2024 Reference Site Monitoring Work Plan

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April 24, 2024
B-065-OWQ-WAP-XXX-24-W-R0

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Work Plan Organization

This work plan is an extension of the existing Indiana Department of Environmental Management (IDEM) Office of Water Quality (OWQ) Watershed Assessment and Planning Branch (WAPB) July 2023 “Quality Assurance Project Plan (QAPP) for Indiana Surface Water Programs (Surface Water QAPP) (IDEM 2023f and October 2020 QAPP for Biological Community and Habitat Measurements” (IDEM 2020a). Per the United States Environmental Protection Agency (U.S. EPA) Guidance on Systematic Planning using the Data Quality Objectives (DQO) Process (U.S. EPA 2006) and the U.S. EPA Guidance for Quality Assurance Project Plans (U.S. EPA 2002), the work plan establishes criteria and specifications pertaining to a specific water quality monitoring project usually described in the following four QAPP groups and associated elements.

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List of Acronyms

AIMS	Assessment Information Management System
ALUS	Aquatic life use support
ASTM	American Society for Testing and Materials
CAC	Chronic Aquatic Criterion
CALM	Consolidated Assessment Listing Methodology
CCC	Criterion Continuous Concentration
DO	Dissolved oxygen
IAC	Indiana Administrative Code
IBI	Index of Biotic Integrity
IDEM	Indiana Department of Environmental Management
MHAB	Multihabitat
OHEPA	Ohio Environmental Protection Agency
OWQ	Office of Water Quality
QA	Quality assurance
QA/QC	Quality assurance and quality control
QC	Quality control
QAPP	Quality assurance project plan
QHEI	Qualitative Habitat Evaluation Index
S.U.	Standard units
SOP	Standard operating procedures
U.S. EPA	United States Environmental Protection Agency
WAPB	Watershed Assessment and Planning Branch

Definitions

Elutriate	To purify, separate, or remove lighter or finer particles by washing, decanting, and settling.
15-minute pick	A multihabitat macroinvertebrate sampling method in which the 1-minute kick sample and 50-meter sweep sample collected at a site are first combined and elutriated. Macroinvertebrates are then manually removed from the resulting sample for 15 minutes.
50-meter sweep	A multihabitat macroinvertebrate sampling method in which approximately 50 m of all available habitat in a stream or river is sampled with a standard 500 µm mesh width D-frame dip net by taking 20 to 25 individual jab or sweep samples, which are then composited.
Macroinvertebrate	Aquatic animals which lack a backbone, are visible without a microscope, and spend some period of their lives in or around water.
1-minute kick sample	A multihabitat macroinvertebrate sampling method in which approximately 1 m^2 of riffle or run substrate habitat in a stream or river is sampled with a standard 500 µm mesh width D-frame dip net for approximately one minute.
Ocular reticle	A thin piece of glass marked with a linear or areal scale inserted into a microscope ocular, superimposing the scale onto the image viewed through the microscope.
Periphyton	Algae attached to an aquatic substrate.
Reach	A segment of a stream used for sampling.
Seston	Organic matter suspended in the water column generally comprised of phytoplankton, bacteria, and fine detritus.

A. Project Management

A.1 Project Objective

The 2024 reference site monitoring project's objective is to obtain reference sites' physical, chemical, and biological data. Reference sites are in areas with the least amount of anthropogenic disturbance and the most natural areas remaining within a specified geographic boundary. The selection of candidate reference sites is based on abiotic factors such as land use, water chemistry, and in-stream physical habitat, which may function as potential stressors to the aquatic assemblages including fish, macroinvertebrate, and diatom communities of the stream or river ecosystem. Data from the chosen sites establish and refine the Index of Biotic Integrity (IBI) for aquatic assemblages and biological criteria for aquatic life use assessments.

The IBI consists of 12 biological assemblage characteristics or metrics assessing the aquatic communities' structural, compositional, and functional integrity. Different IBI metrics depend on variables such as the region of the state (i.e., ecoregion) and stream size (i.e., drainage area) sampled. The 12 different metrics can each score either 0, 1, 3, or 5. The score represents the deviation from the expected community structure, where 5 has no deviation from expectations, and 0 has severe deviation from expected community structure. The total IBI score can range from 0 to 60 for fish communities or 12 to 60 for macroinvertebrate communities, representing severe to excellent conditions, respectively, when compared to least impacted conditions. Appendices A and B provide more information on fish and macroinvertebrate IBI calculations.

A.2 Project Organization and Schedule

Begin sampling and collecting chemical, physical, and biological parameters in April and continue through November 2024. Project laboratory processing and data analysis will continue through spring of 2025 (Table 1).

Table 1. Tasks, Schedule, and Evaluation

Activity	Dates	Number of sites	Frequency of sampling related activity	Parameters to be sampled	How evaluated
Site reconnaissance	Jan through March	29 or more to obtain a minimum of 25 sites sampled during three events	Until confirmation of 25 accessible target sites or the March deadline	Safety to access stream and proper equipment for sampling	Landowner approval and best professional judgment
Biological sampling	Jun 1 through Nov 15	Minimum of 25 sites unless the site is dry, or water is only present in less than half of the sampling reach	Once each for: Fish community (Jun 1 – Oct 15) Macroinvertebrate community (Jul 15 – Nov 15) Diatoms (3rd Round Chemistry in the Fall) (both may occur on same day from Jul 15 – Nov 15)	Fish community/Habitat quality Macroinvertebrate community/Habitat quality Algal diatoms	Fish IBI/ Qualitative Habitat Evaluation Indexes (QHEIs) Macroinvertebrate IBI (mIBI)/ Qualitative Habitat Evaluation Indexes (QHEIs) Diatom IBI
Water chemistry	Apr 1 through Nov 31	Minimum of 25 sites unless a site is dry during all three sampling events.	Three times: April, May, and September/October, with a minimum of 30 days between sampling events	Total phosphorous Nitrogen, nitrate + nitrite Dissolved oxygen (DO) pH Algal conditions Dissolved metals (Table 2) Selenium Dissolved arsenic Nitrogen ammonia Chloride	>0.3 mg/L (nutrients) >10.0 mg/L (nutrients) <4.0 mg/L (warm water aquatic life or nutrients); <6.0 mg/L (cold water fish); >120% saturation (nutrients) >9.0 Standard Units (SU) (nutrients); <6.0 or >9.0 SU (warm water aquatic life) Excessive (nutrients, based on field observation) Chronic Aquatic Criterion (CAC)/Criterion Continuous Concentration (CCC) based on hardness; 3.1 µg/L CAC (Acipenseriformes waters)/CCC 5.5 µg/L CAC (Acipenseriformes-free waters) CAC/CCC based on concentration of 150 µg/L, a conversion factor and water-effect ratio of 1) CAC/CCC based on pH and temperature; CAC/CCC based on hardness and sulfate.

Activity	Dates	Number of sites	Frequency of sampling related activity	Parameters to be sampled	How evaluated
				Sulfate Total dissolved solids	CAC/CCC based on hardness and chloride (downstate) 250 mg/L (Lake Michigan/public water supply criterion) 750 mg/L (public water supply criterion)

A.3 Background and Project Description

The reference site monitoring project operates within the WAPB. Partnering organizations assisting with data preparation, collection, and analysis include private contract laboratories, the Department of Biological and Environmental Sciences at Georgia College and State University, U.S. EPA Region 5, and the Indiana Department of Natural Resources. Landowners and property managers throughout the state participate in the reference site monitoring project by providing IDEM staff with access to remote stream locations.

The reference site monitoring project provides physical, chemical, and biological data from potential reference sites to continuously refine and calibrate the IBI for aquatic assemblages. Once reference condition sites have been identified, continue refining and calibrating reference site sampling in Indiana over a 10-year period to assess and characterize overall water quality and biological integrity. Investigate the following parameters: water chemistry; fish, macroinvertebrate, and diatom assemblages; and habitat evaluations and utilize the data for IBI, biological criteria refinement, as well as assessment purposes.

A.4 Quality Objectives

U.S. EPA recommends the DQO seven-step systematic planning process (U.S. EPA 2006) for all significant environmental data collection activities. The process provides a basis for balancing decision uncertainty with available resources. The DQO planning process clarifies study objectives; defines the types and quantity of data needed to achieve the objectives; and establishes decision criteria for evaluating data quality. The results from the seven-step DQO process provide the basis for the 2024 reference site monitoring project plan.

1. **State the Problem**
   Surface waters of the state are designated for full body contact recreation; will be capable of supporting a well-balanced, warm water aquatic community; and in some northern portions of the state, put-and-take trout fishing [327 IAC 2-1-3]. Indiana is required to assess all waters of the state to determine designated use attainment status. This project gathers biological, chemical, and habitat data at reference sites to refine Indiana’s IBI metrics, refine biological criteria thresholds, and more accurately assess aquatic life use attainment status.

2. **Identify the Project’s Objectives**
   The project’s objectives are to sample reference sites throughout Indiana to:
   - Determine whether the reference site chosen continues to meet criteria as a reference site.

- Collect reference data to measure aquatic life use support (ALUS) assessments.
- Refine and further validate IBI metrics and biological criteria thresholds every 10 years.

