STREAM INVESTIGATION
FIELD SAMPLING PLAN

GM POWERTRAIN – BEDFORD PLANT
105 GM DRIVE
BEDFORD, INDIANA

EPA ID# IND 006036099

Prepared For:
GENERAL MOTORS CORPORATION
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1 Introduction

This field sampling plan (FSP) describes procedures for collecting data to support the RFI stream investigation taking place at the General Motors (GM) Powertrain facility in Bedford, Indiana. The FSP will be used as a reference for conducting all field activities proposed in the stream investigation work plan (Exponent 2001), currently scheduled for early October 2001. The geographic extent of the study area and sampling objectives are provided in the work plan (Exponent 2001). Field sampling procedures for surface water, surface sediment, floodplain soil, and aquatic biota are included in this FSP.

An ecological reconnaissance of the study area was conducted on August 6–8, 2001, to identify candidate sample locations based on stream geomorphology and habitat. A summary of the field observations, as well as the results of trial fishing efforts, are attached to this FSP (Appendix A).

Field activities to be conducted during the stream investigation include:

- Collection of 10 surface water samples from 9 stations in Salt Creek, Pleasant Run, Bailey’s Branch, and unnamed tributaries near the site and from 1 reference area in Gullets Creek during high and low flow events (20 samples total, 10 each at high and low flow)
- Collection of 33 surface sediment samples from 31 sample stations in Salt Creek, Pleasant Run, Bailey’s Branch, and unnamed tributaries near the site and from 2 reference areas in Gullets Creek (35 surface sediment samples total)
- Collection of 23 floodplain soil samples from 6 transects and 6 bank soil samples from 3 additional stations across Pleasant Run, Bailey’s Branch, and unnamed tributaries east of the site (29 floodplain and bank soil samples total)
- Collection of 11 whole-body crayfish samples, 22 whole-body forage fish tissue samples (11 each of 2 species), and up to 11 game fish fillet samples where available from 10 stations in Salt Creek, Pleasant Run, Bailey’s Branch, and unnamed tributaries near the site and from 1 reference area in Gullets Creek (11 biota stations total).

Field sampling locations and procedures are described in Section 2, and the use of quality control samples is described in Section 3. Field data reporting and field custody procedures are discussed in Sections 4 and 5, respectively. Sample packaging and shipping requirements are outlined in Section 6. The proposed schedule and personnel for the sampling event is provided in Section 7. Safety concerns are discussed in Section 8.
Descriptions of laboratory analytical methods and procedures for data management, analysis, and reporting are presented in the project’s quality assurance project plan (QAPP) (CRA 2001a). To ensure that the data collected under the specifications of this FSP achieve an acceptable level of quality, rigorous quality assurance and quality control procedures will be followed at all stages of sample collection and analysis. Standard operating procedures (SOPs) for field activities are provided in Appendix B and include the following:

- SOP 2—Sample Packaging and Shipping
- SOP 4—Field Documentation
- SOP 5—Sample Custody
- SOP 17—Surface Water Sampling
- SOP 51A—Station Positioning Using the Trimble Pathfinder™ Pro XRS
- SOP 51B—Post-Collection Processing and Corrections Using Pathfinder Software
- SOP 99—Surface Sediment Sampling Using an Ekman Grab Sampler
- SOP 111—Fish Collection Procedures for Using a Seine Net
- SOP 112—Fish Collection Procedures while Using an Electroshocker
- SOP 114—Fish Collection Procedures Using Fish Traps
- SOP 115—Fish Processing Procedures
- SOP 116—Crayfish Collection Procedures
- SOP 116A—Aquatic Invertebrate Processing Procedures.

If determined to be necessary as a result of conditions encountered in the field, procedures specified in the referenced SOPs may be modified in the field. Any such modifications will be noted in the field logbook. Example field data forms are provided in Appendix C.

Site-specific health and safety issues are presented in the supplemental health and safety plan (HSP) (provided in Appendix D), which augments the project HSP (CRA 2001b). The supplemental HSP establishes procedures and practices to protect Exponent employees and its subcontractors from potential hazards posed by field activities at the site. The supplemental HSP provides measures to minimize potential exposure, accidents, and physical injuries that may occur during daily onsite activities and to minimize the hazards of adverse conditions. Contingency arrangements are also provided in the supplemental HSP for emergency situations.
2 Field Sampling

A description of sampling station locations and sample analytes is provided in this section. Procedures are included for the following tasks:

- Documenting the locations of stations
- Collecting and compositing (if applicable) samples
- Processing samples to ensure proper subsampling of each matrix
- Cleaning equipment, work surfaces, and sampling implements prior to commencing sampling and between stations.

2.1 Station Locations

Station locations for all field sampling will be determined using a differential global positioning system, which is capable of providing latitude and longitude coordinates with an accuracy of approximately 2 m. Water depth (when applicable) will be measured with either a ruler or a lead line (with a flat disk attached to its bottom to keep it from sinking into soft sediments) at all stations and recorded in the field logbook. All sample locations will also be documented with photographs. The exact locations of the stations in the study area drainage and at the reference area will be determined in the field by the field team leader.

Approximate sample station locations for the stream investigation are shown in Figure 1. Station locations in the streams comprising the primary study area (i.e., tributary from Outfall 002, Bailey’s Branch, Pleasant Run, and Salt Creek) are designated ST-1 through ST-23. Media sampled at a given station location may include surface water, sediment, floodplain soils, and/or biota. Six floodplain transects, designated T-1 through T-6, will be located perpendicular to the stream channel at selected stations where significant floodplains occur. The floodplain transects will consist of 4 to 6 discrete soil samples, spaced in such a manner as to best representatively sample the floodplain (i.e., samples located equidistant along the width of the floodplain). Surface water and sediment samples from the spring-fed headwater areas of both the secondary eastern and western tributaries are designated SP-1 through SP-8. The two reference stations in Gullet’s Creek are designated R-1 and R-2. A description of each sample station location and the media to be sampled at each station is provided below. A summary of the target media by station is provided in Table 1.

2.1.1 Stream Samples

A total of 23 sample stations from the study area drainage are shown in Figure 1.
Station ST-1 is located in the unnamed tributary from Outfall 002 near a small wooden footbridge across the stream. Surface water, stream sediment, and biota will be sampled. Bank soil samples from both stream banks will also be collected.

Station ST-2 is the flooded quarry pit adjacent to the unnamed tributary stream, located just upstream of the confluence with Bailey’s Branch. Stream sediments are minimal to non-existent at this location. However, the stream may overflow into the quarry pond during high rainfall events, resulting in a manmade depositional area. Bank soil samples will be collected from both banks, and a sediment sample will be collected from the quarry pond.

Station ST-3 will be located in the main stem of Bailey’s Branch, downstream of the confluence with the Outfall 002 tributary. A depositional area will be targeted for sediment sampling.

Station ST-4 will be located immediately upstream of the Broomsage Road bridge in Bailey’s Branch. Surface water, stream sediments, and biota will be sampled at this station, as well as floodplain soils on both sides of the stream.

Station ST-5 will be located downstream of the Broomsage Road bridge, in an area where the stream gradient begins to drop and small depositional areas become more common. A stream sediment sample will be collected from a depositional area.

Station ST-6 will be located just downstream of the high voltage power line crossing on Bailey’s Branch. A stream sediment sample will be collected from a depositional area.

Station ST-7 will be located in Bailey’s Branch. Transect T-1 will be located in a line approximately perpendicular to the stream channel at this point. In addition to a stream sediment sample from a depositional area, the transect will include a total of three floodplain samples, one from the narrow floodplain southwest of the stream and two from the wider floodplain northeast of the stream.

