3. Establishing Benchmarks: Identify water body impairments, water quality threats, and baseline data for water quality and biological community parameters.

- Existing data: Sufficient baseline chemical, biological and habitat assessment data have been collected in order to make management decisions for the majority of the eight-digit watershed. One set of data was collected by Harza Engineering Co. as part of the "Diagnostic Study of Pigeon Creek", 1999-2000. This study was funded by Indiana Dept. of Env. Mgt.(IDEM), Indiana Dept. of Natural Resources(IDNR) LARE (lake and river enhancement)program and the City of Evansville Water & Sewer Authority. A Quality Assurance Project Plan (QAPP) was approved for the monitoring portion of the Diagnostic Study under IDEM ARN 99-215. In addition to monitoring nonpoint source pollution, the Harza study also sampled discharges from Evansville's NPDES-permitted combined-sewer overflows. Harza's data covers Pigeon Creek and tributaries in Gibson, Warrick & Vanderburgh counties, and McFadden Creek in Posey County. IDEM Water Quality Assessment Branch also collected chemical data in 1999 and 2000- on the main stem of Pigeon Creek in Vanderburgh County. IDEM's analyses included metals and pesticides/herbicides. *See Appendix A for the raw data, sampling dates and sample site locations.*
- A second data set was collected by Pigeon-Highland Watershed Steering Committee's watershed coordinator, Rick Obenshain. Obenshain collected and analyzed chemical, biological and habitat assessment data from November 2001 to June 2003 (this document includes data collected up to April 2003). The data were quality-assured under a QAPP developed for IDEM grant ARN 00-86. *See Appendix B for the raw data, sampling dates and sample site locations.*
- Summary of Data: The data from Harza's Diagnostic Study and Pigeon-Highland Watershed Steering Committee's monitoring reveals that human-induced changes to the watershed have resulted in degradation of water quality, loss of floodplain storage, diminished wildlife populations, and decreased aesthetic and recreational values. Specifically, the watershed upstream of Evansville is subject to nonpoint source pollution from agricultural, mining and other land use detrimental to stream health. Within the City of Evansville, Pigeon Creek is impacted by combined-sewer overflows (CSO) which contribute nutrients and bacteria to the stream. *See Appendix C for CSO data summary and recommendations.*
- Sediment from erosion is indicated as the greatest pollutant problem. The Harza study estimated that the sediment yield in the Pigeon Creek watershed was 29,712 tons per year. Well correlated to the sediment yield is the phosphorous loading of 39,218 kg per year. Other indicators of poor water quality were dry-weather *E. coli* bacteria levels well-above the state standard, high nitrate and phosphate levels, and poor diversity among the macroinvertebrates sampled.
- Pigeon-Highland Watershed Steering Committee's data reflected similar conditions. Obenshain was able to witness first-hand the destruction of habitat and sedimentation problems associated with development of land in the watershed area. In the spring of 2003, extremely high nitrate levels were detected at several monitoring points- in the absence of known human or animal waste discharges. Further testing revealed that the nitrate source was farm field drainage tile. Obenshain theorizes that the corn crop of 2002, which was well below average in yield in many areas of the watershed, failed to utilize the available nitrogen in the soil. With 12+ inches of snow and significant rain events early this year, the nitrate was subsequently leached through the soil into the groundwater, and discharged through the drainage tiles into the creeks.
- In a separate study of McFadden Creek watershed (05140202070050)in Posey County, both Harza and Pigeon-Highland Watershed Committee produced quality-assured data. Water quality analyses found: supersaturated oxygen levels, generally high nutrient and suspended solids concentrations, and high fecal coliform counts. The Harza study noted the following trends from downstream to upstream reaches: increased dissolved oxygen supersaturation, increased nitrate nitrogen concentrations and degraded physical habitat- particularly in the substrate and riparian ratings. *See Appendix D for raw data, sampling dates & sample site locations.*

Summary of Harza's data from McFadden Creek watershed:

Examined on a stream-reach scale, the data indicates that nonpoint source pollution from agriculture (82% of land-use) is resulting in degradation of water quality. In addition, the riparian zones, especially the upper reaches, have been cleared of all trees- resulting in diminished wildlife values, lack of woody debris in the channel and higher stream temperatures. Higher than normal conductivity readings at some sample sites may indicate brine contamination from oil wells in the watershed. There are three livestock operations in the watershed: one turkey farm, one swine operation and a dairy that all warrant attention. In addition, illegal disposal of solid waste is a problem in some areas of McFadden Creek.