3. **Identify Information Inputs**

   Field monitoring activities require collection of chemical, algal, biological, and habitat data. Section B, Data Generation and Acquisition, describes collection procedures for field measurements, algal, chemical, biological, and habitat data in detail.

   a. Water Quality Criteria

      Use chemical sampling data to validate the absence of anthropogenic disturbance or a minimal level of allowed disturbance at reference sites (U.S. EPA 2013). Evaluate each site as supporting or nonsupporting when compared with water quality criteria shown in Table 2, derived from tables contained in [327 IAC 2-1-6], [327 IAC 2-1.5-8] and following Indiana's 2024 Consolidated Assessment Listing Methodology (CALM) (IDEM 2024).

Table 2. Water Quality Criteria for Non-Great Lakes [327 IAC 2-1-6] and Great Lakes [327 IAC 2-1.5-8]

Parameter	Level	Criterion
Metals (dissolved)	Calculated based on hardness	Calculated CAC (Non-Great Lakes) Calculated CCC (Great Lakes)
Arsenic (dissolved)	150 µg/L (calculated based on a conversion factor and water-effect ratio of 1)	Calculated CAC (Non-Great Lakes) Calculated CCC (Great Lakes)
Selenium	3.1 µg/L 5.5 µg/L	CAC (Non-Great Lakes, waters with Acipensiformes) CCC (Great Lakes) CAC (Non-Great Lakes, Acipensiformes-free waters)
Ammonia as nitrogen	Calculated based on pH and temperature	Calculated CAC (Non-Great Lakes) Calculated CCC (Great Lakes)
Chloride	Calculated based on hardness and sulfate	Calculated CAC (Non-Great Lakes) Calculated CCC (Great Lakes)
DO	At least 5.0 mg/L (warm water aquatic life) At least 6.0 mg/L (cold-water fish*) At least 7.0 mg/L (salmonids spawning and imprinting areas)	Not less than 4.0 mg/L at any time. Not less than 6.0 mg/L at any time. Not less than 7.0 mg/L during spawning season and during the time of imprinting
pH	6.0 – 9.0 S.U.	Must remain between 6.0 and 9.0 S.U. except for daily fluctuations exceeding 9.0 due to photosynthetic activity

Nitrogen, nitrate and nitrite	≤10 mg/L	Human health point of drinking water intake
Sulfate	Calculated based on hardness and chloride 250 mg/L	In all waters outside the mixing zone (Non-Great Lakes) Lake Michigan/public water supply criterion
Dissolved solids	750 mg/L	Not-to-Exceed at point of drinking water intake

CAC = Chronic Aquatic Criterion, CCC = Criterion Continuous Concentration, S.U. = Standard Units; * Waters protected for cold-water fish include those waters designated by the Indiana Department of Natural Resources for put-and-take trout fishing as well as salmonid waters listed in 327 IAC 2-1.5-5.

b. Nutrient Criteria

In addition to the chemical criteria listed in Table 2, evaluate data for several nutrient parameters against the benchmarks below (IDEM 2024a). Assuming a minimum of three sampling events, if two or more of the conditions below are met on the same date, classify the waterbody assessment unit as nonsupporting due to nutrients.

- Total phosphorus: one or more measurements >0.3 mg/L
- Nitrogen, (nitrate and nitrite): one or more measurements >10.0 mg/L
- DO: one or more measurements <4.0 mg/L, or measurements that are consistently at or close to the standard, in the range of 4.0 – 5.0 mg/L, or DO percent saturation >120%
- pH: one or more measurements >9.0 S.U. or measurements consistently at or close to the standard, ranging from 8.7 – 9.0 S.U.
- Algal conditions: visually observed as excessive by trained staff using best professional judgment. B.2. Sampling Methods 3. Algal Community Data further documents the explanation of this observance.

c. Biological Criteria

Indiana narrative biological criteria [327 IAC 2-1-3] states “(2) All waters, except as described in subdivision (5),” (i.e., limited use waters) “will be capable of supporting: (A) a well-balanced, warm water aquatic community”. The water quality standard definition of a “well-balanced aquatic community” is “an aquatic community: (A) diverse in species composition; (B) containing several different trophic levels; and (C) not composed mainly of pollution tolerant species” [327 IAC 2-1-9 (59)]. The table in Appendix 2 illustrates an interpretation or translation of narrative biological criteria into numeric criteria. A stream segment is nonsupporting for aquatic life use when the monitored fish or macroinvertebrate community receives an IBI score of less than 36 which is considered Poor or Very Poor (IDEM 2024a). Stream segments with IBI scores greater than or equal to 36 (Fair to Excellent on the scale of 0 to 60 for fish communities or 12 to 60 for macroinvertebrate communities) are supporting for aquatic life use.

Report each sampled site's assessment in the U.S. EPA 2026 update of Indiana's Integrated Water Monitoring and Assessment Report (Integrated Report). Use site specific data to classify associated assessment units (AU) into one of five major categories in the state's consolidated 303(d) list. Assessment category definitions are available in Indiana's CALM (IDEM 2024a pp. G-35 and G-36).

Periphyton is also collected in conjunction with water chemistry for each site. Diatom samples are collected, preserved, and transported to the laboratory where algae identification and enumeration is conducted. The assessment methodology for the diatom IBI is currently under development.

4. **Define the Boundaries of the Study**
The 2024 reference sites are within the geographic borders of Indiana and contained in the eight-digit HUCs 05080003, 05090203, 05120204, 05120207 and 05140101. Sample sites in geographically separate areas from other IDEM projects allow sampling flexibility, should high water or inclement weather prevent sampling in other areas of the state. B.1. Sampling Design and Site Locations provides further explanation of site selection.

   Collect biological samples when the flow is not dangerous for staff to enter the stream such as when water levels are at or below median base flow; barring any hazardous weather conditions like thunderstorms or heavy rain in the vicinity; or unexpected physical barriers to accessing the site. The field crew chief makes the final determination as to whether a waterbody is safe to enter.

5. **Develop the Analytical Approach**
Evaluate all potential reference sites for ALUS status. For the Integrated Report assessment purposes, ALUS decisions include independent evaluations of chemical and biological criteria as outlined in Indiana's 2024 CALM (IDEM 2024a). Evaluate fish and macroinvertebrate assemblages at each site using the appropriate IBI. Specifically, consider a site nonsupporting for aquatic life use when IBI scores are less than 36. Report assessment decisions in the 2026 Integrated Report. Decisions include stream segment delisting of an impaired biotic community, which is now fully supporting aquatic life use; or listing as nonsupporting for aquatic life use, due to a change in water quality or habitat impairments of the biotic community.

   Reject reference sites not supporting aquatic life use or sites violating the minimal allowable amount of disturbance due to chemical or physical alterations detected by current sampling efforts. To avoid circularity in deriving IBI calibrations, do not choose reference sites based on biological attributes (i.e., excellent IBI metrics or total scores) (U.S. EPA 2013).

After 10 years, IDEM may discover additional reference sites through review of land use criteria, chemical, in-stream physical habitat, or biological assemblage information obtained during additional projects between 2014 and 2024.

IDEM intends to use algal metrics as part of nutrient criteria development and/or ALUS designations for Indiana's surface waters. Given known ecological tolerances for many diatom species, using changes in diatom community composition could diagnose the environmental stressors affecting ecological health (Stevenson 1998; Stevenson and Pan 1999). Many regions (Hill 1997) developed and tested periphyton IBI metrics. Waterbody biological integrity assessments may use periphyton assemblage, including chlorophyll *a* and diatoms, without any other information. However, periphyton are most effective when used in conjunction with habitat and macroinvertebrate assessments, particularly because of the close relationship between periphyton and these elements of stream ecosystems (Barbour et al. 1999). For this reason, conduct algal sampling at the same sites as macroinvertebrates, fish, habitat, chemical, and physical data collection.

6. Specify Performance or Acceptance Criteria

Acceptable data are essential for minimizing decision error. Identifying errors in physical, chemical, and biological parameter sampling design, *in situ* measurements, and laboratory measurements, results in more confidence in IBI calibrations, biological threshold determinations, and aquatic life use assessment decisions.

Site specific aquatic life use assessments, include program specific controls to identify errors. Controls include water chemistry blanks and duplicates; biological site revisits or duplicates; and laboratory verification of species identifications described in field procedure manuals and standard operating procedures (SOPs) (IDEM 2018, 2020a, 2020b, 2023a, 2023b, 2023c, 2023d, 2023e, 2023g, 2024b, 2024h).

The quality assurance and quality control (QA/QC) process detects deficiencies in the data collection as set forth in the Surface Water QAPP (IDEM 2023f) and Biological and Habitat QAPP (IDEM 2020a). The QAPP requires all contract laboratories to adhere to rigorous standards during sample analyses and to provide acceptable and usable data. Chemists within the WAPB review the laboratory analytical results for quality assurance (QA). Data flagged as "Rejected" will not be used for water quality assessment decisions due to analytical problems or errors. Data flagged as "Estimated" will be used on a case-by-case basis. The IDEM Surface Water QAPP (IDEM 2023f Table 28-29: Data Qualifiers and Flags, p 106-107) and Biological and Habitat QAPP (IDEM 2020a pp. 32-36) presents criteria for acceptance or rejection of results as well as application of data quality flags. The Surface Water QAPP Table 3: Performance, Acceptance, Decision Criteria for this Study; and Table 14 Field Parameters showing method and IDEM quantification limit (IDEM 2023a, pp 37 and p 91) provide precision and accuracy goals with acceptance limits for applicable analytical methods. In response to data consistently flagged Rejected, conduct further investigation to determine the source of error. The WAPB QA manager and project manager may troubleshoot errors introduced throughout the entire data collection process using evaluation of field sample collection and preparation techniques, and laboratory procedures employed. Implement corrective actions upon determining the source of error (IDEM 2020a, IDEM 2023f).