Station ST-8 will be located in Bailey’s Branch, approximately 100 m upstream of the confluence with Pleasant Run. Stream sediment and biota will be sampled. Transect T-2 will be located in a line approximately perpendicular to the stream channel at this point. In addition to the sediment samples from stations ST-8 and ST-11, the transect will include three floodplain soil samples: one from the southwest bank of Bailey’s Branch, one from the area between the Bailey’s Branch and Pleasant Run channels, and one from the floodplain northeast of Pleasant Run.

Station ST-9 will be located in Bailey’s Branch, immediately upstream of the confluence with Pleasant Run. A stream sediment sample will be collected from a depositional area.

Station ST-10 will be located in Pleasant Run, just upstream of the Mount Pleasant Road bridge. This area contains several large pools, which were found to support several fish species during the ecological reconnaissance. Surface water, stream sediment, and biota will be sampled.
Station ST-11 will be located in Pleasant Run, upstream of the confluence with Bailey’s Branch. The sample will be field-located in a depositional area as close as possible to the line of Transect T-2.

Station ST-12 will be located in Pleasant Run, approximately 100 m downstream of the confluence with Bailey’s Branch. A stream sediment sample will be collected from a depositional area.

Station ST-13 will be located in Pleasant Run, in an area with numerous pools of significant size, many with depths up to several feet deep at extreme low water and containing large woody debris. Stream sediment and biota will be collected.

Station ST-14 will be located in Pleasant Run, just upstream of the Peerless Road bridge. Transect T-3 will be located in a line approximately perpendicular to the stream channel at this point. In addition to a sediment sample, the transect will include four floodplain samples, two from each bank.

Station ST-15 will be located in Pleasant Run, just downstream of the Peerless Road bridge. The stream channel develops a braided character in this reach, with two primary channels. Several significant pools exist in this area. Stream sediment and biota samples will be collected.

Station ST-16 will be located in the braided channel portion of Pleasant Run. This area has two primary channels, both showing signs of heavy use by cattle. Surface water and stream sediment will be collected. Transect T-4 will be located in a line approximately perpendicular to the stream channel at this point. In addition to the sediment sample in the south branch, the transect will include four samples: one located south of the braided channels, one located between the two primary channels, a sediment sample from the north branch, and a floodplain sample located north of the stream channels.

Station ST-17 will be located in the braided channel portion of Pleasant Run, downstream of the area currently used for pasture. This is the most extensive area of floodplain in the study area. Transect T-5 will be located in a line approximately perpendicular to the stream channel at this point. In addition to the sediment sample from the south branch, the transect will include six samples: two floodplain samples located southwest of the braided channels, one located between the two primary channels, a sediment sample from the north branch, and two samples located northeast of the braided channels.

Station ST-18 will be located just downstream of the braided channel reach, in the vicinity of a concrete cattle crossing over the stream. Stream sediments and biota will be collected. Transect T-6 will be located in a line approximately perpendicular to the stream channel at this point. In addition to the sediment sample, the transect will include three floodplain samples: two located southwest of the stream channel, and one located northeast of the channel.

Station ST-19 will be located just downstream of the site of the former Murdock railroad bridge. A large pool with a depth of several feet at extreme low water occurs at this point. Surface water, stream sediment, and biota will be collected.
Station ST-20 will be located in Salt Creek, approximately 500 m upstream of the confluence with Pleasant Run. A stream sediment sample will be collected.

Station ST-21 will be located in Salt Creek, in the vicinity of the Peerless-Needmore Road bridge. Surface water, stream sediment, and biota will be collected.

Station ST-22 will be located in Salt Creek, approximately 500 m downstream of the confluence with Pleasant Run, but upstream of the confluence with Gullets Creek. Stream sediment will be collected.

Station ST-23 will be located in Salt Creek, approximately 1.5 km downstream of the confluence with Pleasant Run. Surface water, stream sediment, and biota will be collected.

### 2.1.2 Headwater Spring Samples

A total of 8 stations are located in spring areas east and west of the Bedford facility (see Figure 1).

Stations SP-1 through SP-4 are in the spring-fed headwaters of the secondary eastern drainage, which flows into Bailey’s Branch. All sample stations are located west of Bailey’s Scales Road. Three sediment samples will be field-located in each of the three primary channels, which converge in the low area just west of Bailey Scales Road. Sediment and surface water will be collected at Station SP-4, to be located immediately upstream of the culvert beneath the road.

Stations SP-5 through SP-8 are in the spring-fed headwaters of the unnamed western tributary, which flows directly into Salt Creek. All sample stations are located east of M Street. Three sediment samples will be field-located in the lowest points of the spring area. Sediment and surface water will be collected at Station SP-8, to be located immediately upstream of the culvert beneath M Street.

### 2.1.3 Reference Stream Samples

Two reference stations have been identified in Gullets Creek.

Station R-1 will be located in the vicinity of the Peerless-Needmore Road bridge over Gullets Creek, southeast of the village of Needmore. Surface water, stream sediment, and biota samples will be collected.

Station R-2 will be located in the vicinity of the bridge immediately north of the village of Needmore. Stream sediment will be collected.
2.2 Number of Samples and Analytical Parameters

The number and type of aquatic samples to be collected during the stream investigation and the chemical analyses to be performed on these samples are summarized below:

- **Surface Water Samples**—Two rounds of water sampling will be conducted at a total of 10 stations: one under low-flow conditions and one under high-flow conditions. It is anticipated that the October 2001 sampling event will capture low-flow conditions in the study area drainage. A field duplicate sample for chemistry analyses will be collected from one of the stations in the study area drainage. Unfiltered surface water samples will be collected and submitted for analysis of target compound list (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), TCL total polychlorinated biphenyls (PCBs), and target analyte list (TAL) total metals (except earth metals [calcium, magnesium, potassium, and sodium]). Filtered samples will also be collected and submitted for analysis of TCL-dissolved PCBs and TAL-dissolved metals (except earth metals). Surface water will also be analyzed for total and amenable cyanide, total Kjeldahl nitrogen, ammonia, pH, total suspended solids, total dissolved solids, and hardness (as calcium carbonate).

- **Surface Sediment Samples**—A sample of surface sediment (0–10 cm sediment horizon, or until refusal) will be collected from a total of 35 stations (i.e., 33 stations in the study area drainage and 2 reference area stations). A field duplicate sample for chemistry analyses will be collected from four of the stations in the study area drainage. Subsamples from each surface sediment sample will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL metals (except earth metals), total and amenable cyanide, and conventional parameters (grain size distribution, total organic content, and total solids).

- **Floodplain and Bank Soil Samples**—A sample of surface floodplain soil will be collected from six transects in the study area drainage. Bank soils at three additional locations will be sampled. The top soil in the 0–10 cm sediment horizon will be collected at each station. This interval may be modified if a layer of different soil stratification (e.g., clay) is encountered or until refusal. In floodplain areas, discrete samples will be collected along a transect line approximately perpendicular to the stream channel. Along each transect, stations on the bank of the creek and in the floodplain adjacent to the creek will be sampled (as described above for each specific transect), as well as sediment from the stream channel. A field duplicate sample for chemistry analyses will be collected from three of the stations in the study area drainage. Subsamples from each soil sample will be analyzed for selected chemical compounds (TCL VOCs, TCL SVOCs, TCL PCBs, TAL metals...
[except earth metals], total and amenable cyanide), and conventional parameters (grain size distribution, total organic content, and total solids).

- **Biota Tissue Samples**—Individual composite samples of crayfish and fish tissue (whole body) will be collected for chemical analysis from 10 stations in the study area drainage and from 1 station in the reference area. Crayfish and selected species of forage fishes will be targeted to be representative of the aquatic community present. When present, game fish of a size that is suitable for human consumption will also be collected. Subsamples from each composited biota tissue sample will be analyzed for TCL PCBs, mercury, and lipid and moisture content.

