/05
Orthocladius lignicola	6	—	—	—	—	—	—	—	—	—	—	—	—
Parachaetocladius	2	—	—	—	—	—	1	1	—	—	—	—	—
Paracricotopus	4	—	—	—	—	—	—	—	—	—	—	—	—
Parametriocnemus	5	2	—	1	1	4	7	3	—	—	1	—	—
Rheocricotopus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	—	—	—	—	—	—	—
Tvetenia bavarica gr.	4	2	3	—	1	—	5	—	—	—	—	4	—
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	—	—
Chironominae	5	—	—	—	1	—	—	—	—	—	—	—	—
Chironomini													
Chironomus	10	—	—	—	—	1	—	—	—	—	—	—	—
Cryptochironomus	8	—	1	—	—	—	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	—	—	—	—
Microtendipes pedellus gr.	6	—	1	—	—	2	1	—	—	—	—	—	—
Microtendipes rydalensis gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Paralauterborniella	8	—	—	—	—	—	—	—	—	—	—	—	—
Paratendipes albimanus	6	—	—	—	—	—	2	—	—	—	—	—	—
Phaenopsectra	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum	6	4	1	—	—	2	—	—	—	4	—	—	—
Polypedilum aviceps	4	—	1	—	2	1	2	1	4	2	2	4	—
Polypedilum fallax	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum flavum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum illinoense	7	—	—	—	—	—	—	—	—	—	2	—	—
Polypedilum laetum	6	1	—	—	—	—	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum tritum	6	—	—	—	—	—	—	—	—	—	—	—	—
Stenochironomus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	—	—	—	—	—	—	—	—	—	—	—	—
Tribelos	7	—	—	—	—	—	1	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	—	—	—
Cladotanytarsus	5	6	1	3	1	—	3	1	1	—	—	—	—
Micropsectra	7	3	—	2	—	2	—	4	—	—	—	—	—
Micropsectra sp. A	7	—	—	—	—	—	—	—	—	—	—	—	—
Paratanytarsus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheotanytarsus	6	15	—	—	—	1	—	—	1	2	—	—	—
Rheotanytarsus exiguus gr.	6	11	11	1	—	2	2	2	—	—	—	2	—
Rheotanytarsus pellucidus	4	—	—	—	—	—	—	—	—	—	—	—	—
Stempellina	2	—	—	—	—	—	2	—	—	—	—	—	—
Stempellina sp. C	4	—	—	—	—	—	—	—	—	—	—	—	—
Stempellinella	4	1	—	10	1	1	1	1	1	—	—	—	—
Sublettea coffmani	4	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsus	6	2	2	1	4	2	3	—	10	2	3	—	1
Zavrelia	4	—	—	—	—	—	—	—	—	—	—	—	—
Dixidae													
Dixa	1	—	—	—	—	—	—	—	—	—	—	—	—
Simuliidae													
Simulium	5	3	2	—	1	—	1	—	1	—	2	—	—
Tipulidae	4	—	—	—	—	—	—	—	1	—	—	—	—

Taxonomy	Tolerance score	Manada Creek along McLean Road near Manada Gap, Pa.				Manada Creek near Manada Gap, Pa.				Manada Creek below Manada Gap at Manada Gap, Pa.			
		8/12/02	8/15/03	7/28/04	8/15/05	8/1/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/6/05
Tipula	6	—	—	—	—	—	—	—	—	—	—	—	—
Antocha	3	—	2	1	—	—	—	2	—	1	—	1	2
Dicranota	3	—	—	—	—	—	1	—	—	1	—	—	—
Hexatoma	2	—	2	3	—	1	—	3	1	—	—	—	—
Limnophila	3	—	—	—	—	—	—	—	—	—	—	—	—
Limonia	6	—	—	—	—	—	—	—	—	—	—	—	—
Molophilus	4	—	—	—	—	—	—	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	—	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	—	—	—	1
Empididae	6	—	—	—	—	—	—	—	—	—	—	—	—
Chelifera	6	—	6	—	—	—	—	—	—	—	—	—	—
Clinocera	6	—	—	—	—	—	—	—	—	—	—	1	—
Hemerodromia	6	—	—	3	8	—	2	1	3	—	—	3	—
Stratiomyidae	7	—	—	—	—	—	—	—	—	—	—	—	—
Tabanidae													
Chrysops	5	—	—	—	—	—	—	—	—	—	—	—	—
Ephydridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Psychodidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Total taxa		33	36	33	35	25	36	30	30	27	35	31	30
Total number		196	148	139	144	94	125	164	190	112	122	159	124
Percent dominant taxa (single)		32	19	23	15	19	10	21	38	16	15	20	27
Total EPT Taxa		12	14	12	16	8	9	11	12	9	13	12	13
Total EPT		106	98	86	94	58	51	101	144	59	61	91	88
Percent EPT		54.08	66.22	61.87	65.28	61.70	40.80	61.59	76.32	52.68	50.00	57.23	70.97
HBI		4.96	4.13	3.93	3.64	3.25	3.12	3.1	4.13	3.82	3.31	3.48	4.27
Number Chironomidae taxa		12	9	8	8	11	14	7	7	7	8	4	6
Percent Chironomidae		26.53	14.86	14.39	8.33	31.91	31.20	7.93	10.00	16.96	11.48	8.18	10.48

Taxonomy	Tolerance score	Qureg Run at Fort Indiantown Gap, Pa.				Aires Run below Qureg Run at Fort Indiantown Gap, Pa.				Stony Creek near Fort Indiantown Gap, Pa.			
		8/13/02	8/25/03	8/4/04	8/4/05	8/15/02	8/25/03	8/4/04	8/4/05	8/15/02	8/26/03	8/16/04	8/11/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	2	4	2	1	3	—	8	—	—	—	—	—
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	—	—	—	—	—	—	—
NEMATODA	5	—	—	—	—	—	—	—	—	—	—	—	—
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	—	—	—	—	—	—	—	—
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Eclipidrilus	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	—
TUBIFICIDA													
Enchytraeidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Naididae	8	—	—	2	—	—	—	1	—	—	—	—	—
Nais	8	—	—	—	—	—	—	—	—	—	—	—	—
N. behningi	6	—	—	—	—	—	—	—	—	—	—	—	—
Pristina	8	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae w/ capilliform setae	10	1	3	—	—	—	—	—	—	—	—	—	—
Tubificidae w/o capilliform setae	10	—	—	—	—	—	—	—	—	—	—	—	—
LUMBRICINA	6	—	—	—	—	—	1	—	—	—	—	—	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	1	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	4	1	—	—	—	—	—	—	—	—	—	—
Physidae													
Physa	8	—	—	—	—	—	—	—	—	—	—	—	—
Planorbidae	6	1	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	—	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	—	—	—	—
Pisidiidae	6	—	—	1	1	—	—	—	—	—	—	—	—
Pisidium	6	—	—	—	—	—	1	—	—	—	—	—	—
Sphaerium	6	—	—	—	—	—	—	—	—	—	—	—	—
CHELICERATA													
ORIBATEI	8	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Qureg Run at Fort Indiantown Gap, Pa.				Aires Run below Qureg Run at Fort Indiantown Gap, Pa.				Stony Creek near Fort Indiantown Gap, Pa.			
		8/13/02	8/25/03	8/4/04	8/4/05	8/15/02	8/25/03	8/4/04	8/4/05	8/15/02	8/26/03	8/16/04	8/11/05
HYDRACHNIDIA	8	2	—	—	—	2	—	—	—	2	1	4	1
Hygrobatidae													
Atractides	8	—	—	—	1	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	—
Sperchonidae													
Sperchon	6	—	—	—	—	—	—	—	1	—	—	—	—
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	1
Torrenticola	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	—
Lebertiidae													
Lebertia	6	—	—	—	1	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	—	—	—	—
Lirceus	8	—	—	—	—	—	—	—	—	—	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	—	—	—	—
Gammaridae													
Gammarus	6	—	—	—	—	—	—	—	—	—	—	—	—
DECAPODA													
Cambaridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cambarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Orconectes	6	—	—	1	—	—	—	—	—	—	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	—	—	—	—	—	—	—	—	—
Entomobryidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Isotomidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Isotomurus	5	—	—	—	—	—	—	—	—	—	—	—	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebia	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebiodes	6	—	—	—	—	—	—	—	—	—	—	—	—
Paraleptophlebia	1	—	—	—	—	—	—	—	—	—	—	—	—
Ephemeridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Ephemera	2	—	—	—	—	—	—	—	—	—	—	—	—
Litobrancha recurvata	2	—	—	—	—	—	—	—	—	—	—	—	—
Caenidae													
Caenis	6	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerellidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Attenella	1	—	—	—	—	—	—	—	—	—	—	—	1

Taxonomy	Tolerance score	Qureg Run at Fort Indiantown Gap, Pa.				Aires Run below Qureg Run at Fort Indiantown Gap, Pa.				Stony Creek near Fort Indiantown Gap, Pa.			
		8/13/02	8/25/03	8/4/04	8/4/05	8/15/02	8/25/03	8/4/04	8/4/05	8/15/02	8/26/03	8/16/04	8/11/05
Drunella	0	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	—	—	—	—	—
Eurylophella	2	—	—	—	—	—	—	—	—	—	—	—	—
Serratella	2	—	—	—	—	—	—	—	—	—	—	—	—
Baetidae	5	—	—	—	11	—	—	—	1	—	—	—	—
Acentrella	4	—	—	—	—	—	1	—	—	—	—	—	—
Acerpenna	5	—	23	12	5	—	—	—	—	10	—	8	—
Baetis	6	—	45	15	—	14	11	3	—	—	9	1	—
Baetis flavistriga	4	—	—	—	—	—	—	—	—	—	—	—	—
Plauditus	4	—	—	—	—	—	—	—	—	—	—	—	—
Isonychiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isonychia	2	—	1	1	1	5	—	2	2	—	—	1	—
Heptageniidae	4	—	—	—	1	—	—	—	—	—	—	—	1
Epeorus	0	—	—	—	—	—	—	—	—	—	—	—	—
Leucrocuta	1	2	3	4	6	9	3	4	3	—	—	—	—
Stenacron	7	—	—	—	—	—	—	—	—	—	—	—	—
Maccaffertium	3	1	1	—	—	—	—	—	—	—	—	—	—
Maccaffertium modestum	1	—	—	—	—	—	—	—	—	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	—	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	1	—	—	—	—	—	—	—	—	—	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	—	—	—	—	—	—	—	1
Gomphidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Lanthus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stylogomphus	1	—	—	—	—	—	—	—	—	—	—	—	—
Libellulidae	2	—	—	—	—	—	—	—	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Calopteryx	6	—	—	—	—	—	—	—	—	—	—	—	—
Hetaerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Coenagrionidae	8	—	—	—	—	—	—	—	—	—	—	—	—
Argia	6	7	—	1	—	—	1	—	—	—	—	1	—
HEMIPTERA	6	—	—	—	—	—	—	—	—	—	—	—	—
Veliidae													
Microvelia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	—	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	—	—	—	—	—
Capniidae	3	—	—	—	—	—	—	—	—	—	—	—	—
Paracapnia	1	—	—	—	—	—	—	—	—	1	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	—	—	—	—	2
Leuctra	0	—	—	1	—	—	—	—	—	4	4	24	—
Nemouridae	2	—	—	—	—	—	—	—	—	—	—	—	1
Amphinemura	3	—	—	—	—	—	—	—	—	—	—	—	—
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Chloroperlidae	0	—	—	—	—	—	—	—	—	—	—	—	1
Alloperla	0	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Qureg Run at Fort Indiantown Gap, Pa.				Aires Run below Qureg Run at Fort Indiantown Gap, Pa.				Stony Creek near Fort Indiantown Gap, Pa.			