7. Develop the Plan for Obtaining Data

Select base sampling locations from sites previously sampled from 2003 – 2013. Over the 10-year period, reference sites least impacted by anthropogenic sources were determined. Least impacted sites were further selected based on good habitat and water chemistry results compared to other sites sampled. Sampling locations may be near bridges or historical probabilistic monitoring sites in remote areas.

Indiana’s CALM requires at least three samples to complete an assessment for aquatic life use with water chemistry data. Perform three water chemistry sampling events at least 30-days apart.

The primary filter in reference site selection is land use criteria:

- Percent of agricultural or urban areas
- Impervious surface area
- Human population density and distribution
- Road density and crossings
- Proportion of active mining
- Proportion of protected lands
- Proximity to permitted facilities, confined feeding operations, and Superfund sites.

To select reference sites and develop biological expectations in altered watersheds, a secondary filter may be chemical and in-stream physical habitat data.

- Least disturbed condition (best available condition given widespread disturbance)
- Minimally disturbed condition (nearly absent human disturbance)
- Historical condition (prior to major industrialization, urbanization, and intense agricultural practices) (Stoddard et al. 2006)

Ideally, sample reference sites at least once every 10 years, to monitor changes in the biological expectations for least disturbed condition and possible biological criteria revision. Reference site sampling should include at a minimum two biological communities (fish, macroinvertebrates, or diatoms); habitat evaluations; and *in-situ* water chemistry. As resources allow, collect additional samples for laboratory water chemistry parameters, algal biomass, and flow.

In March 2015, OWQ, U.S. EPA, and contractor Tetra Tech developed a framework and criteria for reference site selection (U.S. EPA Assistance Agreement I 96555711-1 IDEM). IDEM provided 1458 site locations, previously sampled for fish, macroinvertebrates, or both between 2003 and 2013, to Tetra Tech for possible reference sites selection. Tetra Tech identified 324 potential reference sites using land use factors as the primary filter. IDEM narrowed the list using in-stream chemical and physical data as a secondary filter.

To ensure an adequate level of statistical confidence in the linear regression models developed from the data, a minimum of 20 reference sites in each of the natural environmental gradient classifications (i.e., ecoregion, stream size, etc.) is required. Given certain explanatory variables, the model outputs accurately indicate changes in biological assemblage structure. Increasing the number of reference sites reduces variability in calibrating the IBI and setting biological criteria thresholds (U.S. EPA 2013, Tetra Tech personal communication).

IDEM conducts site reconnaissance and sampling of reference sites, based on the spatial distribution of the sites and available resources. The goal is to sample at least 25 reference sites each year to refine biological indices, water quality criteria, and possibly develop other assessment indicators and thresholds.

A.5 Training and Staffing Requirements

Table 3. Project Roles, Experience, and Training

Role	Required Training/Experience	Responsibilities	Training References
Project manager	-Database experience -Experience in project management and QA/QC procedures	-Establish project in the Assessment Information Management System (AIMS) II database. -Oversee development of project work plan. -Oversee entry and quality control (QC) of field data. -Querying data from AIMS II to determine results not meeting water quality criteria.	-AIMS II Database User Guide -IDEM 2020a, 2022d 2023f, 2024a, 2024h -U.S. EPA 2006
Field crew chief – fish or macroinvertebrate community sampling	-At least one year of experience in sampling methodology and taxonomy of aquatic communities in the region -Annual review of the Principles and Techniques of Electrofishing -Annual review of relevant safety procedures -Annual review of relevant field operations' SOPs	-Complete field data sheets. -Taxonomic accuracy. -Sampling efficiency and representation. -Track voucher specimens. -Overall field crew operation. -Adherence to safety and field SOP procedures by crew members. -Ensure weekly data sondes' calibrations, field sampling equipment functions properly, and all equipment is loaded into vehicles prior to field sampling activities.	-Barbour et al. 1999 -IDEM 2010a, 2019, 2020a, 2020b, 2021, 2022b, 2023a, 2023c, 2023d, 2023e, 2023g, 2024a, 2024b, 2024c, 2024d, 2024h -Klemm et al. 1990 - Plafkin et al. 1989 -Simon and Dufour 2005 -Xylem Inc. 2017 -YSI Inc. 2020
Field crew staff – fish or macroinvertebrate community sampling	-Completion of hands-on sampling methodology training prior to field sampling activities -Review of the Principles and Techniques of Electrofishing -Review of relevant safety procedures -Review of relevant field operation SOPs	-Follow all safety and SOP procedures while engaged in field sampling activities. -Follow direction of field crew chief while conducting field sampling activities. -Entry and QC of field data.	-IDEM 2010a, 2019, 2020b, 2021, 2022b, 2023a, 2023c, 2023d, 2023e, 2024b, 2024c, 2024d -Xylem Inc. 2017 -YSI Inc. 2020
Field crew chief – water chemistry and algal sampling	-At least one year of experience in sampling methodology -Annual review of relevant safety procedures	-Complete field data sheets. -Ensure sampling efficiency and representativeness. -Ensure overall field crew operation, when remote from central office.	-Barbour et al. 1999 -Hill 1997 -IDEM 2010a, 2018, 2019, 2020a, 2020b, 2021, 2022b, 2023e, 2023f, 2024a, 2024b, 2024c, 2024d, 2024h

Role	Required Training/Experience	Responsibilities	Training References
	-Annual review of relevant field operations' SOP's	-Ensure crew staff adherence to safety and field SOPs. -Ensure weekly data sondes' calibrations, proper functioning of field sampling equipment, and loading of all equipment into vehicles prior to field sampling activities	-Stevenson 1998 -Stevenson and Pan 1999 -Xylem Inc. 2017 -YSI Inc. 2020
Field crew staff – water chemistry and algal sampling	-Completion of hands-on training for sampling methodology prior to field sampling activities -Review of relevant safety procedures and field operation SOPs	-Follow all safety procedures and SOPs while conducting field sampling activities. -Follow direction of field crew chief while conducting field sampling activities. -Entry and QC of field data.	-IDEM 2010a, 2018, 2019, 2020b, 2021, 2022b, 2023e, 2024b, 2024c, 2024d - Xylem Inc. 2017 -YSI Inc. 2020
Laboratory supervisor – fish or macroinvertebrate community sample processing	-At least one year of experience in taxonomy of aquatic communities in the region -Annual review of relevant safety procedures -Annual review of relevant laboratory operations' SOPs	-Ensure laboratory staff's adherence to safety and SOP procedures. -Assist with identification of fish and macroinvertebrate specimens. -Verify samples' taxonomic accuracy. -Track voucher specimens. -Check QC calculations' completeness on data sheets. -Ensure correct data entry into AIMS II.	-IDEM 2010a, 2019, 2020a, 2021, 2023a, 2023g, 2024a, 2024c, 2024d, 2024h
Laboratory staff – fish or macroinvertebrate community sample processing	-Completion of hands-on training for laboratory sample processing methodology prior to laboratory sample processing activities -Annual review of relevant safety procedures and relevant laboratory operations' SOPs	-Adhere to safety procedures and SOPs. -Follow laboratory supervisor direction while processing samples. -Identify fish and macroinvertebrate specimens. -Perform necessary calculations on data and entry onto field sheets.	-IDEM 2010a, 2021, 2023a, 2024c, 2024d
Laboratory supervisor – water chemistry and algal sample processing	-Annual review of relevant safety procedures -Annual review of relevant field operations' SOPs	-Ensure laboratory staff's adherence to safety procedures and SOPs. -Identify diatoms. -Complete laboratory data sheets. -Check data for completeness. -Perform all necessary calculations on the data.	-IDEM 2010a, , 2019, 2020a, 2021, 2023b, 2023f, 2024a, 2024c, 2024d, 2024h

Role	Required Training/Experience	Responsibilities	Training References
		-Ensure data entry into the AIMS II database.	
Quality assurance officer	-Familiarity with QA/QC practices and methodologies -Familiarity with the Surface Water QAPP and data qualification methodologies	-Ensure adherence to Surface Water QAPP QA/QC requirements. -Evaluate data collected by sampling crews for adherence to project work plan. -Review field sampling crews' data collected for completeness and accuracy. -Perform a data quality analysis of data generated. -Assign data quality levels based on the data quality analysis. -Import data into the AIMS II database. -Ensure completion of field sampling methodology audits according to WAPB procedures.	-IDEM 2020a, 2023f, 2024h -U.S. EPA 2006
All staff (safety and reference manuals)	-Basic first aid and cardiopulmonary resuscitation (CPR)	-Must complete a minimum of 4 hours of in-service training provided by WAPB (IDEM 2010a).	
	-Familiarity with PPE Policy	-Must follow the policy when working.	Personal Protective Equipment (PPE) Policy (IDEM 2024d)
	-Familiarity with the Personal Flotation Devices (PFD) WAPB internal memorandum regarding use of approved PFDs and [IC 14-8-2-27]	-When in a watercraft, must wear a PFD at all times when working on boundary waters, as defined by Indiana Code (IC) [IC 14-8-2-27] and between sunset and sunrise on any waters of the state must wear a high intensity whistle and Safety of Life at Sea (SOLAS) certified strobe light.	Personal Flotation Devices (PFD) February 29, 2000 internal WAPB memorandum -[IC 14-8-2-27]
Staff lacking 4 hours of in-service training or appropriate certification	Same as all staff and must be accompanied by WAPB staff, meeting health and safety training requirements at all times in the field	-Always follow trained staff directions.	WAPB staff meeting health and safety training requirements