- **Archive Samples**—Subsamples from all surface sediment, floodplain soil, and biota samples (if extra tissue is available) will be archived for possible future chemical analyses from each station.

### 2.3 Surface Water Sampling

Two rounds of surface water sampling will be conducted, one under low-flow conditions and one under high-flow conditions. It is anticipated that the October 2001 sampling event will capture low-flow conditions in the study area drainage. High-flow sampling will likely take place in Spring 2002. The following sections describe the procedures to be followed in collecting the surface water samples.

#### 2.3.1 Surface Water Sampling Equipment and Procedures

Surface water samples will be co-located with sediment samples and will be collected before collection of sediment and biota (if applicable) samples at each location.

Surface water samples will be collected as grab samples following the procedures in SOP 17. In shallow, wadeable water (e.g., Bailey’s Branch and Pleasant Run), the person collecting the surface water sample will carefully enter the stream from downstream of where the sample will be collected. This is to ensure that bed sediments will not be suspended at the sample collection point. The sampler will stand downstream of the sample collection point and quickly submerge the opening of the sample bottle below the air/water interface with the bottle opening pointed upstream. The water will be collected directly into the sample bottle. If the water velocity is very slow at a given station, then the sampler will move slowly upstream with the sample bottle submerged so that an undisturbed sample is consistently collected. In deeper water, a depth integrated sampler will be used to collect the surface water sample. A 2-L Teflon® bottle will be used in conjunction with the depth integrated sampler. The Teflon® bottle will be pre-cleaned by the testing laboratory by placing it in 4N hydrochloric acid for 12 hours. A new, laboratory pre-cleaned Teflon® bottle will be used at each deeper water station.

After all sampling has been completed, field measurements (pH, Eh, temperature, dissolved oxygen, and conductivity) will be collected at each surface water station and the results will be
recorded in the field logbook. The water meters used to collect these field measurements will be calibrated daily prior to use and the calibration will be verified after a maximum of 10 stations. Specific information concerning calibration frequency, acceptance criteria, and the conditions that require more frequent calibration are provided in the QAPP (CRA 2001a).

After the sample containers are filled, they will be placed on ice in a cooler at 4±2°C. Prior to shipment to the laboratory, subsamples for dissolved PCBs and dissolved metals analyses will be filtered using a 0.45 µm capsule filter and preserved in the field trailer.

Chain-of-custody (COC) and sample analysis request (SAR) forms (see Section 6) will be completed and signed by the field team leader at the end of each day and shipped with the samples to the analytical laboratories. All sample containers will be shipped on ice in a cooler at 4±2°C.

2.3.2 Surface Water Sample Container, Preservation, and Handling Procedures

The approximate laboratory subsample amount required for analysis, along with the sample container, preservation and handling, and maximum holding time (from date of collection) requirements for the subsamples are provided in the QAPP (CRA 2001a). Pre-cleaned containers, shipped from the analytical laboratory, will be used for all sampling. Certificates of analysis that document cleanliness will be kept on file at the laboratory for every lot of sample containers purchased and will be available upon request. The certificates of analysis will document that any possible contamination of the sample containers will be less than the limit of quantitation for the specific analyses. Depending on the compatibility of sample handling requirements, the analytical laboratory will identify subsamples for specific analyses that can be included in the sample containers.

2.3.3 Decontamination of Surface Water Sampling Equipment

Because only new or laboratory pre-cleaned bottles will be used for sample collection, no field equipment decontamination is required for surface water sample collection. All sample bottles will be protected from possible contamination during transport and storage.

2.3.4 Sampling Order

Subsamples for analysis of mercury and TCL VOCs will be collected first. Sample containers for SVOCs will be filled next, followed by containers for other organic analyses (i.e., TCL PCBs), and then the containers for metals analyses will be filled, and finally containers for conventional analyses will be filled. After all sampling has been completed at each station, field measurements will be collected.
2.4 **Surface Sediment, Floodplain, and Bank Soil Sampling**

The following sections describe the procedures to be followed in collecting the surface sediment, floodplain, and bank soil samples.

2.4.1 **Sampling Equipment and Procedures**

The sampling equipment and procedures to be used for surface sediment and floodplain soil sampling are described in the following sections.

2.4.1.1 **Surface Sediment Sampling**

Surface sediment samples will be collected using either a Ekman grab sampler or modified petite Ponar grab sampler in accordance with standard methods recommended by the U.S. Environmental Protection Agency (U.S. EPA) (U.S. EPA 1990). If a Ponar grab sampler is used, then the grab sampler will be modified with a door on top of the sampler to allow collection of an undisturbed surface sediment sample.

Material collected in the grab sampler will be accepted if the following criteria are met:

- The sampler is not overfilled
- Overlying water is present
- The overlying water is not excessively turbid
- The sediment surface is relatively undisturbed
- A sediment penetration depth of at least 11 cm is attained.

The field team leader will evaluate all samples collected. If a sample fails to meet the above criteria, it will be rejected and discarded into the river away from the station. A second grab sample will then be collected. If acceptable grab samples cannot be collected at a specific location after several attempts, the station will be slightly repositioned (3–5 ft) and the sampling effort repeated, if possible.

After a sediment sample is judged to be acceptable, the overlying water will be siphoned off and the upper 10 cm of sediment will be removed in accordance with U.S. EPA (1990) guidelines. Stainless-steel spoons will be used to remove the sediment. A stainless-steel ruler will be used to ensure that the sampling criterion for adequate penetration depth is met and that the correct amount (i.e., 10 cm) of sediment has been removed. Sediment touching the sides of the grab sampler will not be included in the sample.

The surface (top 10 cm) sediment will be removed from each grab sample. A specialized zero headspace sampling tool (EnCore Sampler™) will be used to remove the sediment sample from
the grab sampler for TCL VOC analysis unless the sediments are noncohesive or are saturated with water, in which case subsamples will be immediately transferred to appropriate sample containers with no headspace for analyses of TCL VOCs.

The remaining sediments will be described as the sample is removed from the grab sampler and transferred to a stainless-steel bowl, noting any stratification that may be present. The color of the sediment (based on the EarthColors™ soil color book), grain sizes, approximate percentages of moisture content, organic and/or shell material, and any other noteworthy observations will be recorded in the field logbook. Prior to compositing the sediments in the stainless-steel bowl and subsequent collection of the remaining subsamples for analyses, the sediments in the bowl will be photographed.

Sediments from the grab samples will then be composited to achieve a more representative sample of average surface sediment characteristics at that station. The sediment grab samples at each station will be composited in a stainless-steel bowl and covered with aluminum foil until a sufficient volume of sediment is collected. Sediment in the bowl will then be mixed using a large stainless-steel spoon to achieve a uniform texture and color before subsamples are taken and transferred to appropriate sample containers for the remaining analyses.

Immediately after they are filled, all sample containers will be placed on ice in a cooler. Samples will be stored at 4±2°C. All samples that are to be analyzed upon receipt at the chemical testing laboratory will be maintained at 4±2°C. Sufficient headspace will be left in containers that are to be frozen (i.e., only archive samples) to accommodate expansion during freezing. COC and SAR forms (see Section 6) will be completed and signed by the field team leader at the end of each day and shipped with the samples to the analytical laboratories.

2.4.1.2 Floodplain and Bank Soil Sampling

Soil samples will be collected using stainless steel spoons and scoops in accordance with standard methods recommended by U.S. EPA (1990). A specialized zero headspace sampling tool (EnCore Sampler™) will be used to remove the soil for TCL VOC analysis unless the soil is noncohesive or is saturated with water, in which case subsamples will be immediately transferred to appropriate sample containers with no headspace for analyses of TCL VOCs. A stainless-steel ruler will be used to ensure that the sampling criterion for adequate penetration depth is met and that the correct amount (i.e., 10 cm) of soil has been removed.