		8/13/02	8/25/03	8/4/04	8/4/05	8/15/02	8/25/03	8/4/04	8/4/05	8/15/02	8/26/03	8/16/04	8/11/05
Sweltsa	0	—	—	—	—	—	—	—	—	—	—	1	—
Peltoperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Tallaperla	0	—	—	—	—	—	—	—	—	—	1	3	3
Perlidae	3	—	—	—	—	—	—	—	1	—	—	2	—
Acroneuria	0	—	—	—	—	—	1	—	—	1	2	2	—
A. carolinensis	0	—	—	—	—	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	—	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	—	—	—	—	—
Neoperla	3	—	—	—	—	—	—	—	—	—	—	—	—
Perlesta	4	—	—	—	—	—	—	—	—	—	—	—	—
Perlodidae	2	—	—	—	—	—	—	—	—	—	—	—	1
Isoperla	2	—	—	—	—	—	—	—	—	—	—	1	—
Pteronarcyidae													
Pteronarcys	0	—	—	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	—	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenus	4	49	12	3	3	54	5	15	32	—	—	—	—
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	—
Elmidae	5	—	—	—	—	—	—	—	1	—	—	—	6
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	—
Dubiraphia	6	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus	5	2	—	—	—	—	—	—	—	—	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	—	—	1	—	—
Optioservus	4	2	9	18	15	23	7	45	15	—	—	—	—
Oulimnius	4	—	—	—	—	—	—	—	—	2	—	3	—
Promoresia	2	1	—	—	—	—	—	—	—	30	36	59	30
Stenelmis	5	10	47	55	30	24	3	32	18	—	—	—	—
Ptilodactylidae													
Anchytarsus	5	—	—	—	—	—	—	—	—	—	—	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	—	—	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Corydalidae													
Corydalus	4	—	1	—	—	—	—	—	—	—	—	—	—
Nigronia	4	—	—	—	—	—	—	—	1	—	2	2	—
Sialidae													
Sialis	4	—	—	—	—	—	—	—	—	—	—	—	—
TRICHOPTERA	4	—	—	—	—	—	—	—	3	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	—	—	—	—	—	—	—	—	1	—	—	—

Taxonomy	Tolerance score	Qureg Run at Fort Indiantown Gap, Pa.				Aires Run below Qureg Run at Fort Indiantown Gap, Pa.				Stony Creek near Fort Indiantown Gap, Pa.			
		8/13/02	8/25/03	8/4/04	8/4/05	8/15/02	8/25/03	8/4/04	8/4/05	8/15/02	8/26/03	8/16/04	8/11/05
Hydroptilidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydroptila	6	—	—	—	—	—	—	—	2	—	3	1	—
Leucotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Ochrotrichia	6	—	—	—	—	—	—	—	3	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	1
Glossosoma	0	—	—	—	—	—	—	—	1	—	—	—	—
Philopotamidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Chimarra	4	1	21	14	—	19	6	8	—	—	—	—	—
C. aterrima	4	—	—	—	12	—	—	—	2	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	—
Dolophilodes	4	—	—	—	—	—	6	1	—	1	6	1	—
Wormaldia	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Lype	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	—	—
Dipseudopsidae													
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropodidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	—
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropus	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	—	—	2	—	—	—	—	—	—	—	19
Cheumatopsyche	5	—	9	—	5	12	4	2	1	1	—	—	—
Diplectrona	5	—	—	—	—	—	1	1	—	5	6	6	—
Hydropsyche	4	—	—	—	5	2	1	1	3	—	1	12	2
Hydropsyche morosa gr.	6	—	—	—	—	—	—	—	—	—	—	—	—
Phryganeidae													
Oligostomis	2	—	—	—	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	—	—	—	—	—	—	2	5	1	3
Lepidostomatidae													
Lepidostoma	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	—	—	—	—	—	—	—
Pycnopsyche	4	—	—	—	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	—	—	1	—	—	—	—	—	—	—	—
Goeridae	3	—	—	—	—	—	—	—	—	—	—	—	—
Goera	3	—	—	—	—	—	—	—	—	—	—	—	—
Leptoceridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Oecetis	5	—	—	—	—	—	—	—	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	—	—	—	—	—	—	—	—
Calamoceratidae													
Heteroplectron	3	—	—	—	—	—	—	—	—	—	—	—	—
Odontoceridae													
Psilotreta	0	—	—	—	—	—	—	—	—	—	—	—	—
LEPIDOPTERA	5	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Qureg Run at Fort Indiantown Gap, Pa.				Aires Run below Qureg Run at Fort Indiantown Gap, Pa.				Stony Creek near Fort Indiantown Gap, Pa.			
		8/13/02	8/25/03	8/4/04	8/4/05	8/15/02	8/25/03	8/4/04	8/4/05	8/15/02	8/26/03	8/16/04	8/11/05
Tortricidae													
Archips	5	—	1	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	—	—	—	—	—
Ceratopogonidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	—	—	—	—	—	—
Probezzia	6	—	—	—	—	—	—	—	—	—	—	1	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	—	—	—	—	1
Chironomidae													
Tanypodinae	7	—	—	—	—	—	—	—	1	1	—	—	—
Macropelopiini	6	—	—	—	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopia	6	—	—	—	—	—	—	—	—	—	—	—	—
Natarsiini													
Natarsia	8	—	1	—	—	—	—	—	—	—	—	—	—
Pentaneurini													
Ablabesmyia	8	—	1	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	—	—	2	—	1	—	2	—	—	—	2
Nilotanypus	6	—	—	—	—	—	—	—	—	—	—	—	—
Paramerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	—	—	—	—	—	—	—	—	1
Thienemannimyia gr.	6	1	8	1	1	—	1	5	—	1	2	1	—
Zavrelimyia	8	—	—	—	—	—	—	—	—	—	—	1	—
Diamesini													
Diamesa	5	—	—	—	—	—	—	—	—	—	—	—	—
Pagastia	1	—	—	—	—	—	—	—	—	—	—	—	—
Potthastia longimana	2	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiinae	5	—	—	—	1	—	—	—	1	—	—	—	—
Corynoneurini													
Corynoneura	4	—	—	—	—	—	—	—	—	—	—	—	—
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiini	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia	5	—	—	—	—	—	—	—	—	—	1	—	—
Brillia flaviforms	5	—	—	—	1	—	—	—	1	—	—	—	—
Cricotopus	7	—	—	—	—	—	—	—	1	—	—	—	—
Cricotopus/Orthocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus bicinctus	7	—	5	—	—	—	—	—	1	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	—	—	—	—	—	—
Diplocladius	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	—	—	—	—	—	—	—	—	—	—	1
Eukiefferiella brehmi gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	—	—	—	3	4	—
Eukiefferiella pseudomontana gr.	8	—	—	—	—	—	—	—	—	—	—	—	—
Heleniella	3	—	—	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Krenosmittia	1	—	—	—	—	—	—	1	—	—	—	—	—
Limnophyes	8	—	—	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Qureg Run at Fort Indiantown Gap, Pa.				Aires Run below Qureg Run at Fort Indiantown Gap, Pa.				Stony Creek near Fort Indiantown Gap, Pa.			
		8/13/02	8/25/03	8/4/04	8/4/05	8/15/02	8/25/03	8/4/04	8/4/05	8/15/02	8/26/03	8/16/04	8/11/05
Orthocladius lignicola	6	—	—	—	—	—	—	—	—	—	—	—	—
Parachaetocladius	2	—	2	1	—	1	—	4	1	—	—	—	1
Paracricotopus	4	—	—	—	—	—	—	—	—	—	—	—	—
Parametriocnemus	5	—	4	—	—	—	3	—	2	5	6	4	3
Rheocricotopus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	1	—	—	—	—	—	—
Tvetenia bavarica gr.	4	—	1	—	—	1	1	—	—	5	25	1	1
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	—	—
Chironominae	5	—	—	—	—	—	—	—	—	—	—	—	—
Chironomini													
Chironomus	10	—	—	—	—	—	—	—	—	—	—	—	—
Cryptochironomus	8	—	—	—	—	—	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	—	—	—	—
Microtendipes pedellus gr.	6	—	—	—	—	—	—	—	—	2	—	—	—
Microtendipes rydalensis gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Paralauterborniella	8	—	—	—	—	—	—	—	—	—	—	—	—
Paratendipes albimanus	6	—	—	—	—	—	—	—	—	—	—	1	—
Phaenopsectra	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum	6	—	—	—	—	5	1	—	—	—	—	—	—
Polypedilum aviceps	4	—	1	1	9	—	6	—	14	6	2	6	9
Polypedilum fallax	6	—	—	—	1	—	1	—	—	—	—	—	—
Polypedilum flavum	6	—	2	—	—	—	—	—	—	—	—	—	—
Polypedilum illinoense	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum laetum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum tritum	6	—	—	—	—	—	—	—	—	—	—	1	—
Stenochironomus	5	2	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	—	—	—	—	—	—	—	—	—	—	—	—
Tribelos	7	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	—	—	—
Cladotanytarsus	5	—	—	—	—	—	—	—	2	—	—	—	—
Micropsectra	7	—	2	—	—	—	2	—	—	9	6	14	27
Micropsectra sp. A	7	—	—	—	—	—	—	—	—	—	—	—	—
Paratanytarsus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheotanytarsus	6	1	—	—	1	3	—	—	6	3	—	—	8
Rheotanytarsus exiguus gr.	6	—	5	—	—	—	4	1	—	—	—	—	—
Rheotanytarsus pellucidus	4	—	5	—	—	—	—	—	—	—	—	1	—
Stempellina	2	—	—	—	—	—	—	—	—	—	—	—	—
Stempellina sp. C	4	—	—	—	—	—	—	—	—	—	—	—	—
Stempellinella	4	—	2	—	7	—	3	—	1	1	1	1	2
Sublettea coffmani	4	—	—	—	—	—	—	—	2	—	—	—	—
Tanytarsus	6	1	15	—	8	1	—	—	1	3	—	—	—
Zavrelia	4	—	—	—	—	—	—	—	—	—	—	—	—
Dixidae													
Dixa	1	—	—	—	—	—	—	—	—	—	—	—	—
Simuliidae													
Simulium	5	—	2	—	—	—	29	1	—	—	17	1	1
Tipulidae	4	—	—	—	1	—	—	—	—	—	—	—	1

Taxonomy	Tolerance score	Qureg Run at Fort Indiantown Gap, Pa.				Aires Run below Qureg Run at Fort Indiantown Gap, Pa.				Stony Creek near Fort Indiantown Gap, Pa.			