- Pigeon-Highland Watershed Steering Committee's data on Carpentier Creek (05140202050010)revealed widely-fluctuating E. coli bacteria levels: 0 to 5400 col/100 ml, occasional alkaline spikes in pH, and normal nutrient and sediment loads. However, this urban subwatershed is under tremendous pressure from development, and in fact, the riparian habitat at the sampling location was recently completely removed by a developer. *See Appendix B for raw data.*
- IDEM's Assessment Branch also sampled in the Bayou Creek subwatershed (05140202070020). Their data, from the summer of 2000, indicate critically low dissolved oxygen levels and lower than normal pH. Volunteer data (non quality-assured), from Hoosier Riverwatch taken at two sites upstream from IDEM's site indicates phosphate enrichment, E. coli bacteria counts from 0 to 3600 col/100 ml, poor macroinvertebrate pollution tolerance scores, and poor habitat scores, indicating impaired water quality and habitat. *See Appendix E for the raw data and sample site locations.*

- A WRAS (watershed restoration action study) was completed by USDA-Natural Resources Conservation Service employee Andy Ertel in 2000. The study found similar conditions within the watershed without the detail of the Harza data.
- Impaired streams indicated in IDEM's 303(d)& 305(b) lists: Nine 14-digit subwatersheds of Pigeon-Highland watershed appear in IDEM's 2002 303(d) list: Crawford Brandeis Ditch (Vand) (PCB's); Pigeon Cr.-Lower Locust Cr.(Vand) (PCB's); Harper Ditch (Vand) (PCB's,low dissolved oxygen, high TDS, pathogens); Pigeon Creek at Kleymeyer Park (Vand)(PCB's, sulfates, TDS,pathogens and low dissolved oxygen); and the Ohio River from the confluence of the Green River to the confluence of the Wabash River (Vand, Posey)(PCB's, pathogens, dioxin); Hovey Lake(Posey) (PCB's); Squaw Creek (Warrick) (sulfates, TDS). It should be noted that PCB's are "legacy" contaminants usually found in the sediment of the affected water bodies. "Legacy" means that the original source of the contaminant may not be known, but is no longer actively contributing contaminants to the water body. The 305(b) report states that in the Ohio River Basin- of which Pigeon-Highland is a subbasin- 67% of stream miles do not provide aquatic life support. This is well documented for Pigeon-Highland watershed in the data we have.

- Point source discharges: Evansville is the largest community in the watershed, having a 1990 population of 126,272 person residing in 53,058 households. Other communities in the watershed include Chandler, Elberfeld, Fort Branch, Haubstadt, and portions of Owensville and Princeton. Many of these communities, as well as some industrial facilities, are permitted to discharge treated wastewater to directly to Pigeon Creek or its tributaries (Table 23, Exhibits 18 and 19). In this section we qualitatively evaluate the effects of these discharges on watershed health. Where possible, we relate NPDES compliance with our bioassessment data. The EWSU CSOs are addressed in detail in Appendix C.