The soil will be placed into a stainless-steel bowl, noting any stratification that may be present. The color of the soil (based on the EarthColors™ soil color book), grain sizes, approximate percentages of moisture content, organic material, and any other noteworthy observations will be recorded in the field logbook. Prior to compositing the soils in the stainless-steel bowl and subsequent collection of the remaining subsamples for analyses, the soil in the bowl will be photographed.

The soil collected at each sample location on a transect will be composited in a stainless-steel bowl and covered with aluminum foil until a sufficient volume of soil has been collected. Soil
in the bowl will then be mixed using a large stainless-steel spoon to achieve a uniform texture and color before subsamples are taken and transferred to appropriate sample containers for the remaining analyses. Each sample location along any given floodplain transect will have a unique sample (i.e., soil will not be composited across stations on the transect).

Immediately after sample containers are filled, they will be placed on ice in a cooler. Samples will be stored at 4±2°C. All samples that are to be analyzed upon receipt at the chemical testing laboratory will be maintained at 4±2°C. Sufficient headspace will be left in containers that are to be frozen (i.e., only archive samples) to accommodate expansion during freezing. COC and SAR forms (see Section 6) will be completed and signed by the field team leader at the end of each day and shipped with the samples to the analytical laboratories.

2.4.2 Sediment and Soil Sample Container, Preservation, and Handling Procedures

The approximate laboratory subsample amount required for analysis, along with the sample container, preservation and handling, and maximum holding time (from date of collection) requirements for the subsamples are provided in the QAPP (CRA 2001a). Pre-cleaned containers, shipped from the analytical laboratory, will be used for all samples. Certificates of analysis that document cleanliness will be kept on file at the laboratory for every lot of sample containers purchased and will be available upon request. The certificates of analysis will document that any possible contamination of the sample containers will be less than the limit of quantitation for the specific analyses. Depending on the compatibility of sample handling requirements, the analytical laboratory will identify subsamples for specific analyses that can be included in the sample containers.

2.4.3 Decontamination of Sediment and Soil Sampling Equipment

All field equipment will be decontaminated in a manner appropriate to the matrix being sampled, the type and anticipated concentration of chemicals, the required detection limit, and the anticipated quantity of sample material. Equipment will be decontaminated using the following general sequence: site water rinse, detergent scrub and rinse, organic solvent rinse (acetone followed by hexane for sampling organic constituents), site water or distilled/deionized water rinse, and air dry. The hexane and acetone rinsates will be collected in a container and properly disposed of. If there is a significant lapse of time between decontamination of the sampling equipment and collection of the sample, then the decontaminated sampling equipment will be protected from additional contamination by wrapping the decontaminated equipment in foil, placing the equipment in clean bags, and placing the clean bags in clean containers for transport or storage.

2.4.4 Sampling Order

Subsamples for analysis of TCL VOCs will be placed in sample containers prior to compositing. The remaining sediments or floodplain soils will then be composited in a stainless-steel bowl.
using a stainless-steel spoon to mix to uniform appearance. Sample containers for SVOCs will be filled next, followed by containers for other organic analyses (i.e., TCL PCBs), and then the containers for metals analyses will be filled, and finally containers for conventional analyses will be filled.

2.5 Biota Sampling

2.5.1 Target Species

Based on recent observations of aquatic species abundance and diversity in the study area streams (see Appendix A), the following species will be targeted for sampling:

- Crayfish will be targeted at all biota sample stations. Field observations indicate that they are present in sufficient quantity to sample throughout the study area. The largest crayfish captured will be preferentially selected to make up composites.

- Two species of forage fish will be targeted at all biota sample stations:
  - A cyprinid species, either blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), central stoneroller (*Campostoma anomalum*), or bluntnose minnow (*Pimephales* sp.), will be the primary forage fish target species. The target size class will be 2 to 8 cm. The primary target will be selected in the field, based on the relative abundance of the four candidate species at the two upstream biota sample stations above Broomsage Road. The other three species will be potential alternates if the primary target is not captured at other stations.
  - Sunfish (*Lepomis* sp.) will be the secondary target forage fish species. The target size class will be 6 to 12 cm. Shiner (*Notropis* sp.) will be the alternate secondary target forage fish species, in the event *Lepomis* are not captured at any station.

Whole body composite samples will be collected, with a minimum mass of 50 g per sample. A scientific collection permit has been obtained for this activity from IDNR. While it is desirable to sample the same species throughout the study area, local variations in species diversity and habitat limitations may preclude this possibility. In the event that none of the target species is present at any station, the field team will attempt to collect the most abundant observed fish species.

When present, discrete samples of game fish of edible size will be retained for fillet analysis and assessment of potential human health exposure. Larger fish will be preferentially retained and sent to the laboratory for filleting and analysis. The target sample size for fillets is 100 g.
Fish species regulated as game fishes by the IDNR (2001) are listed in Appendix E. Game fish species of edible size are not expected to be present in the study area, with the exception of the stations in Salt Creek.

2.5.2 Sampling Equipment and Procedures

A combination of electroshocking, seining, and traps will be used to obtain biota species. Each of these alternative techniques is likely to provide different species of crayfish or fish for analysis. The following information will be recorded as soon as possible after sample collection for each individual biota sample collected:

- Species identification
- Total length and weight
- Presence of grossly visible abnormalities.

2.5.3 Biota Sample Container, Preservation, and Handling Procedures

After length and weight measurements have been made for crayfish and fish, they will be double-bagged in plastic Ziploc® bags containing a sample identification label on the inner bag and an external sample identification tag affixed to the outer bag. Chemical analyses of game fish collected for the purpose of assessing potential risks to human health will be performed on fish fillets only. These fish will be filleted at the chemical testing laboratory in accordance with U.S. EPA and IDEM recommended methods (U.S. EPA 2000). Chemical analyses of crayfish and forage fish collected for the purpose of the ecological assessment will be performed on composited whole-body samples.

Sample processing will be conducted in accordance with SOPs 115 and 116A. Composite samples will be bagged together to represent one sample for analytical purposes. Immediately after samples are processed, they will be placed in a cooler on ice. Samples will be stored and shipped at 4±2°C.

2.5.4 Decontamination of Biota Sampling Equipment

Because only whole-animal biota samples will be sent to the laboratory (i.e., no field filleting), no equipment decontamination is required for the biota sampling. All samples will be protected from possible contamination during transport and storage. Sampling equipment will be rinsed with site water after biota sample collection is completed at each station.
2.5.5 Sampling Order

Biota samples will be collected in the same drainage study areas and reference areas as the surface water and sediment samples. The biota sampling will occur at all locations after surface water and sediment sampling have been completed.
Field quality control samples will include field duplicates, equipment rinsate blanks, and trip blanks. The following is a summary of quality control samples, which will be collected in the field and then analyzed by the analytical laboratories with the natural samples. For a full discussion of quality control procedures, refer to the QAPP (CRA 2001a).

- **Field Duplicates**—Field duplicate sediment samples will be collected and analyzed to assess the variability of chemical concentrations at a location. Field duplicates provide a measure of the total analytical bias (field and laboratory variance), including bias resulting from the heterogeneity of the replicate sample set itself. For each sample type (i.e., sediment, floodplain soil, and surface water), field duplicates will be collected at a minimum frequency of 1 per 10 samples or once per sampling event, whichever is more frequent.