		8/13/02	8/25/03	8/4/04	8/4/05	8/15/02	8/25/03	8/4/04	8/4/05	8/15/02	8/26/03	8/16/04	8/11/05
Tipula	6	—	2	1	—	—	—	—	—	—	—	—	—
Antocha	3	—	—	—	—	—	2	1	1	—	—	—	—
Dicranota	3	—	—	1	—	—	—	—	—	—	1	1	—
Hexatoma	2	—	—	—	—	—	—	—	—	—	—	—	—
Limnophila	3	—	—	—	—	—	—	—	—	—	—	—	—
Limonia	6	—	—	—	—	—	—	—	—	—	—	—	—
Molophilus	4	—	—	—	—	—	—	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	—	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	—	—	—	—
Empididae	6	—	—	—	—	—	—	—	—	—	—	—	—
Chelifera	6	—	—	—	—	—	—	—	—	—	—	—	—
Clinocera	6	—	—	—	—	—	—	—	—	—	—	—	1
Hemerodromia	6	—	—	1	—	1	—	1	2	—	—	—	—
Stratiomyidae	7	—	—	—	—	—	—	—	—	—	—	—	—
Tabanidae													
Chrysops	5	—	—	—	—	—	—	—	—	—	—	—	—
Ephydridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Psychodidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Total taxa		19	32	20	27	17	28	20	33	22	23	33	30
Total number		91	240	136	133	179	107	137	129	96	141	171	133
Percent dominant taxa (single)		54	20	40	29	30	27	33	34	31	26	35	38
Total EPT Taxa		3	7	6	10	6	9	8	11	9	9	14	11
Total EPT		4	103	47	49	61	34	22	19	26	37	64	35
Percent EPT		4.40	42.92	34.56	36.84	34.08	31.78	16.06	14.73	27.08	26.24	37.43	26.32
HBI		4.52	5.12	4.65	4.45	4.31	4.44	4.28	4.38	3.42	3.32	2.78	4.28
Number Chironomidae taxa		4	14	3	9	5	11	4	14	10	8	11	10
Percent Chironomidae		5.49	22.50	2.21	23.31	6.15	22.43	8.03	27.91	37.50	32.62	20.47	41.35

Taxonomy	Tolerance score	St. Joseph Springs Outflow at Fort Indiantown Gap, Pa.				Trout Run at Fort Indiantown Gap, Pa.				Trout Run near Inwood, Pa.			
		8/13/02	8/6/03	8/2/04	8/8/05	8/26/02	8/7/03	8/3/04	8/15/05	8/26/02	8/26/03	8/3/04	8/10/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	—	—	—	—	—	—	—	—	—	—	—	—
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	—	—	—	—	—	—	—
NEMATODA	5	—	—	—	—	—	—	—	—	—	—	1	—
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	—	—	5	—	—	—	—	—
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	4	—	—	—	—	—	—	—
Lumbriculidae	5	—	—	3	—	—	—	—	—	—	—	—	—
Eclipidrilus	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	—
TUBIFICIDA													
Enchytraeidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Naididae	8	—	—	—	—	—	1	—	—	—	—	—	—
Nais	8	—	—	—	4	—	—	—	—	—	—	—	3
N. behningi	6	—	—	—	—	—	—	—	—	—	—	—	—
Pristina	8	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae w/ capilliform setae	10	—	—	2	—	—	3	1	—	—	—	—	—
Tubificidae w/o capilliform setae	10	—	1	—	—	—	1	—	—	—	1	2	—
LUMBRICINA	6	—	—	—	—	—	—	—	—	—	—	—	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	—	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	—	—	—	—	—	—	—	—	1	—	—	—
Physidae													
Physa	8	—	—	—	—	—	—	—	—	—	—	—	—
Planorbidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	—	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	—	—	—	—
Pisidiidae	6	1	—	—	—	1	—	—	1	2	—	—	—
Pisidium	6	—	—	—	—	—	—	8	—	—	—	—	—
Sphaerium	6	—	—	—	—	—	3	—	—	—	—	6	—
CHELICERATA													
ORIBATEI	8	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	St. Joseph Springs Outflow at Fort Indiantown Gap, Pa.				Trout Run at Fort Indiantown Gap, Pa.				Trout Run near Inwood, Pa.			
		8/13/02	8/6/03	8/2/04	8/8/05	8/26/02	8/7/03	8/3/04	8/15/05	8/26/02	8/26/03	8/3/04	8/10/05
HYDRACHNIDIA	8	2	—	1	—	—	—	1	—	3	—	—	—
Hygrobatidae													
Atractides	8	—	—	—	—	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	—
Sperchonidae													
Sperchon	6	—	—	—	—	—	—	—	—	—	—	—	1
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticola	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	—
Lebertiidae													
Lebertia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	—	—	—	—
Lirceus	8	—	—	—	—	—	—	—	—	—	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	—	—	—	—
Gammaridae													
Gammarus	6	—	—	—	—	—	—	—	—	—	—	—	—
DECAPODA													
Cambaridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cambarus	6	1	—	1	1	—	1	1	—	—	—	—	—
Orconectes	6	—	—	—	—	—	—	—	—	—	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	—	—	—	—	—	—	—	—	—
Entomobryidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Isotomidae	5	—	—	—	—	1	—	1	1	—	—	—	—
Isotomurus	5	—	—	—	—	—	—	—	—	—	—	—	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebia	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebiodes	6	11	2	7	—	—	4	—	—	—	—	1	—
Paraleptophlebia	1	—	1	1	—	5	—	9	4	2	—	—	3
Ephemeridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Ephemera	2	—	—	—	—	—	—	—	—	—	—	—	—
Litobrancha recurvata	2	—	—	—	—	10	—	—	—	—	—	—	—
Caenidae													
Caenis	6	—	—	—	—	—	—	—	—	2	—	—	—
Ephemerellidae	1	—	—	—	—	—	—	—	2	—	—	—	2
Attenella	1	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	St. Joseph Springs Outflow at Fort Indiantown Gap, Pa.				Trout Run at Fort Indiantown Gap, Pa.				Trout Run near Inwood, Pa.			
		8/13/02	8/6/03	8/2/04	8/8/05	8/26/02	8/7/03	8/3/04	8/15/05	8/26/02	8/26/03	8/3/04	8/10/05
Drunella	0	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	—	—	—	—	—
Eurylophella	2	—	1	3	—	—	6	2	—	—	—	—	—
Serratella	2	—	—	—	—	—	—	—	—	—	—	—	—
Baetidae	5	—	—	—	6	—	—	—	9	—	—	—	—
Acentrella	4	—	—	—	2	—	—	—	—	1	1	3	1
Acerpenna	5	—	—	—	—	—	—	1	—	—	1	—	—
Baetis	6	5	7	7	—	—	2	8	—	5	3	15	7
Baetis flavistriga	4	—	—	—	—	—	—	—	—	—	—	—	—
Plauditus	4	—	—	—	—	—	—	—	—	1	—	—	—
Isonychiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isonychia	2	—	—	—	—	—	—	—	—	—	—	1	2
Heptageniidae	4	—	—	—	—	—	—	—	21	1	—	—	—
Epeorus	0	—	—	—	—	—	—	—	—	—	1	—	1
Leucrocuta	1	—	—	2	—	—	—	—	—	1	—	—	—
Stenacron	7	1	—	1	—	1	—	5	—	—	—	—	—
Maccaffertium	3	11	4	9	—	10	23	26	17	21	4	7	23
Maccaffertium modestum	1	—	—	—	—	—	—	—	—	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	2	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	—	—	—	—	—	—	—	—	—	—	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	—	—	—	—	—	—	—	—
Gomphidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Lanthus	5	1	1	1	—	1	2	—	—	—	—	1	—
Stylogomphus	1	—	—	—	—	—	—	—	—	—	1	—	—
Libellulidae	2	—	—	—	—	—	—	—	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Calopteryx	6	—	—	—	—	—	—	—	—	—	—	—	—
Hetaerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Coenagrionidae	8	—	—	—	—	—	—	—	—	—	—	—	—
Argia	6	—	—	—	—	—	—	—	—	—	—	—	—
HEMIPTERA	6	—	—	—	—	—	—	—	1	—	—	—	1
Veliidae													
Microvelia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	—	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	6	—	—	—	—
Capniidae	3	—	—	—	—	—	—	—	—	—	—	—	—
Paracapnia	1	4	—	—	—	—	—	—	—	—	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	—	—	—	—	—
Leuctra	0	6	16	6	15	7	16	38	34	—	—	10	3
Nemouridae	2	—	1	1	1	—	1	5	—	—	—	—	—
Amphinemura	3	—	1	1	—	—	—	—	—	—	—	—	—
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Chloroperlidae	0	—	—	—	—	5	4	3	—	—	—	—	—
Alloperla	0	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	St. Joseph Springs Outflow at Fort Indiantown Gap, Pa.				Trout Run at Fort Indiantown Gap, Pa.				Trout Run near Inwood, Pa.			
		8/13/02	8/6/03	8/2/04	8/8/05	8/26/02	8/7/03	8/3/04	8/15/05	8/26/02	8/26/03	8/3/04	8/10/05
Sweltsa	0	—	2	3	—	—	—	—	—	—	—	—	—
Peltoperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Tallaperla	0	1	2	—	3	—	—	—	—	—	—	—	—
Perlidae	3	—	—	—	5	—	—	—	—	—	—	—	5
Acroneuria	0	2	6	3	2	1	5	2	—	1	4	4	—
A. carolinensis	0	—	—	—	—	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	—	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	—	—	—	—	—
Neoperla	3	—	—	—	—	—	—	—	—	—	—	—	—
Perlesta	4	—	—	—	—	—	—	—	—	—	—	—	—
Perlodidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isoperla	2	—	—	—	—	—	—	—	—	—	—	—	—
Pteronarcyidae													
Pteronarcys	0	—	—	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	—	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	1	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	5	7	5	—	—	1	—	—	—	—	—	—
Psephenus	4	2	1	3	—	—	—	—	—	7	2	3	1
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	—
Elmidae	5	—	—	—	5	—	—	—	—	—	—	—	14
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	1
Dubiraphia	6	—	—	—	—	—	—	—	1	—	—	—	—
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	1
Macronychus	5	—	—	—	—	—	—	—	—	—	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	—	—	—	—	—
Optioservus	4	2	—	—	2	—	—	—	—	2	4	—	6
Oulimnius	4	3	1	6	—	—	1	—	—	6	1	5	—
Promoresia	2	—	—	—	—	—	—	—	—	9	4	15	2
Stenelmis	5	—	—	—	—	—	—	—	—	2	1	2	2
Ptilodactylidae													
Anchytarsus	5	—	—	—	—	—	—	—	—	—	—	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	—	—	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Corydalidae													
Corydalus	4	—	—	—	—	—	—	—	—	—	—	—	—
Nigronia	4	—	—	1	—	—	—	—	—	2	—	3	7
Sialidae													
Sialis	4	—	—	1	—	3	1	2	1	—	—	1	—
TRICHOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	—	—	1	—	—	1	—	—	—	—	—	2

Taxonomy	Tolerance score	St. Joseph Springs Outflow at Fort Indiantown Gap, Pa.				Trout Run at Fort Indiantown Gap, Pa.				Trout Run near Inwood, Pa.			