B. Data Generation and Acquisition

B.1 Sampling Design and Site Locations

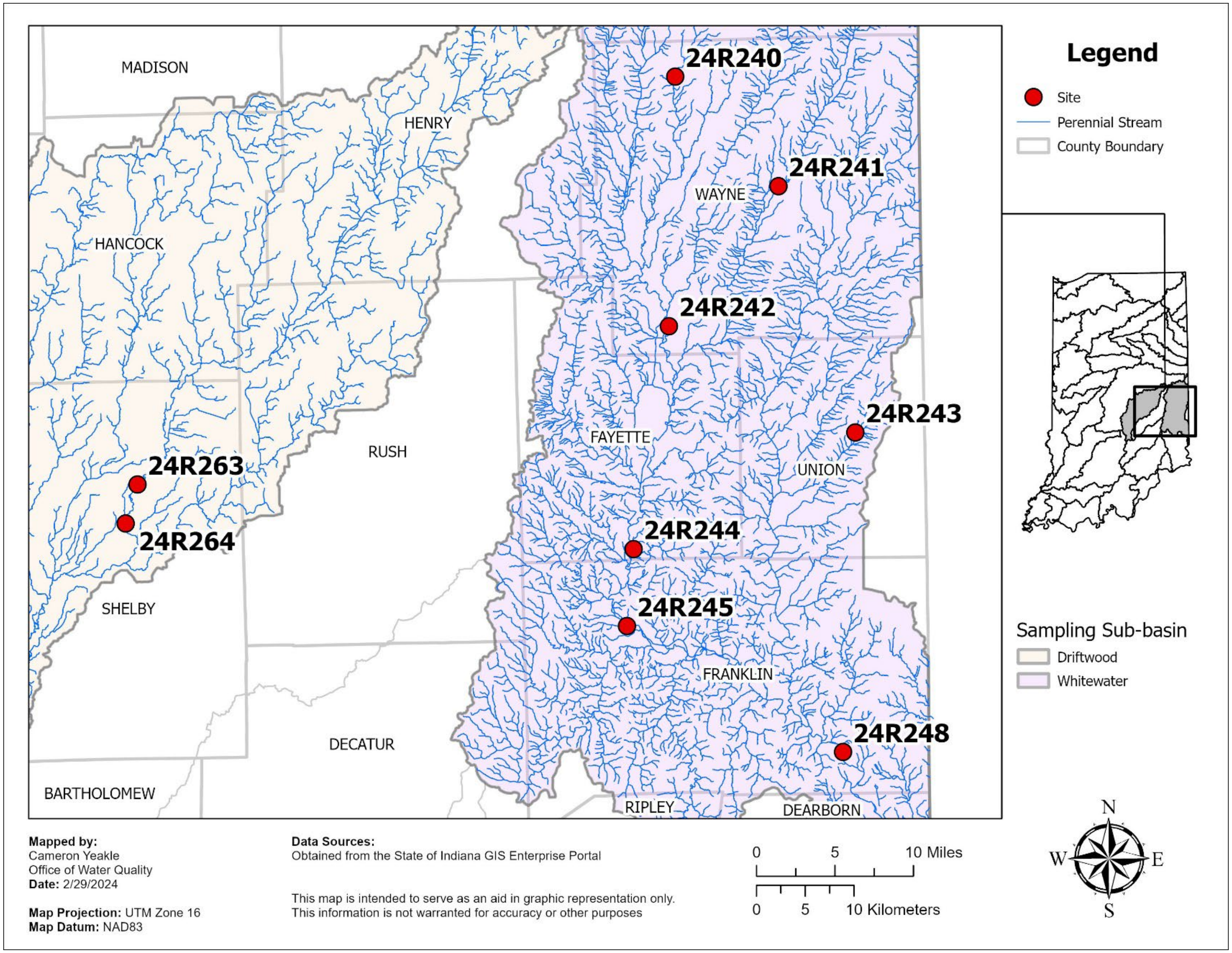
The proposed reference site locations are sites previously sampled for fish or macroinvertebrate communities and water chemistry. After evaluating watershed characteristics (land use, pollution sources, road density, percent impervious surface, etc.), and previous habitat and chemistry results, determine reference site locations considered least impacted by anthropogenic sources. Conduct site reconnaissance activities in house and through physical site visits. In-house activities include preparation and review of site maps and aerial photographs. Physical site visits include verification of accessibility, safety considerations, equipment needed to properly sample the site, and property owner consultations, if required. Record all information on the Site Reconnaissance Form (Attachment 1) and enter the information into the AIMS II database. Determine precise coordinates for each site during the reconnaissance site visits or at the beginning of site sampling. Use an agency approved handheld Global Positioning System (GPS) unit which can verify horizontal precision within five meters or less, described in GPS Data Creation (IDEM 2022b, 2023e). Enter GPS coordinates into the AIMS II database. Table 4 provides 2024 reference sites' sampling locations information in the Whitewater, Middle Ohio-Laughery, Driftwood, Muscatatuck, and Silver-Little Kentucky. Figure 1 provides 2024 reference sites' map sampling locations in the Whitewater and Driftwood basins. Figure 2 provides 2024 reference sites' map sampling locations in the Middle Ohio-Laughery, Muscatatuck, and Silver-Little Kentucky basins.

Table 4. List of Potential 2024 Reference Sites: Whitewater, Middle Ohio-Laughery, Driftwood, Muscatatuck, and Silver-Little Kentucky Basins

AIMS Site Name	Event ID	Stream Name and Location	County	Hydrologic Unit Code (HUC)	Latitude (DD)	Longitude (DD)	HUC 8
WEM050-0036	24R166*	Sugar Creek @ CR 500 North	Ripley	51202070402	39.147128	-85.438781	Muscatatuck
OSK-02-0004	24R171*	Indian Kentuck Creek @ SR 250	Jefferson	51401010205	38.87824200	-85.25740100	Silver-Little Kentucky
WEM060-0040	24R173*	Otter Creek @ CR 560 East	Jennings	51202070303	39.009222	-85.500866	Muscatatuck
GMW-01-0005	24R240	Martindale Creek @ Charles Road	Wayne	50800030102	39.971775	-85.103682	Whitewater
GMW-03-0008	24R241	Nolands Fork @ Nolands Fork Road	Wayne	50800030303	39.868571	-84.982703	Whitewater
GMW-02-0004	24R242	Whitewater River @ Pennville Road	Wayne	50800030205	39.741502	-85.117522	Whitewater
GMW-07-0017	24R243	Hanna Creek @ CR 50 North	Union	50800030714	39.639541	-84.897437	Whitewater
GMW040-0036	24R244	Whitewater River @ SR 121	Fayette	50800030408	39.53617700	-85.16525600	Whitewater
GMW040-0044	24R245	Whitewater River @ SR 121/Rohe Aggregates	Franklin	50800030408	39.46517000	-85.17499400	Whitewater
GMW080-0043	24R248	Whitewater River @ Graf Road/Tri Township Road	Franklin	50800030805	39.34447600	-84.92099400	Whitewater
WEM070-0032	24R249	Vernon Fork Muscatatuck River @ CR 150 West	Jennings	51202070701	38.95199400	-85.63960500	Muscatatuck
WEM020-0038	24R250	Little Graham Creek @ CR 675 East	Jennings	51202070202	38.95281500	-85.48848900	Muscatatuck
WEM-02-0001	24R251	Little Graham Creek @ CR 700 East	Jennings	51202070202	38.93875000	-85.47649000	Muscatatuck
WEM020-0034	24R252	Graham Creek @ J Road	Jennings	51202070203	38.98063200	-85.45288700	Muscatatuck
WEM020-0042	24R253	Graham Creek @ K Road/Northeast Exit Road	Ripley	51202070203	39.00805200	-85.38339500	Muscatatuck
WEM050-0042	24R254	Brush Creek @ CR 675 East	Jennings	51202070403	39.07014800	-85.48652500	Muscatatuck
WEM060-0025	24R255	Otter Creek @ CR 950 West	Ripley	51202070302	39.07515000	-85.42553600	Muscatatuck
WEM060-0022	24R256	Little Otter Creek @ Hopewell Road	Ripley	51202070301	39.09275600	-85.36626200	Muscatatuck
WEM050-0030	24R257	Vernon Fork Muscatatuck River @ CR 700 South	Decatur	51202070401	39.23511900	-85.39874600	Muscatatuck
OSK030-0009	24R258	West Fork Indian Kentuck Creek @ Manville Hill Road	Jefferson	51401010204	38.78812700	-85.28278100	Silver-Little Kentucky
OSK-02-0009	24R259	Brushy Fork @ Brushy Fork Road	Jefferson	51401010205	38.79064100	-85.26925700	Silver-Little Kentucky
OSK030-0012	24R260	Indian Kentuck Creek @ Lonnis Hill Road	Jefferson	51401010205	38.83965900	-85.26022300	Silver-Little Kentucky
OML-09-0005	24R262	Indian Creek @ Bakes Road	Switzerland	50902030902	38.786413	-85.078935	Middle Ohio-Laughery
WED020-0029	24R263	Big Blue River @ Morristown Road	Shelby	51202040805	39.60365400	-85.75635100	Driftwood
WED020-0020	24R264	Big Blue River @ Bear Chase Golf Club	Shelby	51202040805	39.56781300	-85.77113200	Driftwood

*Indicates unused site from previous sampling years.