- **Equipment Rinsate Blanks**—Equipment rinsate blanks will be collected for surface water, sediment, and floodplain soil samples to help identify possible contamination from the sampling environment or from the sampling equipment (e.g., grab, bowl, spoon for sediments and soil; collection bottle for surface water). For surface water samples, the equipment rinsate blank will consist of running distilled/deionized water through the depth-integrated sampler’s collection bottle, after decontamination and prior to collecting field samples. For each type of sediment and floodplain soil sampling (i.e., grab, spoon, and bowl), equipment rinsate blanks will consist of running distilled/deionized water over the sampling equipment. The equipment rinsate blanks will be stored with the associated surface water, sediment, or floodplain soil samples during both shipment from the field and during laboratory storage. For each sample type (i.e., surface water, surface sediment, floodplain soil), an equipment rinsate blank will be collected from the field at a frequency of 1 in 10 field samples or once per sampling event, whichever is more frequent.

- **Trip Blanks**—Trip blanks will be carried with sample coolers when sampling surface water, sediment, and floodplain soils for TCL VOCs and will be used to assess possible contamination during sample transport. Trip blanks will be prepared at the laboratory. The VOC trip blank will consist of American Society for Testing and Materials Type II water that has been purged with an inert gas in clean volatile organic analysis vials. Trip blanks will remain unopened during the sampling event. The trip blank will be included in each cooler used for transporting TCL VOC samples and will remain sealed during sample collection and transport. Trip blanks will be shipped at a frequency of once per matrix per sample shipment that contains samples for TCL VOC analysis.
An extra volume of sample matrix (i.e., surface water, sediment, floodplain soil, biota) will be collected for matrix spike/matrix spike duplicate analysis. The extra volume of sample matrix will be collected at a frequency of 1 in 20 field samples. The extra volume of sample matrix will be designated as “extra volume” on the COC/SAR form.
4 Field Data Reporting

The integrity of each sample from the time of collection to the point of data reporting must be maintained throughout the study. Proper record-keeping will be implemented in the field to allow samples to be traced from collection to final disposition. The various logs and labels required to adequately identify and catalog station and sample information include the following:

- **Field Logbook**—A bound, waterproof field logbook with consecutively numbered pages will be completed for this sampling event. All daily field activities will be documented in indelible ink in this logbook; all entries will be signed and dated and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. Field logbooks will be stored in a secure manner when not in use. The field team leader will record the following information daily in the field logbook:
  - Person to whom the logbook is assigned
  - Logbook number
  - Project name, project location, and project number
  - Project start date and end date
  - Date and time of entry (24-hour clock)
  - Time and duration of daily sampling activities
  - Weather conditions
  - Level of personal protection being used
  - Name of person making entries and other field personnel
  - Onsite visitors, if any
  - The sample identifier and analysis code for each sample to be submitted for laboratory analysis
  - The station name, date, gear, water depth (if applicable), and station location coordinates
  - Specific information on each type of sampling activity
  - Identification of all equipment used to make measurements, along with the date of calibration, if appropriate
- The sample type (i.e., surface water, sediment, floodplain soil, or biota), sample number, and sample tag number
- A description of the sample (source and appearance; e.g., sediment/soil type, color, and odor)
- A description of the riparian habitat, avian species, and signs of any wildlife in the area
- The number of photographs taken at the station
- Variations, if any, from specified sampling protocols and reasons for deviations
- The signature of the person making the entry.

- **Sample Label**—A sample label (example provided in Appendix C) will be completed for each sample, as described in the QAPP (CRA 2001a). All sample label entries will be made with indelible ink. Sample containers will be labeled at the time of sampling with the following information: sample identifier, site name, sampling date and time, sampling personnel, and preservative (if appropriate).

- **Sample Tag**—A sample tag (example provided in Appendix C) will be completed for each sample. A sample tag will be attached to each individual sample container with a rubber band around the container neck through a reinforced hole in the tag. All sample tag entries will be made with indelible ink. Sample containers will be tagged at the time of sampling with the following information: field sample number, site name, sampling date and time, sampling personnel, preservative (if appropriate), and type of analysis. A space for the laboratory sample number (provided by the laboratory at log-in) will also be provided on the sample tag.

The field team leader is responsible for properly completing all forms. The field logbook must be completed at the time the observations are made. In addition, a station map will be updated during sampling and will be maintained throughout the sampling event.
5  Field Custody Procedures

The integrity of each sample from the time of collection to the point of data reporting must be maintained throughout the study. Proper record-keeping and COC procedures will be implemented to allow samples to be traced from collection to final disposition. The various forms required to adequately identify and catalog station and sample information include the following:

- **COC Form**—The sample identifier and tag numbers of each sample container will be recorded on a COC form (example provided in Appendix C). The signed COC form will be secured to the inside top of each cooler in a Ziploc™ bag. The COC form will also identify the sample collection date and time, the type of sample, the project, and the field team leader. The COC form will be sent to the laboratory along with the sample. COC forms will be completed in triplicate, with one copy retained by the field team leader.

- **SAR Form**—Each set of samples sent to a laboratory will be accompanied by an SAR form (example provided in Appendix C). The SAR form will identify samples by sample identifier and sample tag. For each sample tag, the SAR form will identify the preservative or other sample pretreatment applied and the analyses to be conducted by referencing a list of specific analytes or the statement of work for the laboratory. One copy of this form will be retained by the field team leader, and the original form will accompany the shipment. A combined COC and SAR form may be used.

- **Custody Seal**—Custody seals will be affixed with custody packing tape to each sample container, across the lid and the sides of the sample container. Two custody seals (example provided in Appendix C) will also be placed across the lid of the cooler (front right and back left) prior to shipping.

At the end of each day and prior to shipping or storage, COC entries will be made for all samples. Finally, information on the labels and tags will be checked against field logbook entries and samples will be re-counted.

The field team leader is responsible for properly completing all forms. COC and SAR forms will be completed and signed before the end of each sampling day and before the samples are removed from the vessel or pass from the control of the field team leader. COC forms will be signed at each additional point of transfer of samples between the field and the laboratory and within the laboratory. Copies of all forms will be retained by the field team leader.

Whenever samples are split with an Agency representative, a separate COC/SAR form will be prepared for those samples and marked to indicate with whom the samples are being split. The
person relinquishing the samples to Agency personnel will request the Agency representative’s signature on the COC/SAR form acknowledging sample receipt.

If the samples are sent by commercial carrier (e.g., Federal Express), a bill of landing will be used. A copy of the bill of landing will be retained by the field team leader as part of the permanent documentation that will be filed with the original logbooks and COC/SAR forms at Exponent’s Bellevue office. Commercial carriers are not required to sign the custody record as long as the COC/SAR form is sealed inside the sample cooler and the custody seals remain intact. COC seals will be placed across the cooler lids. A copy of the form, signed upon receipt at the laboratory, will be returned to the field sampling contractor and filed in the project file.
6 Sample Packaging and Shipping

All sample containers will be provided by the laboratory and prepared in accordance with U.S. EPA (1990) prior to field operations. Only new sample containers (e.g., I-CHEM 200 or Industrial Glassware or the equivalent) will be used for sample collection. The laboratory will provide the appropriate size and type of sample container with the applicable preservative (if appropriate). Certificates of analyses will be maintained by each testing laboratory for each container lot to document conformance to U.S. EPA specifications. Sample containers will be kept closed and in a cooler or in the shipping package until use. As they are collected, subsamples will be fully labeled and recorded in the field notebook along with other pertinent collection data. Immediately after they are filled and labeled, all sample containers will be placed on ice in a cooler at 4±2°C. Additional subsamples will be collected and archived frozen, in the event that such analyses are later determined to be necessary. For those archived samples, sufficient headspace will be left in each jar to accommodate expansion during freezing.