		8/13/02	8/6/03	8/2/04	8/8/05	8/26/02	8/7/03	8/3/04	8/15/05	8/26/02	8/26/03	8/3/04	8/10/05
Hydroptilidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydroptila	6	—	—	—	—	—	—	—	—	—	—	—	—
Leucotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Ochrotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Glossosoma	0	—	—	—	—	—	—	—	—	—	1	1	—
Philopotamidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Chimarra	4	—	—	—	—	—	—	—	—	3	1	—	—
C. aterrima	4	—	—	—	—	—	—	—	—	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	—
Dolophilodes	4	9	9	1	29	—	—	2	—	2	28	13	—
Wormaldia	2	—	2	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	2	—	—	—	—	—	—
Lype	2	—	—	—	—	—	—	—	—	2	—	1	1
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	—	—
Dipseudopsidae													
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropodidae	6	—	—	—	3	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	—
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropus	6	—	—	1	—	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	—	—	25	—	—	—	8	—	—	—	5
Cheumatopsyche	5	—	—	—	—	—	—	—	—	4	5	12	2
Diplectrona	5	5	14	28	—	1	4	5	5	1	1	2	—
Hydropsyche	4	2	4	8	32	—	—	1	3	2	5	41	17
Hydropsyche morosa gr.	6	—	—	—	—	—	—	—	—	—	—	—	—
Phryganeidae													
Oligostomis	2	—	—	—	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	—	—	—	—	—	—	1	1	1	—
Lepidostomatidae													
Lepidostoma	1	—	—	—	—	—	1	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	—	—	—	—	—	—	—
Pycnopsyche	4	—	—	—	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	—	—	—	—	—	—	—	—	—	—	—
Goeridae	3	—	—	—	—	—	—	—	—	—	—	—	—
Goera	3	—	—	—	—	—	—	—	—	—	—	—	—
Leptoceridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Oecetis	5	—	—	—	—	—	—	1	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	1	2	—	—	—	—	—	—
Calamoceratidae													
Heteroplectron	3	—	—	—	—	—	—	—	—	—	—	—	—
Odontoceridae													
Psilotreta	0	—	—	—	—	—	—	—	—	—	—	—	—
LEPIDOPTERA	5	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	St. Joseph Springs Outflow at Fort Indiantown Gap, Pa.				Trout Run at Fort Indiantown Gap, Pa.				Trout Run near Inwood, Pa.			
		8/13/02	8/6/03	8/2/04	8/8/05	8/26/02	8/7/03	8/3/04	8/15/05	8/26/02	8/26/03	8/3/04	8/10/05
Tortricidae													
Archips	5	—	—	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	1	—	—	—	—
Ceratopogonidae	6	—	—	—	—	1	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	—	—	—	—	—	—
Probezzia	6	—	—	—	—	—	—	—	—	—	—	—	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	—	—	—	—	—
Chironomidae													
Tanypodinae	7	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopiini	6	—	—	—	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	1	—	—	—	—	—	—	—	—	—	—
Macropelopia	6	—	—	—	—	—	—	—	—	—	—	—	—
Natarsiini													
Natarsia	8	—	—	—	—	—	—	—	—	—	—	—	—
Pentaneurini													
Ablabesmyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	—	—	1	—	2	—	—	—	—	1	1
Nilotanypus	6	—	—	—	—	—	1	—	—	—	—	—	—
Paramerina	6	—	—	—	—	1	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	—	—	—	—	—	—	—	—	—
Thienemannimyia gr.	6	4	6	1	—	1	5	2	—	1	2	—	—
Zavrelimyia	8	—	—	—	—	2	—	—	2	—	—	—	—
Diamesini													
Diamesa	5	—	—	—	—	—	—	—	—	—	5	—	—
Pagastia	1	—	—	—	—	—	—	—	—	—	—	—	—
Potthastia longimana	2	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiinae	5	—	—	—	—	—	—	—	—	—	—	—	—
Corynoneurini													
Corynoneura	4	1	—	—	—	1	—	—	—	—	—	—	—
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiini	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia	5	—	—	—	—	—	5	—	—	—	—	—	—
Brillia flaviforms	5	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus/Orthocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus bicinctus	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	—	—	—	—	—	—
Diplocladius	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella brehmi gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella pseudomontana gr.	8	—	—	—	—	—	—	—	—	—	—	—	—
Heleniella	3	—	—	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Krenosmittia	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnophyes	8	—	—	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	St. Joseph Springs Outflow at Fort Indiantown Gap, Pa.				Trout Run at Fort Indiantown Gap, Pa.				Trout Run near Inwood, Pa.			
		8/13/02	8/6/03	8/2/04	8/8/05	8/26/02	8/7/03	8/3/04	8/15/05	8/26/02	8/26/03	8/3/04	8/10/05
Orthocladius lignicola	6	—	—	—	—	—	2	—	—	—	—	—	—
Parachaetocladius	2	—	—	—	—	—	—	—	—	—	—	—	—
Paracricotopus	4	—	—	—	—	—	—	—	—	—	—	—	—
Parametriocnemus	5	2	2	3	1	6	3	1	—	—	1	—	—
Rheocricotopus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	—	—	—	—	—	—	—
Tvetenia bavarica gr.	4	—	—	1	—	—	2	1	—	—	5	—	2
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	—	—
Chironominae	5	—	—	—	—	—	—	—	—	—	—	—	—
Chironomini													
Chironomus	10	—	—	—	—	—	—	—	—	—	—	—	—
Cryptochironomus	8	—	—	—	—	1	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	—	—	—	—
Microtendipes pedellus gr.	6	—	—	—	—	—	—	—	—	2	—	—	2
Microtendipes rydalensis gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Paralauterborniella	8	—	—	—	—	1	—	—	—	—	—	—	—
Paratendipes albimanus	6	—	—	—	—	4	—	—	—	—	—	—	—
Phaenopsectra	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum	6	1	—	—	—	8	1	—	—	9	—	1	—
Polypedilum aviceps	4	—	—	—	4	—	—	—	—	—	13	1	5
Polypedilum fallax	6	—	1	—	—	—	—	—	—	—	—	—	—
Polypedilum flavum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum illinoense	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum laetum	6	—	—	—	—	1	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	1	—	—	—	—	—	—	—
Polypedilum tritum	6	—	—	1	—	—	—	—	—	—	—	—	—
Stenochironomus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	—	—	—	—	—	—	—	—	—	—	—	—
Tribelos	7	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	—	—	—
Cladotanytarsus	5	—	—	—	—	—	—	—	—	—	—	—	—
Micropsectra	7	2	3	1	—	1	3	1	—	3	2	—	2
Micropsectra sp. A	7	—	—	—	—	—	—	—	—	—	—	—	—
Paratanytarsus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheotanytarsus	6	1	—	—	—	2	—	—	3	—	—	—	—
Rheotanytarsus exiguus gr.	6	1	1	—	—	—	—	2	—	6	5	4	—
Rheotanytarsus pellucidus	4	—	—	—	—	—	3	1	—	2	—	—	—
Stempellina	2	—	—	—	—	—	—	—	—	—	—	—	—
Stempellina sp. C	4	—	—	—	—	—	—	—	—	—	—	—	—
Stempellinella	4	2	—	1	—	8	—	6	—	2	2	3	1
Sublettea coffmani	4	—	—	—	—	—	—	—	—	1	—	—	1
Tanytarsus	6	—	7	2	1	4	—	3	—	—	—	—	—
Zavrelia	4	—	—	—	—	4	—	—	—	—	—	—	—
Dixidae													
Dixa	1												
Simuliidae													
Simulium	5	—	—	1	—	—	1	1	—	1	6	—	—
Tipulidae	4	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	St. Joseph Springs Outflow at Fort Indiantown Gap, Pa.				Trout Run at Fort Indiantown Gap, Pa.				Trout Run near Inwood, Pa.			
		8/13/02	8/6/03	8/2/04	8/8/05	8/26/02	8/7/03	8/3/04	8/15/05	8/26/02	8/26/03	8/3/04	8/10/05
Tipula	6	—	—	—	—	—	—	—	1	—	—	—	—
Antocha	3	—	—	—	—	—	—	—	—	—	1	—	—
Dicranota	3	—	3	—	3	—	3	—	—	1	3	3	—
Hexatoma	2	1	2	2	—	—	—	—	—	—	—	1	—
Limnophila	3	—	—	—	—	—	—	—	—	—	—	—	—
Limonia	6	—	—	—	—	2	—	—	—	—	—	—	—
Molophilus	4	—	—	—	—	—	—	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	—	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	1	—	—	8
Empididae	6	—	—	—	—	—	—	—	1	—	—	—	—
Chelifera	6	2	2	2	—	—	1	—	—	—	—	—	—
Clinocera	6	—	—	—	—	—	—	—	—	—	—	—	1
Hemerodromia	6	—	—	—	3	—	—	—	—	—	1	4	1
Stratiomyidae	7	—	—	—	—	—	—	—	—	—	—	—	—
Tabanidae													
Chrysops	5	—	—	—	—	2	1	—	—	—	—	—	—
Ephydridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Psychodidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Total taxa		29	30	37	21	34	36	30	21	36	32	32	35
Total number		91	111	122	148	103	118	145	124	113	116	169	137
Percent dominant taxa (single)		12	14	23	23	10	19	26	29	19	24	24	19
Total EPT Taxa		11	15	17	11	9	13	14	10	16	13	14	14
Total EPT		57	72	83	123	41	71	108	103	50	56	112	74
Percent EPT		62.64	64.86	68.03	83.11	39.81	60.17	74.48	84.68	44.25	48.28	66.27	54.01
HBI		3.54	2.71	2.98	3.87	4.29	3.46	2.78	2.85	4.03	3.06	3.48	3.97
Number Chironomidae taxa		8	7	7	4	16	10	8	2	8	8	5	7
Percent Chironomidae		15.38	18.92	8.20	4.73	44.66	22.88	11.72	4.03	23.01	30.17	5.92	10.22

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Manada Gap, Pa.				Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.				Unnamed Tributary to Manada Creek at Rt 443 near Manada Gap, Pa.			