Figure 1. 2024 Reference Sites for the Whitewater (05080003) and Driftwood (05120204) Basins



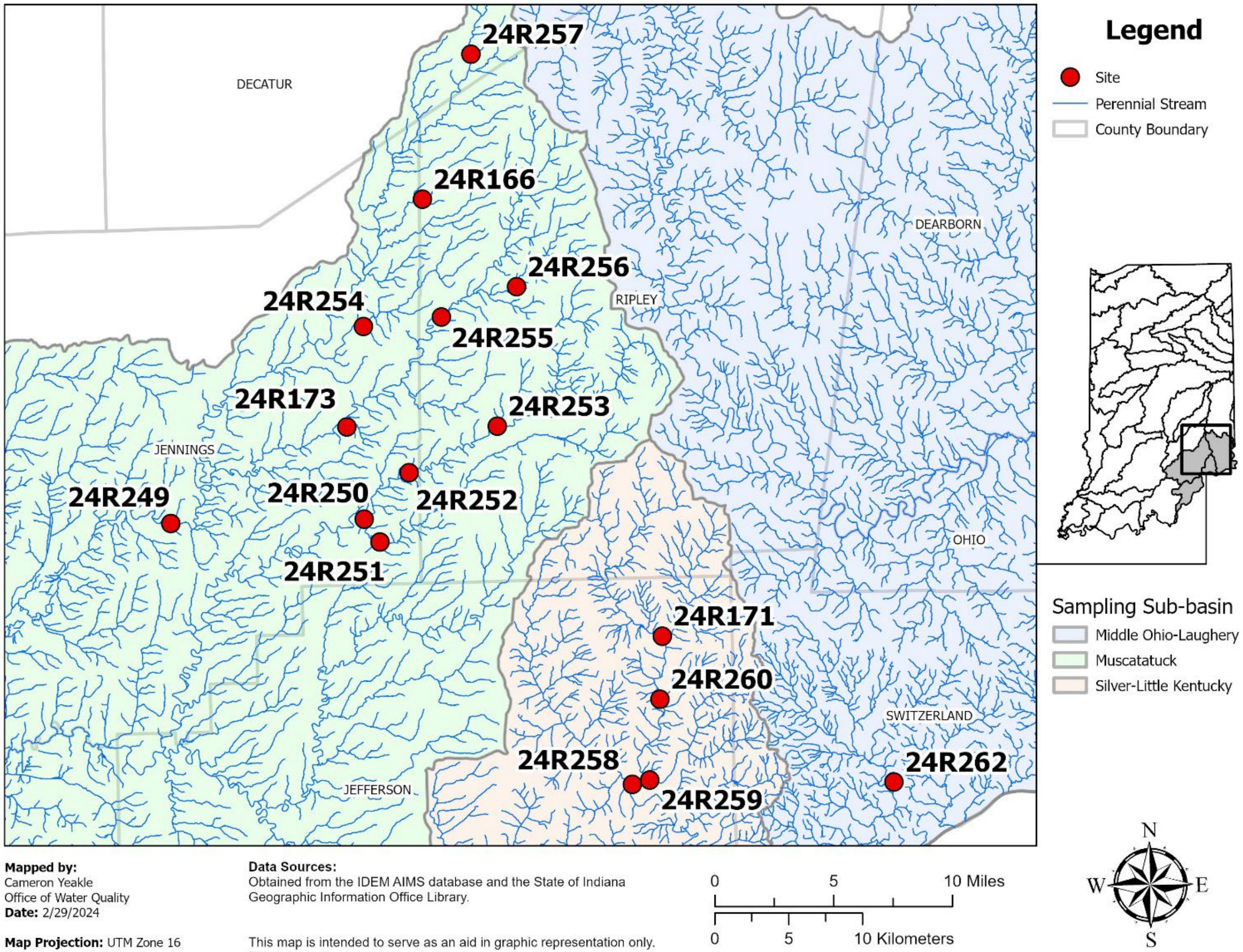
Mapped by:
Cameron Yeakle
Office of Water Quality
Date: 2/29/2024

Map Projection: UTM Zone 16
Map Datum: NAD83

Data Sources:
Obtained from the State of Indiana GIS Enterprise Portal

This map is intended to serve as an aid in graphic representation only.
This information is not warranted for accuracy or other purposes

Figure 2. 2024 Reference Sites for the Middle Ohio-Laughery (05090203), Muscatatuck (05120206), and Silver-Little Kentucky (05140101) Basins



Mapped by:
Cameron Yeakle
Office of Water Quality
Date: 2/29/2024

Map Projection: UTM Zone 16
Map Datum: NAD83

Data Sources:
Obtained from the IDEM AIMS database and the State of Indiana Geographic Information Office Library.

This map is intended to serve as an aid in graphic representation only. This information is not warranted for accuracy or other purposes

B.2 Sampling Methods

1. **Water Chemistry**
   During three discrete sampling events, teams of two staff collect water chemistry grab samples, record water chemistry field measurements, and record physical site descriptions on the IDEM Stream Sampling Field Data Sheet (Attachment 2). All water chemistry sampling will adhere to the Water Chemistry Field Sampling Procedures (IDEM 2020b).

2. **Field Parameter Measurements**
   Measure DO, pH, water temperature, specific conductance, and DO percent saturation with a data sonde, during each sample collection event regardless of the sample type. Perform measurement procedures and operation of the data sonde in accordance with the manufacturers' manuals (Xylem Inc. 2017; YSI Inc. 2020). Calibration of YSI Multiparameter Data Sondes (IDEM 2024b and Water Chemistry Field Sampling Procedures (IDEM 2020b). Measure turbidity with a Hach™ turbidity kit and write the meter number in the comments under the field parameter measurements. If a Hach™ turbidity kit is not available, record the data sonde measurement for turbidity and note in the comments. Record all field parameter measurements and weather codes on the IDEM Stream Sampling Field Data Sheet (Attachment 2). Also take a digital photo upstream and downstream of the site during each sampling event (IDEM 2018).

3. **Algal Sampling**
   During the third round of standard water chemistry sampling, teams of two staff collect periphyton communities at all sites. For an average site, sampling, which includes all the above parameters, requires approximately 1.5 hours of effort. Record information regarding substrates sampled for periphyton on the Algal Biomass Lab Data Sheet (Attachment 3). Phytoplankton and Periphyton Field Collection Procedures (IDEM 2018 describes methods used in algal community sampling. Processing and Identification of Diatom Samples (IDEM 2023b) describes the methods used in preparing samples for diatom identification and enumeration.

4. **Fish Community Sampling**
   Perform fish community sampling using standardized electrofishing methodologies depending on stream size and site accessibility. Perform fish assemblage assessments in a sampling reach of 15 times the average wetted width, with a minimum reach of 50 meters and a maximum reach of 500 meters (IDEM 2023a). Try to sample all habitat types available (i.e., pools, shallows; IDEM 2023c, pp 10–11 contains more potential habitat types) within the sample reach to ensure adequate representation of the fish community present at the

time of the sampling event. List of possible electrofishers for use with sampling include: the Midwest Lake Electrofishing Systems (MLES) Infinity XStream, Smith-Root LR-24 or LR-20B Series backpack electrofishers; or MLES Infinity Control Box with MLES junction box and rat-tail cathode cable, assembled in a canoe (if parts of the stream are not wadable, the system may require the use of a dropper boom array outfitted in a canoe or possibly a 12 or 14 foot Loweline boat); or, for non-wadable sites, the Smith-Root Type VI-A electrofisher or MLES Infinity Control Box assembled in a 16 foot Loweline or Blazer boat (IDEM 2020a, 2023a).

Avoid sample collection during high flow or turbid conditions due to 1) low collection rates which result in nonrepresentative samples and 2) safety considerations for the sampling team. Avoid sample collection during late autumn due to the cooling water temperature, which may affect the responsiveness of some species to the generated electric field. This lack of responsiveness can result in samples not representative of the stream’s fish assemblage (IDEM 2023a).

Collect fish using dipnets with fiberglass handles and netting of 1/8-inch bag mesh. Sort fish collected in the sampling reach by species into baskets or buckets. Do not retain young-of-the-year fish less than 20 millimeters (mm) total length in the community sample (IDEM 2023a).

For each field taxonomist (generally the crew leader), retain a complete set of fish vouchers for any different species encountered during the summer sampling season. Vouchers may consist of either preserved specimens or digital images. Prior to processing fish specimens and completion of the fish community datasheet, possibly preserve one to two individuals per new species encountered in 3.7% formaldehyde solution to serve as representative fish vouchers. Fish specimens must be positively identified and small enough to fit in a 2000 mL jar. If, however, a specimen is too large to preserve, take a photo of key characteristics (e.g., fin shape, size, body coloration) for later examination (IDEM 2023a). Also, prior to sampling, randomly select 10% of the sites for revisits. Preserve a few representative individuals of all species found at the site or photograph to serve as vouchers (IDEM 2020a). Review taxonomic characteristics for possible species encountered in the basin of interest prior to field work. Also preserve fish specimens if they cannot be positively identified in the field (i.e., those co-occurring like the Striped and Common Shiners or are difficult to identify when immature); individuals appearing to be hybrids or have unusual anomalies; and dead specimens taxonomically valuable for undescribed taxa (e.g., Red Shiner or Jade Darter), life history studies, or research projects (IDEM 2023a).