Table 7: NPDES discharges

NPDES DISCHARGES TO PIGEON CREEK
(Source: USEPA Permit Compliance System)

FACILITY	RECEIVING WATER	HUC	NPDES
Indiana Hardwoods, Kimball Intern'l	Pigeon Cr via Stollberg Ditch via Ditch.	05140202030070	IN0058530
EWSU - Westside Plant	Ohio R (except certain CSOs)	05140202040	IN0032956
EWSU - Eastside Plant	Ohio R (except certain CSOs)	05140202040	IN0033073
Chandler Municipal WWTP	Pigeon Cr via Stollberg Ditch	05140202030070	IN0020435
Haubstadt Municipal WWTP	West Fork Pigeon Cr via Haubstadt (aka Hurricane) Ditch	05140202020030	IN0021482
Solar Sources Inc. - Pit 12	Smith Fork Cr Honey Cr Rough Cr.	05140202020060	IN0047970
Darmstadt Municipal WWTP	Pigeon Cr via Little Pigeon Creek	05140202040090	IN0052990
Lynnville Municipal WWTP	Pigeon via Big Cr via Mill Cr	05140202040010	IN0040282
Elberfeld Municipal WWTP	Pigeon Cr via Bluegrass Creek	05140202040020	IN0020788
Warrick Cnty Coal-Lynnville	Pigeon Cr via Big Cr via Plum B	05140202040010	IN0047287
Cargill Meat Products	West Fork Pigeon Creek via Toops Ditch	05140202020040	IN0001686
Fort Branch Municipal WWTP	West Fork Pigeon Creek	05140202020040	IN0022896
Mid-State Rubber Products	Clear Fork Pigeon Creek via storm sewer	05140202020020	IN0004880

Stollberg Ditch
Stollberg Ditch drains a portion of Hydrologic Unit Code (HUC) 05140202030070. We included this stream in our bioassessment. Stollberg Ditch was found it to contain some of the highest TSS, BOD, phosphorus, nitrate and ammonia nitrogen concentrations, and some of the lowest DO levels among sites we surveyed in the watershed. We also found low benthic diversity and an absence of sensitive macroinvertebrate taxa (mayflies, stonefiles, caddisflies). Stollberg Ditch is the receiving water for two NPDES discharges: Chandler Municipal Wastewater Treatment Plant (WWTP) and Indiana Hardwoods. Chandler WWTP was issued a new NPDES permit on June 18, 1999 to discharge 1.8 million gallons per day of treated sanitary wastewater into Stollberg Ditch. The facility is currently being upgraded to a major plant, with construction nearing completion. According to the new permit, effluent parameters to be limited and/or monitored include flow, carbonaceous BOD5, total suspended solids, ammonia nitrogen, pH, dissolved oxygen, total residual chlorine and *E. coli.* The Chandler WWTP has a history of being overloaded, bypassing of sewage, and regular noncompliance reports (USEPA Permit Compliance System).

Indiana Hardwoods, of Kimball International, Inc. is a manufacturer of hardwood veneers and plywood. Indiana Hardwoods also has a permit to discharge to Stollberg Ditch. Permit IN0058530 expires December 31, 2000 (has since been renewed). According to the Permit Compliance System, their wastewater is from the washing of logs in the yard. They are required to monitor pH, ammonia nitrogen, flow and carbonaceous BOD5. The facility has an apparently good compliance record, with two reportable noncompliance events recorded between March 1996 and July 2000.

West Fork Pigeon Creek
Two municipal and one industrial point source discharges are permitted in this drainage. The Haubstadt Municipal WWTP discharges to Haubstadt Ditch, a tributary of Hurricane Ditch, HUC 05140202020030, which drains to the West Fork Pigeon Creek HUC 05140202020040. The Town of Haubstadt WWTP was issued a new NPDES Permit, No. IN0021482, in November 1999 to discharge 0.81 million gallons per day of treated sanitary wastewater into Haubstadt Ditch. HC1 was one of our bioassessment sites, downstream of the Haubstadt WWTP. We found high concentrations of nitrate, phosphorus and coliform bacteria. The RBP results included very low numbers of sensitive taxa at HC1, a lack of shredders and a dominance of filterers. The permit requires that certain effluent parameters be limited and/or monitored at the WWTP: flow, carbonaceous BOD, total suspended solids, ammonia nitrogen, pH, dissolved oxygen and total residual chlorine. In July 2000, the Town approved IDEM-mandated upgrades to the WWTP to reduce wet weather overflows and to improve effluent quality. IDEM required the upgrades due to the Haubstadt WWTP's history of regular noncompliance reporting. This facility has completed upgrades to treatment processes.