		8/12/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/9/05	8/14/02	8/6/03	8/6/04	8/16/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	—	—	1	—	—	—	—	—	—	—	1	—
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	—	—	—	—	—	—	—
NEMATODA	5	—	—	—	—	—	—	1	—	—	—	—	—
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	—	—	—	—	—	—	—	—
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculidae	5	1	—	1	—	—	—	1	—	—	16	7	—
Eclipidrilus	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	6
TUBIFICIDA													
Enchytraeidae	10	—	—	—	—	—	1	—	—	—	—	—	—
Naididae	8	—	5	2	—	4	1	4	—	2	4	120	3
Nais	8	—	—	—	1	—	—	—	—	—	—	—	1
N. behningi	6	—	—	—	—	—	—	—	3	—	—	—	4
Pristina	8	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	1	—	—	—	—
Tubificidae w/ capilliform setae	10	1	—	—	—	—	—	—	—	1	—	—	—
Tubificidae w/o capilliform setae	10	—	—	1	—	—	—	—	—	2	—	—	—
LUMBRICINA	6	—	—	—	—	—	—	—	—	—	—	—	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	—	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	—	—	—	—	—	—	—	—	1	—	—	—
Physidae													
Physa	8	—	—	—	—	—	—	—	—	—	—	—	—
Planorbidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	—	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	—	—	—	—
Pisidiidae	6	—	2	—	1	—	9	—	3	1	1	—	1
Pisidium	6	—	—	—	—	—	—	12	—	—	—	—	—
Sphaerium	6	—	—	3	—	—	—	—	—	—	—	—	—
CHELICERATA													
ORIBATEI	8	—	—	—	—	—	—	—	1	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Manada Gap, Pa.				Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.				Unnamed Tributary to Manada Creek at Rt 443 near Manada Gap, Pa.			
		8/12/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/9/05	8/14/02	8/6/03	8/6/04	8/16/05
HYDRACHNIDIA	8	—	—	—	5	2	—	1	—	1	—	8	—
Hygrobatidae													
Atractides	8	—	—	—	—	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	—
Sperchonidae													
Sperchon	6	—	—	—	—	—	—	—	—	—	—	—	1
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticola	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	—
Lebertiidae													
Lebertia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	1	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	—	—	—	—
Lirceus	8	—	—	—	—	—	—	—	—	—	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	—	—	—	—
Gammaridae													
Gammarus	6	—	—	—	—	—	—	—	—	—	—	—	—
DECAPODA													
Cambaridae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cambarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Orconectes	6	—	—	—	—	—	—	—	—	—	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	—	—	—	—	—	—	—	—	—
Entomobryidae	10	—	—	—	—	—	1	—	—	—	—	—	—
Isotomidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Isotomurus	5	—	—	—	—	—	—	—	—	—	—	—	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebia	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebiodes	6	—	—	—	—	—	—	—	—	—	—	—	—
Paraleptophlebia	1	1	—	3	—	—	—	2	—	—	—	—	—
Ephemeridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Ephemera	2	—	—	—	—	—	—	—	—	—	—	—	—
Litobrancha recurvata	2	—	—	—	—	—	—	—	—	—	—	—	—
Caenidae													
Caenis	6	6	—	—	—	—	—	—	—	—	—	—	—
Ephemerellidae	1	—	—	3	3	1	—	—	4	—	—	1	4
Attenella	1	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Manada Gap, Pa.				Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.				Unnamed Tributary to Manada Creek at Rt 443 near Manada Gap, Pa.			
		8/12/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/9/05	8/14/02	8/6/03	8/6/04	8/16/05
Drunella	0	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	—	—	—	—	—
Eurylophella	2	1	1	6	—	—	—	1	—	—	—	—	—
Serratella	2	1	—	—	—	—	—	—	—	—	—	—	—
Baetidae	5	—	—	—	3	1	—	—	—	—	—	—	—
Acentrella	4	—	—	—	—	—	—	—	—	—	—	—	1
Acerpenna	5	—	—	—	1	—	—	—	—	—	—	—	—
Baetis	6	8	6	3	—	12	2	—	—	2	7	14	10
Baetis flavistriga	4	—	—	—	—	—	—	—	—	—	—	—	—
Plauditus	4	—	—	1	—	—	—	—	—	—	—	—	—
Isonychiidae	2	—	—		1	—	—	—	—	—	—	—	—
Isonychia	2	1	—	3	—	—	—	—	4	8	2	—	1
Heptageniidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Epeorus	0	—	—	—	—	—	—	—	1	—	—	—	—
Leucrocuta	1	1	1	—	—	—	—	—	—	—	—	—	—
Stenacron	7	—	—	—	—	—	—	—	—	1	—	1	—
Maccaffertium	3	16	2	16	2	10	14	10	15	34	5	6	22
Maccaffertium modestum	1	—	—	—	—	—	—	—	—	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	—	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	—	—	—	—	—	—	—	1	—	—	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	1	—	—	—	—	—	—	—
Gomphidae	4	1	—	—	1	—	—	—	—	—	—	—	—
Lanthus	5	—	—	—	—	—	—	2	—	1	—	—	—
Stylogomphus	1	—	—	—	—	—	—	—	—	—	—	—	—
Libellulidae	2	—	—	—	—	—	—	—	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Calopteryx	6	11	—	—	—	—	—	—	—	—	—	—	—
Hetaerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Coenagrionidae	8	—	—	6	5	—	—	—	—	—	—	—	1
Argia	6	1	1	—	—	—	—	—	—	—	—	—	—
HEMIPTERA	6	—	—	—	—	—	—	—	—	—	—	—	—
Veliidae													
Microvelia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	—	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	2	—	—	—	—
Capniidae	3	—	—	—	1	—	—	—	—	—	—	—	—
Paracapnia	1	—	—	—	—	—	—	—	—	—	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	—	—	—	—	—
Leuctra	0	7	6	16	—	17	14	17	1	6	—	2	—
Nemouridae	2	—	—	—	—	—	—	—	—	—	—	—	—
Amphinemura	3	—	—	—	—	—	—	—	—	—	—	—	—
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Chloroperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Alloperla	0	—	—	—	—	—	—	1	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Manada Gap, Pa.				Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.				Unnamed Tributary to Manada Creek at Rt 443 near Manada Gap, Pa.			
		8/12/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/9/05	8/14/02	8/6/03	8/6/04	8/16/05
Sweltsa	0	—	—	—	—	—	—	—	—	—	—	—	—
Peltoperlidae	0	—	—	—	—	—	—	—	1	—	—	—	—
Tallaperla	0	—	—	—	1	7	1	—	—	—	—	—	—
Perlidae	3	—	—	—	—	—	—	—	2	—	—	—	2
Acroneuria	0	1	—	1	—	4	8	2	—	2	1	1	—
A. carolinensis	0	—	—	—	—	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	—	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	1	—	—	—	—
Neoperla	3	—	—	—	—	—	—	—	—	—	—	—	—
Perlesta	4	—	—	—	—	—	—	—	—	—	—	—	—
Perlodidae	2	—	—	—	2	—	—	—	1	—	—	1	—
Isoperla	2	—	—	—	—	—	—	—	—	—	—	—	—
Pteronarcyidae													
Pteronarcys	0	—	1	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	—	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	—	—	1	—	—	—	—	—	1	—	—	—
Psephenus	4	—	—	1	—	—	—	—	—	1	—	—	—
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	—
Elmidae	5	—	—	—	1	—	—	—	1	—	—	—	—
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	2
Dubiraphia	6	—	2	1	—	—	—	—	—	—	—	—	—
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus	5	—	—	—	—	—	—	—	—	—	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	—	—	1	—	—
Optioservus	4	4	—	—	2	—	1	—	2	4	3	1	1
Oulimnius	4	—	1	5	—	5	3	6	—	—	1	1	—
Promoresia	2	1	22	79	36	—	1	5	—	9	8	29	12
Stenelmis	5	—	—	—	—	—	1	1	1	—	—	2	—
Ptilodactylidae													
Anchytarsus	5	—	—	—	—	—	—	—	—	—	1	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	—	—	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Corydalidae													
Corydalus	4	—	—	—	—	—	—	—	—	—	—	—	—
Nigronia	4	1	—	1	—	—	4	1	1	5	7	10	9
Sialidae													
Sialis	4	—	1	—	—	—	1	—	—	—	—	—	—
TRICHOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	—	—	1	—	—	1	3	—	—	—	2	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Manada Gap, Pa.				Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.				Unnamed Tributary to Manada Creek at Rt 443 near Manada Gap, Pa.			
		8/12/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/9/05	8/14/02	8/6/03	8/6/04	8/16/05
Hydroptilidae	6	—	—	—	1	—	—	—	—	—	—	—	—
Hydroptila	6	2	—	—	—	—	—	—	—	—	—	—	—
Leucotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Ochrotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	1
Glossosoma	0	—	—	—	—	—	—	2	—	—	3	1	—
Philopotamidae	4	—	—	—	—	—	—	—	—	—	—	—	—
Chimarra	4	—	—	—	—	—	—	—	—	—	2	—	—
C. aterrima	4	—	—	—	—	—	—	—	—	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	—
Dolophilodes	4	—	—	—	—	4	4	1	3	6	13	6	2
Wormaldia	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	—	—	2	—	—	—	—
Lype	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	—	—
Dipseudopsidae													
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropodidae	6	1	—	—	—	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	—
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropus	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	1	—	7	—	—	—	10	—	—	—	10
Cheumatopsyche	5	—	1	7	—	6	2	—	8	11	15	12	4
Diplectrona	5	—	—	3	—	4	10	18	—	—	—	4	—
Hydropsyche	4	—	—	1	—	2	—	15	2	2	2	23	15
Hydropsyche morosa gr.	6	—	—	—	—	—	—	—	—	—	—	—	—
Phryganeidae													
Oligostomis	2	—	1	2	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	2	—	—	—	—	—	—	1	4	—
Lepidostomatidae													
Lepidostoma	1	—	—	—	—	1	—	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	1	—	—	—	—	—	—
Pycnopsyche	4	—	—	—	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	—	—	—	—	—	—	—	—	—	—	—
Goeridae	3	—	—	—	1	—	—	—	—	—	—	—	—
Goera	3	—	—	—	—	—	—	—	—	—	—	—	—
Leptoceridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Oecetis	5	—	—	1	—	—	—	—	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	—	—	—	—	—	—	—	—
Calamoceratidae													
Heteroplectron	3	—	—	—	—	—	—	—	—	—	—	—	—
Odontoceridae													
Psilotreta	0	—	—	2	—	—	2	2	—	—	—	—	—
LEPIDOPTERA	5	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Manada Gap, Pa.				Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.				Unnamed Tributary to Manada Creek at Rt 443 near Manada Gap, Pa.			