All surface water sample coolers will be delivered to the testing laboratory by an overnight delivery service (e.g., Federal Express) at the end of each day’s sampling, or as soon as practical. All other coolers will be held on ice (4±2°C) in a secure environment and shipped as soon as possible after the cooler has been filled with samples. Commercial carriers will not be required to sign off on the COC form because the custody forms will be sealed inside the sample cooler and the custody seals will remain intact. When the samples are sent by a delivery service, the shipping form will be used as part of the permanent documentation.

Surface water, sediment, floodplain soil, and biota samples for all chemical analyses will be shipped on ice (4±2°C) to the testing laboratories and will be stored at 4±2°C until analysis and final disposition of the samples. Maximum sample holding times are stipulated in the QAPP (CRA 2001a). All field samples, except archived chemical samples, will be analyzed as soon as possible after receipt at the laboratory. Archived sediment samples will be placed at an angle to minimize breakage and will be placed in a plastic bag to avoid cross contamination should breakage occur. The archived samples for possible future chemical analyses will be held frozen (i.e., −20°C) at the laboratory pending a decision to begin analyses within the specified holding time for frozen samples.

Samples in glass jars or bottles that are shipped or sent by courier will be packed in bubble-wrap plastic to prevent breakage. All sample jars and bottles will be placed in individual resealable plastic bags (e.g., Ziplocs®). All samples will be placed in an upright position and packing will be limited to one layer of samples for all surface water samples and equipment rinseate blanks. After all sample containers and ice are placed in the cooler, additional bubble wrap or packing material will be added to fill any space. Combined COC/SAR forms will be enclosed in the coolers, and COC seals will be placed across the right and left sides of the cooler lids. A copy of the form, signed upon receipt at the laboratory, will be returned to the field sampling contractor and filed in the project file. Sample packaging and shipping requirements are described in SOP 2 (provided in Appendix B).
7 Schedule and Personnel

Sampling for the stream investigation is anticipated to take place during the weeks of October 1 and 8, 2001. Sampling is estimated to require 7 to 12 days. The sequence of sample collection will be arranged to maximize efficiency while minimizing potential cross-sample contamination. All samples will be collected in a downstream-to-upstream direction. Surface water samples will be collected prior to all other stream sampling activities (i.e., sediment, floodplain soil, and biota collection). After all of the surface water samples have been collected, the sediment and floodplain soil samples will be collected, followed by the biota collection activities. The actual sequence in which the stations will be visited will be determined in the field by the field team leader.

During the sampling event, the sampling team will consist of a vessel operator (biota sampling only), a field team leader, and at least one field team member. The field team leader will be responsible for all decisions concerning sample collection. If a significant deviation from this FSP needs to be considered because of conditions encountered during sampling (e.g., repositioning of a station location), the field team leader will notify the Exponent project manager and the GM project manager.

The anticipated Exponent field team will include the following:

- **Field team leader**: Steve Klein
- **Field team members**: Sheryl Law, Johanna Salatas, Brian Estes, Cristin Krachon
8 Sampling Safety

All aspects of the project HSP (CRA 2001b) will be followed. Safety hazards are associated with the equipment and supplies that will be used, as well as with the general rigors of work on the water. The supplemental HSP provided in Appendix D is to identify potential hazards, institute procedures for minimizing those hazards, document the proper responses in case of accident and injury, and make this information known to all shipboard personnel. Before sampling begins, a health and safety briefing will be held before boarding the sampling vessel.

To ensure safe and efficient boating operations, the field team leader will be designated the safety officer responsible for all boating operations, including evaluating hazardous conditions, ensuring compliance with safety precautions, and suspending shipboard operations if necessary. A halt to or suspension of operations can also be dictated by the vessel operator.

8.1 Hazards

Hazards encountered during sampling are generally classified as either chemical or physical. Chemical hazards are primarily associated with the materials used to clean sampling gear. Physical hazards are associated with the gear and conditions of work on the water.

8.1.1 Chemical Hazards

Stations to be sampled during the survey are not expected to contain concentrations of chemicals (including natural sulfide) that pose an acute hazard to human health. Nitrile gloves will be worn during sampling. If excessive odor, nonaqueous liquids, or organic enrichment is observed during field operations, the sampling plan will be reassessed. Precautionary steps may include artificially ventilating the rear deck, instituting suitable protective measures for the crew, or relocating or eliminating the sampling station.

Acetone and hexane will be used to clean the sampling equipment. Both are clear, colorless, volatile solvents with strong odors. Acetone and hexane will be used only on in the open air, and personnel must wear protective gloves when handling these liquids.

Material safety data sheets for acetone and hexane are included in the supplemental HSP (Appendix D).

8.1.2 Physical Hazards

Lines, mud, and uneven deck surfaces present tripping, slipping, and falling hazards. Every member of the sampling team will be instructed to be alert for these types of hazards.
A drowning hazard exists for personnel working from a boat on Salt Creek, primarily from tripping (discussed above). Flotation vests will be worn by all personnel onboard a vessel.

Fatigue presents a hazard when working in the field or on the water and can be compounded by the motion of the vessel, exposure, heat stress, or hypothermia. Personnel will monitor their own conditions and capabilities and are responsible for taking appropriate measures to relieve fatigue or exposure. The field team leader may also direct any member of the field team to cease working.

### 8.2 Safe Work Practices

Precautions for handling chemicals include wearing gloves, storing and dispensing the chemicals from narrow-mouth bottles or squirt bottles, and exercising care in use. Solvent rinsate from sampling gear will be collected in a container so excess solvent is not spilled.

Hands and feet must never be placed underneath sediment sampling gear. Special safety precautions must be observed when working with the electroshocker. These safety procedures are provided in SOP 112.

Weather conditions will be monitored by the field team leader and vessel operator. Food and water will be available in the field for the sampling team. Each team member will be required to bring clothing appropriate for the weather to minimize the hazards of exposure, heat stress, and hypothermia.

### 8.3 Emergency Planning

If an emergency or accident occurs during sampling, the field team leader and vessel operator will determine the appropriate response. They will assess the severity of the incident and, if appropriate, contact emergency assistance. The vessel operator is responsible for moving the boat into position to receive emergency aid, if necessary. A basic first-aid kit will be kept with each field team to treat minor cuts or scrapes. At least one member of the field team will have received first-aid and CPR training. All accidents must be reported to the field team leader and will be recorded in the logbook. Contact information for local emergency services, hospitals, and ambulance services will be with each field team and the location will be known to and accessible to all personnel. Emergency contact information is provided in the supplemental HSP (Appendix D).
9 References


Figure
Figure 1. Stream investigation sampling stations

Source: Base map from TIGER line and boundary files

LEGEND
- Sediment / Floodplain station
- Sediment / Floodplain station with water samples
- Sediment / Floodplain station with biota samples
- Sediment / Floodplain station with biota & water samples
- Transect location

Note: Contour intervals are 10 feet

Source: Water map from TIGER line and boundary files
Table 1. Stream investigation sample media by station

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Appendix A

Field Notes from Ecological Reconnaissance of Bedford Stream Investigation Study Area—August 6–8, 2001
Field Notes from Ecological Reconnaissance of Bedford Stream Investigation Study Area—August 6–8, 2001

Reconnaissance Participants

- Rick Bodishbaugh, Pieter Booth, Tony Dodd, Johanna Salatas—Exponent
- Jeff Nichols—CRA
- Will Enriquez—U.S. EPA Region 5
- John Gunter, Ann Kominowski (Monday, August 6 only).

The reconnaissance effort was initiated with a kick-off meeting at the site trailer on August 6. All participants confirmed review of the project Health and Safety Plan. Property boundaries, access agreements, and the reconnaissance strategy were reviewed. The study area is described in the stream investigation work plan (Exponent 2001). During the two-and-a-half-day visit, the entire study area drainage was viewed on foot and by car. Gullets Creek, a potential reference sampling location, was also observed at two road crossings. The following narrative presents habitat characterizations and observations organized according to stream reach. Observations made on different days have been consolidated. Trial fishing efforts using a backpack electroshocker and seine net were conducted at four locations. The findings of these efforts are also noted below.