Record the following data for non-preserved fish on the IDEM Fish Collection Data Sheet (Attachment 4): number of individuals, minimum and maximum total length (mm), mass weight in grams (g), and number of individuals with deformities, eroded fins, lesions, tumors, and other anomalies (DELTs). Upon recording the data, release specimens within the sampling reach from which they were collected. Record data for preserved fish specimens following taxonomic identification in the laboratory (IDEM 2023a).

5. **Macroinvertebrate Sampling**
Crews of two to three staff conduct macroinvertebrate community sampling immediately following the fish community sampling event or on a different date. Collect samples, using a modification of the U.S. EPA Rapid Bioassessment Protocol multihabitat (MHAB) approach (Plafkin et al. 1989; Barbour et al. 1999; Klemm et al. 1990; IDEM 2023d). The IDEM MHAB approach (IDEM 2023d) involves collecting dislodged macroinvertebrates, with a D-frame 500 µm mesh dip net, from a 1-minute kick sample within a riffle or run and a 50-meter sweep sample of all available habitats. Define the 50-meter length of riparian sampling corridor at each site using a tape measure or rangefinder. If the stream is too deep to wade, use a boat to sample the 50-meter zone along the shoreline with the best available habitat. Combine the 1-minute kick, if collected, and 50-meter sweep samples in a bucket of water. Elutriate the combined sample through a U.S. standard number 35 (500 µm) sieve a minimum of five times to remove all rocks, gravel, sand, and large pieces of organic debris from the sample. Then transfer the remaining sample from the sieve to a white plastic tray. The collector, while still on site, conducts a 15-minute pick of macroinvertebrates at a single organism rate. By turning and examining the entire sample in the tray, endeavor to pick for maximum organism diversity, and relative abundance. Preserve the resulting picked sample in 80% isopropyl alcohol. Return the picked sample to the laboratory for identification at the lowest practical taxonomic level, if possible, usually at genus or species level (IDEM 2023g). Evaluate using the MHAB mIBI.

In addition to the standard MHAB method of macroinvertebrate collection, employ two alternate macroinvertebrate sampling methods at each reference site. The alternate sampling methods were developed to validate components of the MHAB method, specifically the 15-minute field pick and use of a 50-meter sample zone instead of a sample zone which is a multiple of the stream width (i.e., 15 times the streams wetted width). The alternate methods were first employed at randomly selected Probabilistic sites in the 2013 and 2014 sample seasons (IDEM 2014). Analysis of the previous samples may prove an alternate method is superior, at which point only use the alternate method and the MHAB method at reference sites. The alternate methods are:

1. Collect three jabs taken with a D-frame dip net at each equally spaced transect. Calculate transects by measuring the wetted width of the stream at the site location times 15 and divide by 10 (10 transects x 3 jabs = 30 jabs total).
2. Collect two 0.25 m^2 kick samples with a 0.5 m wide bottom-kick net at each transect. Collect samples from alternating thirds of each transect. Calculate transects by measuring the wetted width of the stream at the site location times 15 and divide by 10 (10 transects x 2 kicks of 0.25 m^2 = 5 m^2 of stream substrate).

At three reference sites (roughly 10% of sites), collect an additional duplicate set of all three sampling methods. The samples collected in 2024 will increase the total number of sites sampled for the methods comparison study to 218 with 22 sets of duplicate samples. Further information regarding macroinvertebrate community sampling duplicates is in B.4 Quality Control and Custody Requirements.

6. **Habitat Assessments**
Complete habitat assessments immediately following macroinvertebrate and fish community sample collections at each site using a slightly modified version of the Ohio EPA (OHEPA) QHEI (OHEPA 2006). Complete a separate IDEM OWQ QHEI form (Attachment 5) for each of the two sample types, since the sampling reach length may differ (i.e., 50 meters for macroinvertebrates and between 50 and 500 meters for fish). IDEM 2023c describes the method for completion of the QHEI.

B.3 Analytical Methods

Table 5 lists the field parameters, respective test method, and IDEM quantification limits. Table 6 lists water chemistry sample container, preservative, and holding time requirements. Table 7 lists numerous parameters (priority metals, anions and physical chemistry, and nutrients and organic); respective test methods; IDEM reporting limits; and contract laboratory reporting limits. The OWQ Chain of Custody Form (Attachment 6) and the 2024 Reference Sites Water Sample Analysis Request Form (Attachment 7) accompany each sample set through the analytical process.

Table 5. Field Parameters Showing Method and IDEM Quantification Limit

Parameters	Method (SM=Standard Method)	IDEM Quantification Limit
DO (data sonde optical)	ASTM D888-09[1]	0.05 mg/L
DO (data sonde membrane probe)	SM 4500-OG	0.05 mg/L
DO % Saturation (data sonde optical)	ASTM D888-09	0.05%
DO % Saturation (data sonde)	SM 4500-OG	0.01%
pH (data sonde)	U.S. EPA 150.2	0.10 S.U.
pH (field pH meter)	SM 4500H-B [1]	0.10 S.U.
Specific Conductance (data sonde)	SM 2510B	1.00 µmho/cm
Temperature (data sonde)	SM 2550B(2)	0.1 °C
Temperature (field meter)	SM 2550B(2) [1]	0.1 °C
Turbidity (data sonde)	SM 2130B	0.02 NTU [2]
Turbidity (Hach™ turbidity kit)	EPA 180.1[1]	0.05 NTU [2]

[1] Method used for Field Calibration Check
[2] NTU = Nephelometric Turbidity Unit(s)
SM = Standard Method
ASTM = American Society for Testing and Materials

Table 6. Water Chemistry Sample Container, Preservative, and Holding Time Requirements

Parameter	Container	Preservative	Holding
[1,2] Alkalinity as $CaCO_3$*	1 L, plastic, narrow mouth	None	14 days
[1,3] Ammonia-N**	1 L, amber glass Boston round, narrow mouth	$H_2SO_4 < pH\ 2$	28 days
[1]Chloride*	1 L, plastic, narrow mouth	None	28 days
[1]Chemical oxygen demand**	1 L, amber glass Boston round, narrow mouth	$H_2SO_4 < pH\ 2$	28 days
Hardness (as $CaCO_3$*) calculated	1 L, plastic, narrow mouth	$HNO_3 < pH\ 2$	6 months
Metals (total and dissolved)	1 L, plastic, narrow mouth	$HNO_3 < pH\ 2$	6 months
[1]Nitrate and Nitrite-N**	1 L, amber glass Boston round, narrow mouth	$H_2SO_4 < pH\ 2$	28 days
[1]Total phosphorus**	1 L, amber glass Boston round, narrow mouth	$H_2SO_4 < pH\ 2$	28 days
[1,4]Solids (all forms)*	1 L, plastic, narrow mouth	None	7 days
[1]Sulfate*	1 L, plastic, narrow mouth	None	28 days
[1]Total Kjeldahl nitrogen**	1 L, amber glass Boston round, narrow mouth	$H_2SO_4 < pH\ 2$	28 days
[4]Dissolved organic carbon**	1 L, amber glass Boston round, narrow mouth	$H_2SO_4 < pH\ 2$	28 days
[1]Total organic carbon**	1 L, amber glass Boston round, narrow mouth	$H_2SO_4 < pH\ 2$	28 days

[1]All samples iced to 4°C
[2]General chemistry includes all parameters noted with an *.
[3]Nutrients include all parameters noted with a **.
[4]Separate 1 Liter samples are required for Total Suspended Solids and dissolved organic carbon

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Table 7. Water Chemistry Parameters, Test Method, and IDEM and Laboratory Reporting Limits

Priority Metals

Parameter	Total	Dissolved	Test Method	IDEM requested Reporting Limit (µg/L)	Pace Laboratory Reporting Limit (µg/L)
Aluminum	☒	☒	U.S. EPA 200.8	10	10
Antimony	☒	☒	U.S. EPA 200.8	1	1
Arsenic	☒	☒	U.S. EPA 200.8	2	1
Cadmium	☒	☒	U.S. EPA 200.8	1	0.2
Calcium	☒	☐	U.S. EPA 200.7	20	1,000
Chromium	☒	☒	U.S. EPA 200.8	3	2
Copper	☒	☒	U.S. EPA 200.8	2	1
Lead	☒	☒	U.S. EPA 200.8	2	1
Magnesium	☒	☐	U.S. EPA 200.7	95	1,000
Nickel	☒	☒	U.S. EPA 200.8	1.5	1
Selenium	☒	☒	U.S. EPA 200.8	4	1
Silver	☒	☒	U.S. EPA 200.8	0.3	0.5
Zinc	☒	☒	U.S. EPA 200.8	5	3

Anions/Physical

Parameter	Pace Test Method	IDEM requested Reporting Limit (mg/L)	Pace Laboratory Reporting Limit (mg/L)
Alkalinity (as $CaCO_3$)	SM 2320B	10	10
Chloride	U.S. EPA 300.0	1	0.25
Dissolved Solids	SM 2540C	10	10
Hardness (as $CaCO_3$) by calculation	SM 2340B	0.4	10
Sulfate	U.S. EPA 300.0	0.05	0.25
Total Solids	SM 2540B	1	10
Total Suspended Solids	SM 2540D	1	2.5

Nutrients/Organic

Parameter	Pace Test Method	IDEM requested Reporting Limit (mg/L)	Pace Laboratory Reporting Limit (mg/L)
Ammonia-N	U.S. EPA 350.1	0.01	0.1
Chemical Oxygen Demand (COD)	U.S. EPA 410.4	3	10
Nitrogen, Nitrate + Nitrite	U.S. EPA 353.2	0.05	0.1
Total Kjeldahl Nitrogen (TKN)	U.S. EPA 351.2	0.1	0.5
Dissolved Organic Carbon (DOC)	SM 5310C	1	1
Total Organic Carbon (TOC)	SM 5310C	1	1
Total Phosphorus	U.S. EPA 365.1	0.01	0.05

SM: Standard Methods for the Examination of Water and Wastewater
U.S. EPA: United States Environmental Protection Agency

B.4 Quality Control and Custody Requirements

QA protocols will follow part B5 of the Surface Water QAPP (IDEM 2023f, p. 105) and B.5 of the Biological and Habitat QAPP (IDEM 2020a, p. 27).