		8/12/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/9/05	8/14/02	8/6/03	8/6/04	8/16/05
Tortricidae													
Archips	5	—	—	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	—	—	—	—	—
Ceratopogonidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	—	—	—	—	—	—
Probezzia	6	—	—	—	—	—	1	—	—	—	—	—	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	—	—	—	—	—
Chironomidae													
Tanypodinae	7	—	—	—	1	—	—	—	—	—	—	—	1
Macropelopiini	6	—	—	1	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopia	6	—	—	—	—	—	—	—	—	—	—	—	—
Natarsiini													
Natarsia	8	—	—	—	—	—	—	—	1	—	—	—	—
Pentaneurini													
Ablabesmyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	—	—	—	—	—	—	1	—	—	—	—
Nilotanypus	6	—	—	—	—	—	—	—	—	—	—	—	—
Paramerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	1	—	—	—	1	1	—	3	—
Thienemannimyia gr.	6	5	2	6	1	—	1	—	3	—	2	—	—
Zavrelimyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Diamesini													
Diamesa	5	—	—	—	—	—	—	—	—	—	6	—	1
Pagastia	1	—	1	—	—	—	1	—	—	—	3	—	—
Potthastia longimana	2	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiinae	5	—	—	—	1	—	—	1	1	—	—	—	—
Corynoneurini													
Corynoneura	4	—	1	—	—	—	—	—	—	—	—	—	—
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiini	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia flaviforms	5	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus	7	—	—	—	2	—	—	—	—	—	—	—	—
Cricotopus/Orthocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus bicinctus	7	—	1	2	—	—	—	—	—	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	1	—	—	—	—	—
Diplocladius	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	1	—	31	—	—	—	1	—	—	4	—
Eukiefferiella brehmi gr.	4	—	2	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	1	—	—	—	—	—
Eukiefferiella pseudomontana gr.	8	—	—	—	1	—	—	—	—	—	—	—	—
Heleniella	3	—	1	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Krenosmittia	1	—	—	1	—	—	—	—	—	—	—	—	—
Limnophyes	8	—	—	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	1	—	—	—	1	—	—	—	—	—	—	1

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Manada Gap, Pa.				Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.				Unnamed Tributary to Manada Creek at Rt 443 near Manada Gap, Pa.			
		8/12/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/9/05	8/14/02	8/6/03	8/6/04	8/16/05
Orthocladius lignicola	6	—	—	—	—	—	—	2	5	—	—	1	—
Parachaetocladius	2	—	—	—	2	—	—	—	—	—	—	—	—
Paracricotopus	4	—	—	—	—	—	—	—	—	—	—	—	—
Parametriocnemus	5	2	1	9	—	—	1	1	2	—	1	2	—
Rheocricotopus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	—	—	—	—	—	—	—
Tvetenia bavarica gr.	4	—	—	8	1	2	1	2	—	1	4	3	—
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	—	—
Chironominae	5	—	—	—	1	—	—	—	—	—	—	—	—
Chironomini													
Chironomus	10	—	—	—	—	—	—	—	—	—	—	—	—
Cryptochironomus	8	—	—	—	—	—	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	—	—	—	—
Microtendipes pedellus gr.	6	—	—	—	—	—	—	—	1	—	—	—	—
Microtendipes rydalensis gr.	4	—	—	—	—	—	—	—	—	—	—	—	1
Paralauterborniella	8	—	—	—	—	—	—	—	—	—	—	—	—
Paratendipes albimanus	6	—	—	—	—	—	—	—	—	—	—	—	—
Phaenopsectra	7	—	—	—	—	—	—	—	—	—	—	—	1
Polypedilum	6	—	—	—	1	4	—	1	1	—	—	—	—
Polypedilum aviceps	4	—	3	3	6	—	1	2	13	—	5	—	—
Polypedilum fallax	6	—	—	1	—	—	—	—	—	—	—	—	—
Polypedilum flavum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum illinoense	7	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum laetum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum tritum	6	—	—	1	—	—	—	—	—	—	—	—	—
Stenochironomus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	—	—	—	—	—	1	—	—	—	—	—	—
Tribelos	7	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	—	—	—
Cladotanytarsus	5	1	—	1	5	—	—	—	1	—	—	—	1
Micropsectra	7	5	3	—	—	2	6	—	—	1	—	3	17
Micropsectra sp. A	7	—	—	—	—	—	—	—	—	—	—	—	—
Paratanytarsus	6	—	—	1	—	—	—	—	—	—	—	—	—
Rheotanytarsus	6	9	—	—	14	5	—	—	5	2	—	—	—
Rheotanytarsus exiguus gr.	6	5	3	2	—	3	8	1	—	—	18	2	—
Rheotanytarsus pellucidus	4	—	—	—	—	—	—	—	—	—	1	1	—
Stempellina	2	—	—	—	—	—	—	—	—	—	—	—	—
Stempellina sp. C	4	—	1	—	—	—	—	—	—	—	—	—	—
Stempellinella	4	5	13	10	10	1	—	—	5	—	2	—	1
Sublettea coffmani	4	—	3	—	—	—	—	—	—	—	—	—	—
Tanytarsus	6	—	—	2	28	1	1	1	18	—	1	—	2
Zavrelia	4	—	—	—	—	—	—	—	—	—	—	—	—
Dixidae													
Dixa	1	—	—	—	—	—	—	—	—	—	—	—	—
Simuliidae													
Simulium	5	—	1	3	—	—	1	—	—	—	—	2	—
Tipulidae	4	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Manada Gap, Pa.				Tributary along Horseshoe Trail to Manada Creek at Manada Gap, Pa.				Unnamed Tributary to Manada Creek at Rt 443 near Manada Gap, Pa.			
		8/12/02	8/5/03	7/28/04	8/9/05	8/1/02	8/13/03	8/6/04	8/9/05	8/14/02	8/6/03	8/6/04	8/16/05
Tipula	6	—	—	—	—	—	—	—	—	1	—	—	—
Antocha	3	1	—	1	1	1	—	1	—	—	2	2	5
Dicranota	3	1	—	—	—	—	3	—	—	—	—	—	—
Hexatoma	2	—	1	—	—	—	—	2	1	—	—	—	—
Limnophila	3	—	—	—	—	—	—	—	—	—	—	—	—
Limonia	6	—	—	—	—	—	—	—	—	—	—	—	—
Molophilus	4	—	—	—	—	—	—	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	1	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	—	—	—	—
Empididae	6	—	—	—	—	—	—	1	—	—	—	—	—
Chelifera	6	—	—	—	—	1	2	1	—	—	3	2	—
Clinocera	6	—	—	—	—	—	—	—	1	—	—	—	—
Hemerodromia	6	—	—	—	1	—	—	—	1	—	—	—	1
Stratiomyidae	7	—	—	—	—	—	—	—	1	—	—	—	—
Tabanidae													
Chrysops	5	1	1	1	—	—	—	—	—	—	—	—	—
Ephydridae	6	—	—	—	—	—	—	1	—	—	—	—	—
Psychodidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Total taxa		31	33	46	38	26	35	37	43	26	31	34	33
Total number		103	93	226	184	102	111	127	134	107	141	282	145
Percent dominant taxa (single)		15	24	35	45	17	13	14	20	32	13	43	18
Total EPT Taxa		12	9	17	11	12	11	12	15	9	10	14	11
Total EPT		46	20	71	23	69	59	74	55	72	51	78	72
Percent EPT		44.66	21.51	31.42	11.96	67.65	53.15	58.27	41.04	67.29	36.17	27.66	49.66
HBI		4.55	3.82	3.15	4.39	3.27	2.64	2.8	4.44	3.22	3.89	5.4	4.44
Number Chironomidae taxa		8	14	14	16	8	9	10	15	4	10	8	9
Percent Chironomidae		32.04	38.71	21.24	57.61	18.63	18.92	10.24	44.03	4.67	30.50	6.74	17.93

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Sand Beach, Pa.				Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.				Vesle Run at Indiantown, Pa.			
		8/1/402	8/13/03	8/6/04	8/15/05	7/30/02	8/6/03	8/2/04	8/8/05	7/31/02	8/11/03	7/29/04	8/3/05
PLATYHELMINTHES													
TURBELLARIA													
TRICLADIDA													
Planariidae	1	1	—	8	—	—	—	—	—	—	1	—	—
NEMERTEA													
ENOPLA													
HOPLONEMERTEA													
Tetrastemmatidae													
Prostoma	8	—	—	—	—	—	—	—	—	—	4	1	3
NEMATODA	5	1	—	—	—	—	—	—	—	—	—	—	—
ANNELIDA													
BRANCHIOBDELLAE	6	—	—	—	—	—	—	—	—	—	—	—	—
OLIGOCHAETA													
LUBRICULIDA	5	—	—	—	—	—	—	—	—	—	—	—	—
Lumbriculidae	5	—	—	2	—	—	—	—	—	—	—	—	—
Eclipidrilus	5	—	—	—	—	—	—	—	—	—	—	—	1
Lumbriculus	5	—	—	—	—	—	—	—	—	—	—	—	—
TUBIFICIDA													
Enchytraeidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Naididae	8	1	—	—	—	—	—	58	—	—	—	5	—
Nais	8	—	—	—	—	—	—	—	7	—	—	—	—
N. behningi	6	—	—	—	—	—	—	—	—	—	—	—	—
Pristina	8	—	—	—	—	—	—	—	—	—	—	—	—
Tubificidae	10	—	—	—	—	—	—	—	—	—	—	—	1
Tubificidae w/ capilliform setae	10	—	—	—	—	—	53	—	—	1	—	1	—
Tubificidae w/o capilliform setae	10	—	—	—	—	—	—	1	—	—	—	1	—
LUMBRICINA	6	—	—	—	—	1	—	—	—	—	—	—	—
MOLLUSCA													
GASTROPODA													
MESOGASTROPODA													
Viviparidae													
Campeloma decisum	6	—	—	—	—	—	—	—	—	—	—	—	—
BASOMMATOPHORA													
Ancylidae													
Ferrissia	6	—	—	—	—	—	—	—	—	2	—	—	—
Physidae													
Physa	8	—	—	—	—	—	—	—	—	—	—	—	—
Planorbidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Planorbella	6	—	—	—	—	—	—	—	—	—	—	—	—
BIVALVIA													
VENEROIDA													
Corbiculidae													
Corbicula fluminea	6	—	—	—	—	—	—	—	—	—	7	—	—
Pisidiidae	6	—	—	—	—	—	—	—	1	—	—	—	—
Pisidium	6	—	—	—	—	—	—	—	—	—	—	—	—
Sphaerium	6	—	—	—	—	—	5	4	—	—	1	2	—
CHELICERATA													
ORIBATEI	8	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Sand Beach, Pa.				Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.				Vesle Run at Indiantown, Pa.			