Conditions during the reconnaissance were dry and very hot. All streams were in an extremely low-flow condition.
Seep Area East of Stormwater Retention Pond

Surface water originating from several seeps or bedrock springs collects in this low area. The largest of these seeps is approximately 4 ft in diameter with water depth to 0.5 in. Flow emerges in soft sediment substrates covered with detritus and a rust colored scum on the water surface. Several channels, including manmade ditches leading from Outfall 003 (normally zero flow), and the location of former Outfall 001 converge here. The combined water then flows east through a culvert under Bailey Scales Road, and eventually to Bailey’s Branch. Average stream widths in the seep area are approximately 2 ft with water depths to 1 in. The soft fine-grained substrates are laden with twigs and detritus. The stream banks are well vegetated and shaded by a canopy of mature trees. No aquatic macroinvertebrates or fish were observed in this reach.

Outfall 002 to Bailey Scales Road Bridge

The entire flow of the unnamed tributary leading from the GM facility comes from the treated water discharge of Outfall 002 under the low-flow conditions observed. This stream segment varies in width from approximately 1 to 8 ft wide with depths ranging to nearly 1.5 ft in pools of the reach. Cobble, bedrock outcrop, gravel, and occasional patches of fine-grained deposits in pool habitats comprise the substrates throughout the reach. These microhabitats are augmented by limited bankside cover in the form of undercut ledges, patches of periphyton, and root wads. Water velocities range from trace velocities (<0.05 ft/s) in pools to nearly 1.5 ft/s in the cobble runs and riffles. Stream banks of the reach are well vegetated and well shaded by stands of mature trees. A single spot of floating sheen with faint chemical odors was observed in one location, though there was no sediment, depositional environment, or any evidence of submerged oil at this location.

A limited variety of aquatic and terrestrial fauna and/or animal signs were observed in this reach including: adult and nymph stage damsel flies (Odonata), aquatic snail (Gastropoda), crayfish (Decapoda) burrows, water striders (Veliidae), orangethroat darter (*Etheostoma spectabile*), blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), Johnny darter
(Etheostoma nigrum), green sunfish (Lepomis cyanellus), and central stoneroller (Campostoma anomalum).

Signs of terrestrial fauna observed included tracks of white-tailed deer (Odocoileus virginianus), raccoon (Procyon lotor), turkey vultures (Cathartes aura) flying overhead, and one dead short-tailed shrew (Blarina brevicauda). Evidence of mole activity was also observed.

**Bailey Scales Road Bridge to Broomsage Road Bridge**

In this reach, the unnamed tributary flows north into Bailey’s Branch, which continues northwest towards Pleasant Run. Stream width ranges from approximately 7 to 9 ft with estimated maximum water depth to a few in. in the runs and to 12 in. in the pools. Substrate throughout the reach consists of bedrock outcrop, cobble, gravel, and occasional patches of fine-grained sediments in the pools. Dominant microhabitats are represented by shallow cobble runs and shallow pools. Unique habitats include a segment of channel approximately 500 ft long where stream flow subsides beneath the streambed, and a segment of very shallow water (to approximately 0.5 in. deep) flowing over smooth, fairly featureless, bedrock outcrop adjacent to a small, flooded rock quarry cut into the bedrock hillside. The quarry pond, of unknown depth, is located approximately 50 ft east of the stream channel. The surface is covered with algae and detritus. There are no visible outlets. According to local residents, the stream occasionally overflows its banks into the quarry pond during flood events. A sewage pipe runs the length of this reach to its terminus at a sewage lift station located along the main stem of Bailey’s Branch. Stream banks of the reach are well vegetated and fully shaded by tree canopy. Several thousand feet downstream of the quarry pond area, other tributaries originating from the east join the Outfall 002 tributary to form Bailey’s Branch. Under the conditions observed, these tributaries contribute little or no flow. Water velocities range from trace velocities in pools to approximately 1 ft/s across the bedrock slab.

Observations of aquatic fauna in this reach include aquatic pillbugs (Isopoda), leeches (Hirudinoidea), unidentified Cyprinid minnows and Centrarchid sunfishes, unidentified salamanders or newts (Caudata), water striders, crayfish, caddisfly nymphs (Glossosomatidae),
mayfly nymphs (Ephemeroptera), and water pennies (aquatic beetle or Psephenidae). Amphibians were abundant, including red-spotted newt (*Notophthalmus viridescens*), leopard frog (*Rana pipiens*), and green frog (*Rana clamitans melanota*).

Observations or signs of terrestrial or avian fauna included numerous sightings of passerine birds, red-headed woodpeckers, hawk feathers (*Buteo* sp.), tracks of deer and raccoon, and an Eastern box turtle (*Terrapenne carolina carolina*).

Electrofishing just upstream of the Broomsage Road bridge yielded 43 individual fish representing 5 species. A ranking of species by relative abundance is as follows: blacknosed dace (55.8 percent), orangethroat darter (14 percent), creek cub (11.6 percent) central stoneroller (11.6 percent), Johnny darter (4.7 percent), and green sunfish (2.3 percent). Attachment 1 provides a list of species by relative abundance collected at this location plus three other locations sampled for fish during the reconnaissance.

**Broomsage Road Bridge to Bailey’s Branch—Pleasant Run Confluence**

Typical habitat in the lower segment of Bailey’s Branch is characterized by wetted channel width averaging approximately 8 ft and water depth to 1 ft in the pools. Substrate consists mostly of cobble, bedrock, gravel, and occasional patches of fine-grained sediments. The average stream gradient decreases below Broomsage Road, and areas of limited floodplain occur in the middle and lower reaches of this segment. Instream habitat consists mostly of interstices among the cobble, occasional undercut ledges, root wads, and accumulations of large woody debris. A few larger pools (to 30 ft long and 10 in. deep) and shallow, open runs over bedrock are present in the upper reach near a high voltage powerline right-of-way. Water velocities range from trace to approximately 0.75 ft/s. Isolated pools with apparently little or no flow occur near the most downstream portion of this reach near the confluence with Pleasant Run Creek. Stream banks of the reach are well vegetated and well shaded by stands of mature trees.
Observations of aquatic fauna included: unidentified minnows, crayfish, mayfly nymphs, and green frog. Observations or signs of non-aquatic animals were limited to small birds and deer tracks.

**Bailey’s Branch—Pleasant Run Confluence to Peerless Road Bridge**

The stream gradient of Pleasant Run is considerably lower than that of Bailey’s Branch. Relatively steep, heavily vegetated stream banks characterize this watercourse. Bank height averages approximately 6 ft throughout the reach. High water marks (to 9 ft) are evidence of seasonal high flow and over-bank flooding in this segment, and floodplain areas exist on both banks. Wetted channel width averaging approximately 10 ft and depths possibly ranging to 3 ft in pools. Substrate consists mostly of cobble interspersed among areas of gravel or soft sediments or cobble covered by soft sediments. Instream habitat consists mostly of root wads, accumulations of large woody debris, and shaded pools. Water velocities are sluggish with trace to 0.5 ft/s common. Stream banks exhibit a general trend of sloughing from high-flow events in addition to extensive segments of heavily worn and exposed banks due to cow activity. Instream habitat conditions for fish and aquatic invertebrates appear to be of marginal quality throughout this segment due to soft transient sediments and turbid conditions.