1. **Water Chemistry Data**
   Only use sample bottles and preservatives certified for purity. Adhere to U.S. EPA requirements for water chemistry testing sample collection containers for each parameter, preservative, and holding time (Table 6). Collect field duplicates and matrix spike and matrix spike duplicates (MS/MSD) at the rate of one per sample analysis set or one per every 20 samples, whichever is greater. Additionally, take field blank samples using ASTM D1193-91 Type I water at a rate of one per sample analysis set or one per every 20 samples, whichever is greater. Complete the sample collection portion of the OWQ Chain of Custody Form in the field (Attachment 6). The sample collector is responsible for signing the chain of custody form and ensuring the lab receiving the samples records the date, time, and signs for the samples. Pace Analytical Services, Inc. (Indianapolis, Indiana) processes all samples collected for water chemistry analysis following the specifications set forth in Request for Proposals 22-68153 (IDEM 2022a).

2. **Algal Community Data**
   Staff will note excessive algal conditions upon observing an algal bloom on the water’s surface or in the water column. Calibration of staff on this rating (i.e., the decision as to the severity of the bloom is based on best professional judgement) is not possible, but an algal mat on the surface of the water or a bloom giving the water the appearance of green paint is justification for deciding algal conditions are excessive.

   Collect duplicate diatom samples at 10% of sampling sites (approximately 3). After completion of sampling at a given site, clean all equipment which contacted the sample with detergent and rinse with ASTM D1193-91 Type III water to decrease the potential for cross contamination and bias of the algal samples. Accurately and thoroughly complete all sample labels, include AIMS II database sample numbers, date, stream name, and sampling location. Complete the sample collection portion of the OWQ Chain of Custody forms (Attachment 6) in the field and when transferring samples to the laboratory. Upon arrival at the laboratory, the laboratory manager will check in samples. For diatom samples, a Laboratory Chain of Custody form (Attachment 8) documents when samples are removed from storage, processed, and made into permanent mounts (IDEM 2018).

Document QC of the diatom sampling, enumeration, and identification project by QC checks for both field and laboratory data. IDEM 2018 describes QA/QC protocols used in diatom identification and enumeration. The Department of Biological and Environmental Sciences of Georgia College and State University (Milledgeville, Georgia) will analyze or verify at least 10% of diatom samples (and up to 100%) (IDEM 2020a) following the specifications set forth in IDEM 2018.

3. **Fish Community Data**
   Perform fish community sampling revisits at a rate of 10% of the total fish community sites sampled (approximately 3) (IDEM 2023a). Perform revisit sampling with at least 2 weeks of recovery between the initial and revisit sampling events. Perform fish community revisit sampling and habitat assessment with either a partial or complete change in field team staff (IDEM 2023a). Use the resulting IBI and QHEI total score between the initial visit and the revisit to evaluate precision (IDEM 2020a). Use the IDEM OWQ Chain of Custody Form to track samples from the field to the laboratory (Attachment 6). Regionally recognized non-IDEM freshwater fish taxonomists (e.g., Brant Fisher, Nongame Aquatic Biologist, Indiana Department of Natural Resources) may verify fish taxonomic identifications made by IDEM staff in the laboratory. For all raw data: 1) check for completeness; 2) utilize to calculate derived data (i.e., total weight of all specimens of a taxon) and enter into the AIMS II database; and 3) check again for data entry errors.

4. **Macroinvertebrate Community Data**
   Prior to beginning the field season, randomly select 10% of the total macroinvertebrate community sampling sites (approximately 3) for collection of duplicate macroinvertebrate field samples. Immediately after collecting the initial macroinvertebrate community sample and performing the habitat assessment, the same staff collects the duplicate sample and performs another habitat assessment. Base the precision evaluation on the duplicate of samples collected (IDEM 2020a). Use the IDEM OWQ Chain of Custody form (Attachment 6) to track samples from the field to the laboratory. The Probabilistic Monitoring Section laboratory supervisor maintains laboratory identifications and QA/QC of taxonomic work (2023g). An outside taxonomist will verify 10% of initial samples taken at sites where duplicate samples were collected (IDEM 2023d, 2023g).

B.5 Field Parameter Measurements and Instrument Testing and Calibration

Calibrate the data sonde prior to each week's sampling (IDEM 2024b). Record, maintain, store, and archive calibration results and drift values in logbooks located in the calibration laboratories at the Shadeland facility. Drift value is the difference between two successive calibrations. Field parameter calibrations will conform to the procedures described in the instrument users' manuals (Xylem Inc. 2017; YSI Inc. 2020) and the Calibration of YSI Multiparameter Data Sondes technical standard operating procedure (IDEM 2024b). Use the air calibration method (IDEM 2024b) to conduct the DO component of the calibration procedure. Conduct an accuracy field check for the unit once during the week by comparison with an YSI DO meter, Hach™ turbidity, and a pH and temperature meter. Record weekly calibration and verification results on the field calibrations portion of the Stream Sampling Field Data Sheet (Attachment 2) and enter in the AIMS II database. Also use the YSI DO meter at sites where the DO concentration is 4.0 mg/L or less.

Collect *in-situ* water chemistry data in the field using calibrated or standardized equipment. Perform calculations in the field or later in the office. Analytical results, which have limited QC checks, are included in this category. Detection limits and ranges are set for each analysis (Table 5). Perform QC checks on information for field or laboratory results to estimate precision, accuracy, and completeness for the project, as described in the Surface Water QAPP (IDEM 2023f Table 3, p 37 and Section B.5 p 91).

Use a Nikon© differential interference contrast (DIC) microscope and Nikon© Elements D camera and imaging system for identification and enumeration of diatoms. Branch staff calibrate the ocular reticle in the microscope. Calibrate the ocular reticle at each magnification with a stage micrometer. Upon moving the microscope to a new location, check the calibration.

C. Assessment and Oversight

C.1. Assessments and Response Actions

Conduct performance and system audits to ensure good quality data.

Field and laboratory performance checks include:

- Precision measurements by relative percent difference (RPD) of field and laboratory duplicates per Surface Water QAPP (IDEM 2023f, Table 3 p. 37).
- Accuracy measurements by percent of recovery of MS/MSD samples analyzed in the laboratory (IDEM 2023f, Table 3 p. 37).
- Completeness measurements by the percent of planned samples collected, analyzed, reported, and usable for the project (IDEM 2023f, Table 3 p. 37).

For biological and habitat measurements, field performance measurements include:

- Completeness (IDEM 2020a, pp. 10-11, 14, 17)
- Examination of fish IBI score differences and the relative percent difference (RPD) for number of fish species at revisit sites (IDEM 2020a, pp. 9-10)
- RPD for number of taxa for macroinvertebrate duplicate samples (IDEM 2020a, p. 13)
- RPD for number of taxa for diatom duplicate samples (IDEM 2020a, p. 17)
- RPD between the two total QHEI scores (IDEM 2020a, p. 18)

Lab performance measurements include:

- Percent Taxonomic Disagreement (PTD) for fish (IDEM 2020a, p. 12)
- Diatoms (IDEM 2020a, p. 18)
- Percent Difference in Enumeration (PDE), Percent Taxonomic Disagreement (PTD), and Percent Sorting Efficiency (PSE) for macroinvertebrates (IDEM 2020a, pp. 14-16)

IDEM WAPB staff conduct field audits every other year to ensure sampling activities adhere to approved SOPs. WAPB managers conduct systematic audits to include all WAPB staff engaged in field sampling activities. Managers, trained in the associated sampling SOPs and in the processes related to conducting an audit, evaluate WAPB field staff involved with sample collection and preparation. Managers produce an evaluation report documenting each audit for review by field staff audited and WAPB management. As a result of the audit process, corrective actions are communicated to field staff who will implement the corrections per Surface Water QAPP (IDEM 2023f, Section C. p 99-100; IDEM 2020a, p. 31).

Require contract laboratories to have NELAC audits at the beginning of a laboratory contract and at least once a year during the contract. In addition, IDEM QA staff annually review performance studies conducted by the contract laboratories. The audit includes any or all the operational QC elements of the laboratory’s QA system. Address all applicable elements of the QAPP and the laboratory contract requirements including, but not limited to, sample handling, sample analysis, record keeping, preventative maintenance, proficiency testing, staff requirements, training, and workload (IDEM 2023f, Section C.1. p. 99).