		8/1/402	8/13/03	8/6/04	8/15/05	7/30/02	8/6/03	8/2/04	8/8/05	7/31/02	8/11/03	7/29/04	8/3/05
HYDRACHNIDIA	8	1	—	—	—	—	—	—	—	—	—	1	—
Hygrobatidae													
Atractides	8	—	—	—	—	—	—	—	—	—	—	—	—
Hygrobates	8	—	—	—	—	—	—	—	—	—	—	—	—
Sperchonidae													
Sperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticolidae													
Testudacarus	6	—	—	—	—	—	—	—	—	—	—	—	—
Torrenticola	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydryphantidae													
Protzia	8	—	—	—	—	—	—	—	—	—	—	—	—
Lebertiidae													
Lebertia	6	—	—	—	—	—	—	—	—	—	—	—	—
Rhynchohydracaridae													
Clathrosperchon	6	—	—	—	—	—	—	—	—	—	—	—	—
ARTHROPODA													
CRUSTACEA													
MALACOSTRACA													
ISOPODA													
Asellidae													
Caecidotea	8	—	—	—	—	—	—	—	—	—	—	—	—
Lirceus	8	—	—	—	—	—	—	—	—	—	—	—	—
AMPHIPODA													
Crangonyctidae													
Crangonyx	6	—	—	—	—	—	—	—	—	—	1	—	—
Gammaridae													
Gammarus	6	5	2	3	2	—	—	—	—	—	—	—	—
DECAPODA													
Cambaridae	6	1	—	—	—	—	—	—	—	—	—	—	—
Cambarus	6	—	—	—	—	—	1	—	—	—	—	—	—
Orconectes	6	—	—	—	—	—	—	—	—	1	—	—	—
INSECTA													
COLLEMBOLA	10	—	—	—	—	—	—	—	—	—	—	—	1
Entomobryidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Isotomidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Isotomurus	5	—	—	—	—	—	—	—	—	—	—	1	—
EPHEMEROPTERA													
Leptophlebiidae	4	—	—	—	—	1	—	—	1	—	—	—	—
Habrophlebia	4	—	—	—	—	—	—	—	—	—	—	—	—
Habrophlebiodes	6	—	—	—	—	—	—	—	—	—	—	—	—
Paraleptophlebia	1	—	—	—	—	—	1	5	—	—	—	—	—
Ephemeridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Ephemera	2	—	—	—	—	—	—	—	—	—	—	—	—
Litobrancha recurvata	2	—	—	—	—	—	—	—	—	—	—	—	—
Caenidae													
Caenis	6	—	—	—	—	—	—	—	—	1	—	—	—
Ephemerellidae	1	—	—	—	—	—	—	—	3	—	—	—	—
Attenella	1	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Sand Beach, Pa.				Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.				Vesle Run at Indiantown, Pa.			
		8/1/402	8/13/03	8/6/04	8/15/05	7/30/02	8/6/03	8/2/04	8/8/05	7/31/02	8/11/03	7/29/04	8/3/05
Drunella	0	—	—	—	—	—	—	—	—	—	—	—	—
Ephemerella	1	—	—	—	—	—	—	—	—	—	—	—	—
Eurylophella	2	—	—	—	—	—	—	1	—	—	—	—	—
Serratella	2	—	—	—	—	—	—	—	—	—	—	—	—
Baetidae	5	—	—	—	6	—	—	—	1	—	—	—	—
Acentrella	4	—	—	—	—	—	—	—	1	—	—	—	—
Acerpenna	5	—	—	—	—	—	—	3	—	—	—	—	—
Baetis	6	8	13	16	—	—	28	—	—	10	1	8	8
Baetis flavistriga	4	—	—	—	—	—	—	—	—	—	—	—	—
Plauditus	4	—	—	—	—	—	—	—	—	—	—	—	—
Isonychiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isonychia	2	—	—	1	—	1	—	1	1	8	1	5	4
Heptageniidae	4	—	—	—	6	—	—	—	—	—	—	—	6
Epeorus	0	—	—	—	—	—	—	—	—	—	—	—	—
Leucrocuta	1	—	4	1	4	—	—	—	—	25	—	—	5
Stenacron	7	—	—	—	—	—	—	1	—	—	—	—	—
Maccaffertium	3	1	2	—	—	28	62	46	81	2	1	39	7
Maccaffertium modestum	1	—	—	—	—	—	—	—	7	—	—	—	—
ODONATA	3	—	—	—	—	—	—	—	—	—	—	—	—
ANISOPTERA													
Aeschnidae													
Boyeria	2	—	—	—	—	—	—	—	—	—	—	—	—
Cordulegastridae													
Cordulegaster	3	—	—	—	—	—	—	—	—	—	—	—	—
Gomphidae	4	—	—	—	—	1	—	—	—	—	—	—	—
Lanthus	5	—	—	—	—	—	—	—	—	—	—	1	—
Stylogomphus	1	—	—	—	—	—	—	—	—	—	—	1	—
Libellulidae	2	—	—	—	—	—	—	—	—	—	—	—	—
ZYGOPTERA													
Calopterygidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Calopteryx	6	—	—	—	—	—	—	—	—	—	—	—	—
Hetaerina	6	1	—	—	—	—	—	—	—	—	—	—	—
Coenagrionidae	8	—	—	—	—	3	—	—	—	—	—	—	—
Argia	6	—	—	—	—	—	—	—	—	—	—	—	—
HEMIPTERA	6	—	—	—	—	—	—	—	—	—	—	—	—
Veliidae													
Microvelia	6	—	—	—	2	—	—	—	—	—	—	—	—
Rhagovelia	6	—	—	—	—	—	—	—	—	—	—	—	—
PLECOPTERA	1	—	—	—	—	—	—	—	—	—	—	—	—
Capniidae	3	—	—	—	—	—	—	—	—	—	—	—	—
Paracapnia	1	—	—	—	—	—	—	—	—	—	—	—	—
Leuctridae	0	—	—	—	—	—	—	—	4	—	—	—	—
Leuctra	0	—	—	—	—	11	10	21	60	—	—	—	—
Nemouridae	2	—	—	—	—	—	—	—	—	—	—	—	—
Amphinemura	3	—	—	—	—	—	—	—	—	—	—	—	—
Taeniopterygidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Chloroperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Alloperla	0	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Sand Beach, Pa.				Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.				Vesle Run at Indiantown, Pa.			
		8/1/402	8/13/03	8/6/04	8/15/05	7/30/02	8/6/03	8/2/04	8/8/05	7/31/02	8/11/03	7/29/04	8/3/05
Sweltsa	0	—	—	—	—	1	—	—	—	—	—	—	—
Peltoperlidae	0	—	—	—	—	—	—	—	—	—	—	—	—
Tallaperla	0	—	—	—	—	—	—	—	—	—	—	—	—
Perlidae	3	—	—	—	—	—	—	—	1	—	—	—	—
Acroneuria	0	—	1	—	—	—	3	2	—	3	—	6	—
A. carolinensis	0	—	—	—	—	—	—	—	—	—	—	—	—
Agnetina	2	—	—	—	—	—	—	—	—	—	—	—	—
Eccoptura xanthenes	3	—	—	—	—	—	—	—	—	—	—	—	—
Neoperla	3	—	—	1	5	—	—	—	—	—	—	—	—
Perlesta	4	—	—	—	—	—	—	—	—	—	—	—	—
Perlodidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Isoperla	2	—	—	—	—	—	—	—	—	—	—	—	—
Pteronarcyidae													
Pteronarcys	0	—	—	—	—	—	—	—	—	—	—	—	—
COLEOPTERA													
ADEPHAGA													
Gyrinidae													
Dineutus	4	—	—	—	—	—	—	—	—	—	—	—	—
POLYPHAGA													
Hydrophilidae													
Enochrus	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydrobius	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenidae													
Ectopria	5	—	—	—	—	—	—	—	—	—	—	—	—
Psephenus	4	6	1	4	1	—	—	—	—	29	1	14	51
Lampyridae	5	—	—	—	—	—	—	—	—	—	—	—	—
Elmidae	5	—	—	—	—	—	—	—	—	—	—	—	—
Ancyronxy variegata	5	—	—	—	—	—	—	—	—	—	—	—	—
Dubiraphia	6	—	—	—	—	—	—	—	8	—	—	—	—
Macronychus glabratus	5	—	—	—	—	—	—	—	—	—	—	—	—
Macronychus	5	—	—	—	—	—	—	—	—	—	—	—	—
Microcylloepus	3	—	—	—	—	—	—	—	—	—	—	—	—
Optioservus	4	9	22	24	16	1	5	—	5	17	3	22	20
Oulimnius	4	—	—	—	—	6	20	10	—	—	—	—	—
Promoresia	2	—	—	—	—	1	1	—	—	—	—	—	—
Stenelmis	5	14	27	44	31	—	5	4	2	24	2	25	9
Ptilodactylidae													
Anchytarsus	5	—	—	—	—	—	—	—	—	—	—	—	—
Curculionidae	5	—	—	—	—	—	—	—	—	1	—	—	—
MEGALOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Corydalidae													
Corydalus	4	—	—	—	—	—	—	—	—	—	1	—	—
Nigronia	4	—	—	—	—	1	5	—	9	—	—	—	—
Sialidae													
Sialis	4	—	—	—	—	—	—	—	—	1	—	—	—
TRICHOPTERA	4	—	—	—	—	—	—	—	—	—	—	—	—
Rhyacophilidae													
Rhyacophila	1	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Sand Beach, Pa.				Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.				Vesle Run at Indiantown, Pa.			
		8/1/402	8/13/03	8/6/04	8/15/05	7/30/02	8/6/03	8/2/04	8/8/05	7/31/02	8/11/03	7/29/04	8/3/05
Hydroptilidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydroptila	6	—	—	—	—	—	—	—	—	—	—	—	—
Leucotrichia	6	—	—	—	—	—	—	—	—	—	—	—	1
Ochrotrichia	6	—	—	—	—	—	—	—	—	—	—	—	—
Glossosomatidae	1	—	—	—	—	—	—	—	—	—	—	—	—
Glossosoma	0	—	—	—	—	—	—	—	—	—	—	—	1
Philopotamidae	4	—	—	—	—	—	—	—	2	—	—	—	—
Chimarra	4	22	11	4	4	—	7	—	—	10	2	2	—
C. aterrima	4	—	—	—	11	—	—	—	7	—	—	—	—
C. obscura	4	—	—	—	—	—	—	—	—	—	—	—	—
Dolophilodes	4	—	—	—	—	—	—	—	9	—	—	—	—
Wormaldia	2	—	—	—	—	—	—	—	—	—	—	—	—
Psychomyiidae	2	—	—	—	—	—	—	—	—	—	—	—	—
Lype	2	—	—	—	—	—	—	—	—	—	—	2	—
Psychomyia	2	—	—	—	—	—	—	—	—	—	—	—	—
Dipseudopsidae													
Phylocentropus	5	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropodidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Cyrnellus	8	—	—	—	—	—	—	—	—	—	—	—	—
Neureclipsis	7	—	—	—	—	—	—	—	—	—	—	—	—
Polycentropus	6	—	—	—	—	—	—	—	—	—	—	—	—
Hydropsychidae	5	—	—	—	11	—	—	—	24	—	—	—	—
Cheumatopsyche	5	3	10	12	5	28	4	1	4	7	84	6	—
Diplectrona	5	—	—	—	—	—	—	—	—	—	—	—	—
Hydropsyche	4	—	1	14	5	6	45	9	15	6	5	18	4
Hydropsyche morosa gr.	6	—	—	—	—	—	—	—	—	—	—	—	—
Phryganeidae													
Oligostomis	2	—	—	—	—	—	—	—	—	—	—	—	—
Brachycentridae													
Micrasema	2	—	—	—	—	—	—	—	—	—	—	—	—
Lepidostomatidae													
Lepidostoma	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnephilidae													
Hydatophylax	2	—	—	—	—	—	—	—	—	—	—	—	—
Pycnopsyche	4	—	—	—	—	—	—	—	—	—	—	—	—
Uenoidae													
Neophylax	3	—	—	—	—	—	—	—	—	—	—	—	—
Goeridae	3	—	—	—	—	—	—	—	—	—	—	—	—
Goera	3	—	—	—	—	—	—	—	—	—	—	—	—
Leptoceridae	4	—	—	—	—	—	—	—	—	—	—	—	—
Oecetis	5	—	—	—	—	—	—	—	—	—	—	—	—
Molannidae													
Molanna	6	—	—	—	—	—	—	—	—	—	—	—	—
Calamoceratidae													
Heteroplectron	3	—	—	—	—	—	—	—	—	—	—	—	—
Odontoceridae													
Psilotreta	0	—	—	—	—	1	—	—	—	—	—	—	—
LEPIDOPTERA	5	—	—	—	—	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Sand Beach, Pa.				Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.				Vesle Run at Indiantown, Pa.			