The Town of Fort Branch WWTP discharges to the West Fork Pigeon Creek (Permit No. IN0022896). This WWTP was issued a new permit on July 31, 1998 to discharge 0.655 million gallons per day of treated sanitary wastewater into the West Fork of Pigeon Creek. It is a minor municipal wastewater treatment facility, and is required to monitor and or limit the following effluent parameters: flow, carbonaceous BOD, total suspended solids, ammonia nitrogen, dissolved oxygen, total residual chlorine and pH. There are sanitary sewer overflows in this system during wet weather. Since the new permit was issued, the permittee has reported four noncompliance events. We also had bioassessment sites on the West Fork Pigeon Creek. We found supersaturation DO, high concentrations of coliform bacteria, and nitrate. PHWSC monitored upstream and downstream from this plant and found similar results, although the treatment plant does not seem to be the main source of phosphorous in West Fork.

Cargill Processed Meat Products, of Fort Branch, was issued a new NPDES permit on May 14, 1999 (IN0001686). The permit allows the owner to discharge 0.272 million gallons per day of meat products processing wastewater into Toops Ditch, tributary to West Fork of Pigeon Creek. The permit requires the owner to limit or monitor the following effluent parameters: flow, BOD5, total suspended solids, oil and grease, ammonia nitrogen, fecal coliform bacteria, total residual

chlorine and pH. The facility is apparently well operated, without reports of noncompliance in the EPA's Permit Compliance System. The meat processing plant has since been closed, but a hog transfer station is still active at the site. PHWSC found no evidence of improper discharge from the site.

Clear Fork-Pigeon Creek
Mid-State Rubber Products, Inc. is in Princeton, IN. This industrial concern was issued a NPDES storm water permit on June 7, 1999 (IN0004880). The permittee manufactures molded, extruded, and lathe-cut mechanical rubber goods. The discharge is to the Clear Fork branch of Pigeon Creek on the south side of Princeton.

Big Creek
On April 27, 1998, NPDES Permit No. IN0040282 was renewed for the Town of Lynnville. The permit allows the WWTP to discharge 0.1 million gallons per day of treated sanitary wastewater into an unnamed tributary to Mill Creek, which discharges to Big Creek (HUC 05140202040010) in Warrick County. The facility is considered a minor municipal wastewater treatment plant. The permit requires the following effluent parameters to be limited and/or monitored: flow, carbonaceous BOD5, total suspended solids, ammonia nitrogen, dissolved oxygen, pH and total residual chlorine. Review of the EPA's Permit Compliance System database indicates two noncompliance reports since the permit was renewed.

Warrick County Coal had an NPDES permit to discharge to Big Creek, Permit No. IN0047287. The Permit Compliance System no longer includes this permit, so it has likely been abandoned.

Bluegrass Creek
Bluegrass Creek is the receiving water for Elberfeld WWTP, located in HUC 05140202040020. The facility is permitted to discharge 0.3 millon gallons per day of treated municipal wastewater to Bluegrass Creek. The permit requires the following effluent parameters to be limited and/or monitored: flow, carbonaceous BOD5, total suspended solids, ammonia nitrogen, dissolved oxygen, pH and total residual chlorine. While the facility has a poor compliance record, with numerous noncompliance reports in the EPA's Permit Compliance System database, the bioassessment sites on Bluegrass Creek did not indicate significant impairment. Elberfeld's WWTP is currently being upgraded.

Lower Pigeon Creek
While the EWSU wastewater treatment plants discharge to the Ohio River, the sewer system carries both stormwater and wastewater, and there are nine combined sewer outfalls that discharge to Pigeon Creek during wet weather. These discharges are permitted under NPDES Permits IN0032956 and IN0033073, which require the preparation of a Stream Reach Characterization Evaluation Report (see Appendix C) evaluating the impacts of these CSOs.