Observations of aquatic fauna included: creek chub, bluegill (Lepomis macrochirus), longear sunfish (L. megalotis), green sunfish, Johnny darter, blacknose dace, unidentified molluscs, numerous crayfish, and numerous frogs. Observations of non-aquatic mammals or their sign were limited to deer and raccoon tracks and scat. Several Eastern bluebird (Sialia sialis) boxes set in the stream banks on posts approximately 3 ft high were opened and found to be vacant and overrun by ants. Evidence of potential nesting materials from earlier in the breeding season was not found. One great-blue heron (Ardea herodias) was witnessed flying overhead, and one belted kingfisher (Ceryle alcyon) was noticed flying along the creek.

Trial fishing using a seine net was conducted just downstream of the Peerless Road bridge. The fish collection yielded 33 individual fish representing 6 species. Dominant species included
bluegill (42.4 percent of the catch), creek chub (24.2 percent), longear sunfish (15.2 percent), and blacknose dace (12.1 percent). Attachment 1 provides a list of other fish species collected at this location in ranked order of relative abundance.

**Peerless Road Bridge to Salt Creek**

Prominent riparian features of this segment include active and fallow agricultural fields and forested floodplain. Braided channel systems occur in floodplain areas and are influenced by beaverdam impoundments, occasional accumulation of large woody debris, and significant evidence of cow activity in the form of trodden and eroded stream banks and turbid waters. A herd of approximately 20 cows was present in the riparian area immediately west of the Peerless Road bridge.

High water stages from storm flows likely occur in this reach were indicated based on the presence of watermarks to 12 ft above streambed, water stains, and drift lines along steep embankments; although, stream banks are not as high (3 to 6 ft) in the upper-middle and upper reaches of this segment. Wetted channel width ranges from 6 to 12 ft with depths in pools possibly to 4 ft. Shallow runs with depths ranging from 0.2 to 1 ft deep are common, whereas cobble or gravel riffles occur at only one location, near the site of the former Murdock railroad bridge. Water velocities of 0.5 ft/s or less are common. Throughout the entire reach, the dominant substrate consists mostly of soft sediments over cobble or cobble patches interspersed with soft sediments. Floodplains are extensive on both banks upstream of the former railroad bridge. Stream banks exhibit sloughing slopes subject to storm flow events in addition to extensive segments of heavily worn and exposed banks due to cow activity, especially in the middle and upper reaches. Instream habitat conditions for fish and aquatic invertebrates appear to be of marginal to satisfactory quality throughout this segment due to occurrence of sluggish flows, soft sediments, and turbid conditions.

Pleasant Run flows into Salt Creek. Trial fish collections were not conducted in Salt Creek. Owing to its larger size and based on fish data from previous investigations of the area, Salt Creek is expected to provide an ample supply and diversity of target fishes for the purpose of
satisfying a fish tissue sampling event. This location may be a good candidate for collecting tissues from larger gamefish. Roadside observations were made at Salt Creek and Peerless Road bridge. At that location, the wetted perimeter of Salt Creek is approximately 55 ft wide. Depths are expected to commonly range to 6 ft or deeper throughout the vicinity. This area of Salt Creek is characterized by high, steep unvegetated banks that are mostly shaded by mature tree canopies throughout. Instream fish cover appears limited to occasional boulders, cobble patches, and large woody snags.

Observations of aquatic fauna included: juvenile pickerel (*Esox* sp., likely grass pickerel), unidentified shiners (*Notropis* sp.), bluegill, orangethroat darter, Johnny darter, common shiner, unidentified minnow (*Pimephales* sp.), silverjaw minnow (*Ericymba buccata*), central stoneroller, creek chub, striped shiner, northern hogsucker (*Hypentelium nigricans*), pugnose minnow (*Opsopoeodus emiliae*), white sucker (*Catostomus commersoni*), blacknose dace, longear sunfish, juvenile bullhead catfish (*Ameiurus* sp.), backswimmer beetles (Pleidae), unidentified minnow mayfly nymphs, caddisfly nymphs, aquatic snails, numerous crayfish, and frogs, including green frog and Southern leopard frog (*Rana utricularia*).

Observations of terrestrial wildlife or their signs included Northern cardinal (*Cardinalis cardinalis*), American goldfinch (*Carduelis tristis*), tracks and feathers of wild turkey (*Meleagris gallopavo*), feathers of a hawk (*Buteo* sp.), deer and raccoon tracks, and signs of beaver (*Castor canadensis*) activity.

Trial fishing using a seine net was conducted in the immediate vicinity of the former Murdock railroad bridge. The fish collection effort yielded 82 individual fish representing 18 species. Dominant species listed in ranked order of abundance included creek chub (23.2 percent), *Notropis* sp. shiners (22 percent), and striped shiner (11 percent). Attachment 1 provides a list of other fish species collected at this location in ranked order of relative abundance.
Pleasant Run at Mount Pleasant Road Bridge

Pleasant Run was observed in the vicinity of the Mount Pleasant Road bridge, approximately 1 mile upstream of the confluence with Bailey’s Branch. Several large pools just upstream of the bridge were electrofished. Species observed and returned to the stream included orangethroat darter, bluegill, Johnny darter, green sunfish, common shiner (*Luxilus cornutus*), central stoneroller, creek chubsucker (*Erimyzon oblongus*), unidentified shiners (*Notropis* sp.), blacknose dace, striped shiner (*Luxilus chrysocephalus*), white sucker, unidentified minnow (*Pimephales* sp.), creek chub, and fantail darter (*Etheostoma flabellare*). The trial electrofishing effort yielded 151 individual fish representing 14 species. Dominant species listed in ranked order of abundance included central stoneroller (53.6 percent), blacknose dace (9.9 percent), and Johnny darter (9.3 percent). Attachment 1 provides a list of other fish species collected at this location in ranked order of relative abundance.

Pleasant Run at County Road 400 Bridge

Pleasant Run was observed in the vicinity of the County Road 400 culvert. The stream had no flow at this location. Several large isolated pools (approximately 15 ft wide by 20–50 ft long and up to 12 in. deep) are present downstream of the road crossing. These pools consisted of stagnant water with abundant algae growth. No fish were observed to be present in the pools. The pools were being used by cattle for wallowing and were heavily contaminated with manure at the time of the site reconnaissance. Little to no sediment was observed in the streambed at this location.

Gullett’s Creek

Gullett’s Creek was observed from two road crossings, one above and one below the town of Needmore. Based on the roadside observations, Gullett’s Creek appears to support a relatively high quality aquatic habitat. Clear flowing waters and clean swept cobble, gravel, and bedrock substrates in wetted channels to 35 ft wide were apparent from the roadside views. A number of
schooling fishes were observed at these locations. Based on previous fish collections, Gullett’s Creek is expected to provide an ample abundance and species diversity as a reference location.

Summary

Observations of aquatic fauna in the study area indicate that a limited diversity of aquatic macroinvertebrates and fish currently inhabit the area. The limited diversity is not unexpected based on the small size and relatively unproductive nature of headwater streams in the upper watershed (unnamed tributaries and Bailey’s Branch) and the presence of degraded aquatic habitat due to cattle and agricultural activities in the middle and lower reaches of the study area (Pleasant Run). The reach of Pleasant Run between the confluence with Bailey’s Branch and the Peerless Road bridge is most heavily impacted by sedimentation and turbid waters related to cattle movement along the stream banks and through the stream. The segment of Pleasant Run located farther downstream towards Salt Creek also exhibits marginal instream habitat quality. Sedimentation and turbidity in this reach is likely the combined result of downstream effects from the middle reaches, combined with short- and long-term runoff effects from tillage in the adjacent agricultural fields. Fish species diversity in the study area appears to reflect habitat-based constraints. Fish (and crayfish) of certain species appear to be relatively abundant in most reaches of the study area, excluding upper Bailey’s Branch and its unnamed tributaries.

Reference