		8/1/402	8/13/03	8/6/04	8/15/05	7/30/02	8/6/03	8/2/04	8/8/05	7/31/02	8/11/03	7/29/04	8/3/05
Tortricidae													
Archips	5	—	—	—	—	—	—	—	—	—	—	—	—
DIPTERA (red non-midges, purple midges)	6	—	—	—	—	—	—	—	—	—	—	—	—
Ceratopogonidae	6	—	—	—	—	—	—	—	—	—	—	—	—
Atrichopogon	6	—	—	—	—	—	—	1	1	—	—	—	—
Probezzia	6	—	—	—	—	—	—	—	—	—	—	—	—
Bezzia/Palpomyia	6	—	—	—	—	—	—	—	1	—	—	—	—
Chironomidae													
Tanypodinae	7	—	—	—	1	—	—	—	—	—	—	—	—
Macropelopiini	6	—	—	—	—	—	—	—	—	—	—	—	—
Brundiniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Macropelopia	6	—	—	—	—	—	—	—	—	—	—	—	—
Natarsiini													
Natarsia	8	—	—	—	—	—	—	—	—	—	—	—	—
Pentaneurini													
Ablabesmyia	8	—	—	—	—	—	—	—	—	—	—	—	—
Conchapelopia	6	—	2	—	—	—	—	—	8	—	—	—	—
Nilotanypus	6	—	—	—	—	—	—	—	—	—	—	—	—
Paramerina	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheopelopia	4	—	—	—	—	—	—	—	—	—	—	—	—
Thienemannimyia gr.	6	—	1	2	3	5	32	6	—	1	—	2	—
Zavrelimyia	8	—	—	—	—	—	2	—	—	1	—	—	—
Diamesini													
Diamesa	5	—	—	—	—	—	—	—	—	—	—	—	—
Pagastia	1	—	—	—	—	—	—	—	—	—	—	—	—
Potthastia longimana	2	—	—	—	—	—	—	2	—	—	—	—	—
Orthocladiinae	5	—	—	—	1	—	—	—	2	—	—	—	—
Corynoneurini													
Corynoneura	4	1	—	—	—	—	—	—	—	—	—	—	—
Thienemanniella	6	—	—	—	—	—	—	—	—	—	—	—	—
Orthocladiini	5	—	—	—	—	—	—	—	—	—	1	—	—
Brillia	5	—	—	—	—	—	—	—	—	—	—	—	—
Brillia flaviforms	5	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus	7	—	—	—	—	—	—	—	4	—	—	—	—
Cricotopus/Orthocladius	7	—	—	—	—	—	—	—	—	—	—	—	—
Cricotopus bicinctus	7	—	—	—	—	—	—	11	—	—	—	—	—
Cricotopus vierriensis	7	—	—	—	—	—	—	9	—	—	—	—	—
Diplocladius	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella brehmi gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella claripennis	8	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella devonica gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Eukiefferiella pseudomontana gr.	8	—	—	—	—	—	—	—	—	—	—	—	—
Heleniella	3	—	—	—	—	—	—	—	—	—	—	—	—
Heterotrissocladius marcidus gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Krenosmittia	1	—	—	—	—	—	—	—	—	—	—	—	—
Limnophyes	8	—	—	—	—	—	—	—	—	—	—	—	—
Nanocladius	7	—	—	—	—	—	—	—	1	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Sand Beach, Pa.				Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.				Vesle Run at Indiantown, Pa.			
		8/1/402	8/13/03	8/6/04	8/15/05	7/30/02	8/6/03	8/2/04	8/8/05	7/31/02	8/11/03	7/29/04	8/3/05
Orthocladius lignicola	6	—	—	—	—	—	—	—	—	—	—	—	—
Parachaetocladius	2	—	—	—	—	—	—	—	—	—	—	—	—
Paracricotopus	4	—	—	—	—	—	—	—	—	—	—	—	—
Parametriocnemus	5	4	—	1	—	—	5	—	4	—	—	6	—
Rheocricotopus	6	—	—	—	—	—	—	—	—	—	—	—	—
Rheocricotopus robacki	5	—	—	—	—	—	—	—	—	—	—	—	—
Tvetenia bavarica gr.	4	3	2	2	—	—	—	—	1	—	—	—	—
Xylotopus par	2	—	—	—	—	—	—	—	—	—	—	—	—
Chironominae	5	—	—	—	—	—	—	—	—	—	—	—	—
Chironomini													
Chironomus	10	—	—	—	—	—	—	—	—	—	—	—	—
Cryptochironomus	8	—	—	—	—	—	—	—	—	—	—	—	—
Glyptotendipes	10	—	—	—	—	—	—	—	—	—	—	—	—
Microtendipes pedellus gr.	6	—	—	—	—	—	3	—	—	—	—	—	—
Microtendipes rydalensis gr.	4	—	—	—	—	—	—	—	—	—	—	—	—
Paralauterborniella	8	—	—	—	—	—	—	—	—	—	—	—	—
Paratendipes albimanus	6	—	—	—	—	—	—	—	—	—	—	—	—
Phaenopsectra	7	—	—	—	1	—	—	—	—	—	—	—	—
Polypedilum	6	13	—	—	—	2	—	—	—	1	—	—	—
Polypedilum aviceps	4	3	1	3	5	1	3	—	10	—	—	1	1
Polypedilum fallax	6	—	—	—	2	—	—	—	—	—	—	—	—
Polypedilum flavum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum illinoense	7	1	—	—	—	—	—	—	—	—	—	—	—
Polypedilum laetum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum scalaenum	6	—	—	—	—	—	—	—	—	—	—	—	—
Polypedilum tritum	6	—	—	—	—	—	—	—	—	—	—	—	—
Stenochironomus	5	—	—	—	—	—	—	—	—	—	—	—	—
Stictochironomus	9	1	—	—	—	—	—	—	—	—	—	—	1
Tribelos	7	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsini	5	—	—	—	—	—	—	—	—	—	—	—	—
Cladotanytarsus	5	—	—	—	—	—	—	—	6	—	—	—	—
Micropsectra	7	—	—	—	—	2	39	3	1	—	—	—	1
Micropsectra sp. A	7	—	—	—	—	21	—	—	—	—	—	—	—
Paratanytarsus	6	—	—	—	—	—	—	—	—	—	—	1	—
Rheotanytarsus	6	4	—	—	—	—	—	2	3	—	—	1	5
Rheotanytarsus exiguus gr.	6	—	3	1	—	2	7	—	—	1	1	—	—
Rheotanytarsus pellucidus	4	—	—	—	—	—	1	—	—	—	—	—	—
Stempellina	2	—	—	—	—	1	—	—	—	—	—	—	—
Stempellina sp. C	4	—	—	—	—	—	—	1	—	—	—	—	—
Stempellinella	4	1	1	1	—	2	—	—	2	1	—	—	—
Sublettea coffmani	4	—	—	—	—	—	—	—	—	—	—	—	—
Tanytarsus	6	—	—	—	7	—	—	2	2	—	—	—	2
Zavrelia	4	—	—	—	—	—	—	—	—	—	—	—	—
Dixidae													
Dixa	1	—	—	—	—	—	—	—	—	—	—	—	—
Simuliidae													
Simulium	5	1	—	2	—	1	17	—	—	—	1	1	—
Tipulidae	4	—	—	—	2	—	—	—	—	—	—	—	—

Taxonomy	Tolerance score	Unnamed Tributary to Manada Creek near Sand Beach, Pa.				Unnamed Tributary to Indiantown Run at Fort Indiantown Gap, Pa.				Vesle Run at Indiantown, Pa.			
		8/1/402	8/13/03	8/6/04	8/15/05	7/30/02	8/6/03	8/2/04	8/8/05	7/31/02	8/11/03	7/29/04	8/3/05
Tipula	6	—	—	—	—	—	1	—	—	—	—	—	—
Antocha	3	—	—	—	—	—	1	2	3	—	3	1	4
Dicranota	3	—	—	—	1	—	1	—	1	—	—	—	—
Hexatoma	2	—	—	1	—	—	—	1	—	—	—	—	—
Limnophila	3	—	—	—	—	—	—	—	—	—	—	—	—
Limonia	6	—	—	—	—	—	—	—	—	—	—	—	—
Molophilus	4	—	—	—	—	—	—	—	—	—	—	—	—
Pilaria	7	—	—	—	—	—	—	—	—	—	—	—	—
Athericidae													
Atherix	4	—	—	—	—	—	—	—	—	—	—	—	—
Empididae	6	—	—	—	—	—	—	—	—	—	—	—	—
Chelifera	6	—	—	—	—	—	1	1	1	—	—	—	—
Clinocera	6	—	—	—	—	—	—	—	—	—	—	—	—
Hemerodromia	6	—	—	—	—	—	3	7	7	—	4	—	1
Stratiomyidae	7	—	—	—	—	—	—	—	—	—	—	—	—
Tabanidae													
Chrysops	5	—	—	—	—	—	1	—	—	—	—	—	—
Ephydridae	6	—	—	—	—	—	—	—	3	—	—	—	—
Psychodidae	10	—	—	—	—	—	—	—	—	—	—	—	—
Total taxa		24	17	21	23	24	31	28	41	22	20	27	22
Total number		106	104	147	132	128	372	215	314	153	125	174	137
Percent dominant taxa (single)		21	26	30	28	22	14	27	30	19	67	22	40
Total EPT Taxa		4	7	7	9	8	8	10	16	9	6	8	8
Total EPT		34	42	49	57	77	160	90	221	72	94	86	36
Percent EPT		32.08	40.38	33.33	43.18	59.38	43.01	41.86	70.06	47.06	75.20	49.43	26.28
HBI		4.95	4.56	4.76	4.74	4.31	5.34	4.9	3.35	3.81	5.04	4.14	4.28
Number Chironomidae taxa		9	6	6	7	8	8	8	12	5	2	5	5
Percent Chironomidae		29.25	9.62	6.80	15.15	28.13	24.73	16.74	14.01	3.27	1.60	6.32	7.30

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