For macroinvertebrate verifications by an external lab, the lab must maintain Society for Freshwater Science taxonomic certifications for their taxonomists. Genus level taxonomic certifications are required for 1. Eastern General Arthropods, 2. Eastern Ephemeroptera, Plecoptera and Trichoptera, 3. Chironomidae and 4. Oligochaeta.

C.2 Data Quality Assessment Levels

Surface Water QAPP (IDEM 2023f, pp 107-108) and the Biological and Habitat QAPP (IDEM 2020a, pp. 34-35) describe the intent to collect samples and various types of data to meet the QA criteria and rated Data Quality Assessment (DQA) Level 3.

D. Data Validation and Usability

QA reports to management, and data validation and usability are also important components of the QAPP ensuring good quality data. Should problems arise and require investigation and correction, submit a QA audit report to the QA manager and project manager for review. The following steps ensure data meet the project DQO and allow assessment by users:

- Reduce by converting raw analytical data into final results in proper reporting units.
- Validate by qualifying data based on the performance of field and laboratory QC measures incorporated into the sampling and analysis procedures.
- Report by completely documenting the calibration, analysis, QC measures, and calculations.

D.1. Quality Assurance, Data Qualifiers, and Flags

Use the various data qualifiers and flags for QA and validation of the data found in the Surface Water QAPP (IDEM 2023f Section D.3.3. pp 108-109) and Biological and Habitat QAPP (IDEM 2020a pp. 33-34).

D.2. Reconciliation with User Requirements

Qualify the environmental project data, each lab or field result, usability per Surface Water QAPP (IDEM 2023f pp 107-108) and Biological and Habitat QAPP (IDEM 2020a pp. 35-36). Categorize data in one or more of the following classifications.

- Acceptable Data
- Enforcement Capable Results
- Estimated Data
- Rejected Data

D.3. Information, Data, and Reports

Record the 2024 data collected in the AIMS II database. Present in three compilation summaries:

- A general compilation of the 2024 Reference Site field and water chemistry data prepared for use in the Integrated Report.

- A database report format containing biological results and habitat evaluations, produced for inclusion in the Integrated Report and individual site folders.
- Laboratory bench sheets containing the species taxa names and enumerations of all diatoms collected.

Maintain all site folders at the WAPB facility until uploaded into the IDEM Virtual File Cabinet. All data and reports are available to public and private entities which may find the data useful for municipal, industrial, agricultural, and recreational decision-making processes (TMDL, NPDES permit modeling, watershed restoration projects, water quality criteria refinement, etc.).

D.4. Laboratory and Estimated Cost

Project laboratory analysis and data reporting should comply with the Surface Water QAPP (IDEM 2023f), Request for Proposals 22-68153 (IDEM 2022a), the Biological and Habitat QAPP (IDEM 2020a), and the IDEM 2023 Quality Management Plan (IDEM 2024h).

The following labs perform analytical tests:

- General chemistry, nutrients, and total and dissolved metals – Pace Analytical Services in Indianapolis, Indiana (accreditation in Attachment 9)
- Collection and slide mount diatoms – IDEM staff
- Diatom identification and enumeration – Department of Biological and Environmental Sciences, Georgia College and State University
- Collection and analysis of all macroinvertebrate samples – IDEM staff
- Validation of 10% of macroinvertebrate samples – Rhithron Associates, Inc.
- Collection and analysis of all fish samples – IDEM staff

Table 8 outlines the anticipated budget for the project’s laboratory costs.

Table 8. Total Estimated Laboratory Cost for the Project.

Analysis	Laboratory	Estimated Cost
Water Chemistry	Pace Analytical Services 7726 Moller Road. Indianapolis, Indiana 46268 Contract # 58463, PO # 20003041 Line # 7	$48,699
Diatom Identification and Enumeration	Department of Biological and Environmental Sciences Georgia College and State University 320 S. Wayne St. Milledgeville, GA 31061	$4,900
Macroinvertebrate Identification	Rhithron Associates, Inc. 33 Fort Missoula Road Missoula, Montana 59804	$690
	Total	$54,289.00

E. References

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*Documents may be inspected at the Watershed and Assessment Branch office, located at 2525 North Shadeland Avenue, Indianapolis, IN.

F. Distribution List

Electronic Distribution Only

Name	Organization
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Timothy Bowren	IDEM, OWQ, WAPB, Technical and Logistical Services Section
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G. Attachments

Attachment 1. IDEM Site Reconnaissance Form

Attachment 2. IDEM Stream Sampling Field Data Sheet

Attachment 3. IDEM Algal Biomass Lab Data Sheet

Attachment 4. IDEM Fish Collection Data Sheet

Attachment 5. IDEM OWQ Biological Qualitative Habitat Evaluation Index

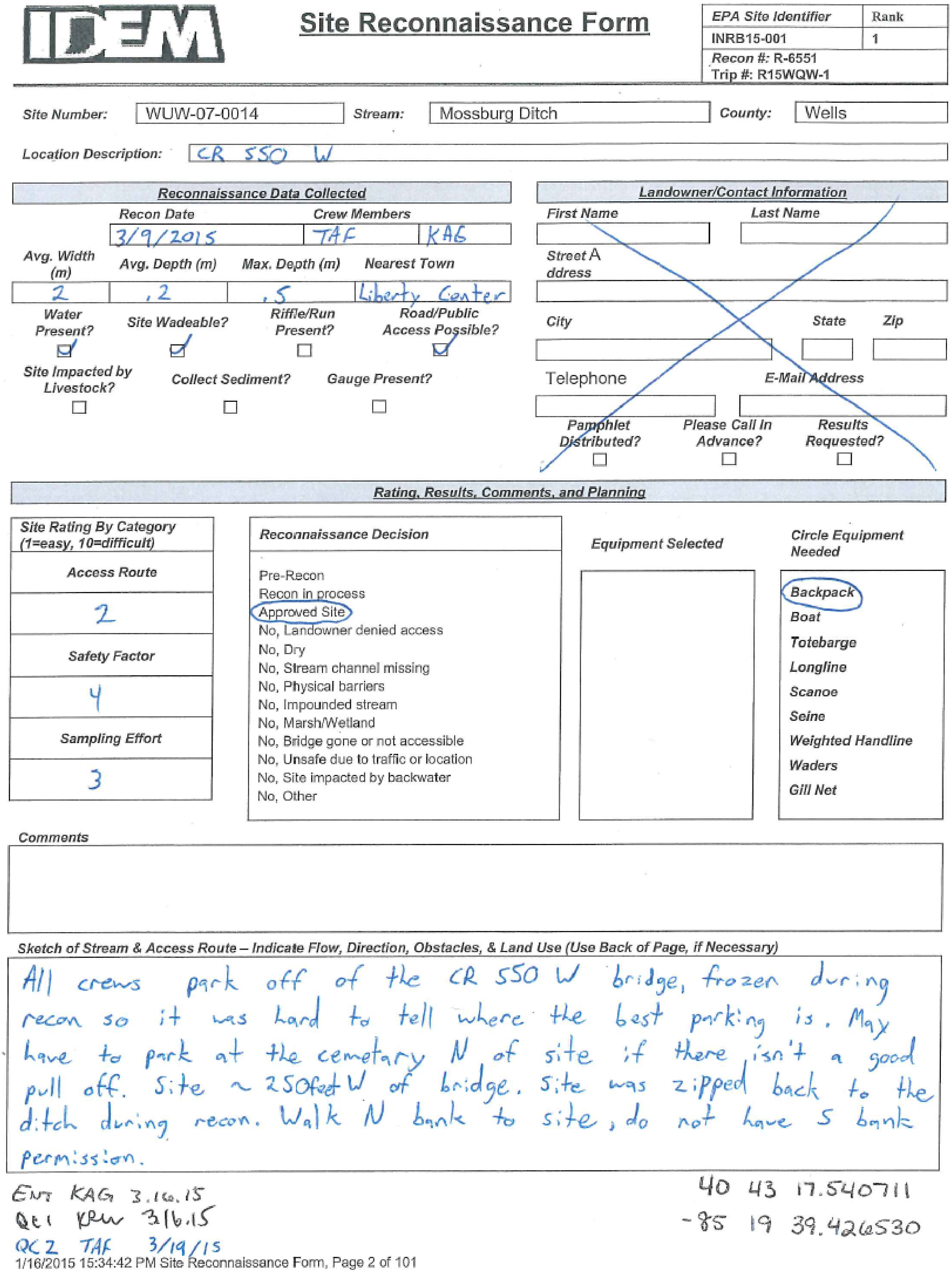
Attachment 6. IDEM OWQ Chain of Custody Form

Attachment 7. 2024 Reference Sites Water Sample Analysis Request Form

Attachment 8. Biological Samples Laboratory Chain of Custody Form

Attachment 9. Pace Laboratory Inc., Indianapolis: Certification

Attachment 1. IDEM Site Reconnaissance Form



IDEM

Site Reconnaissance Form

EPA Site Identifier	Rank
INRB15-001	1

Recon #: R-6551
Trip #: R15WQW-1

Site Number: WUW-07-0014 **Stream:** Mossburg Ditch **County:** Wells

Location Description: CR 550 W

Reconnaissance Data Collected

Recon Date	Crew Members	
3/9/2015	TAF	KAG

Avg. Width (m)	Avg. Depth (m)	Max. Depth (m)	Nearest Town
2	.2	.5	Liberty Center

Water Present? ☑
Site Wadeable? ☑
Riffle/Run Present? ☐
Road/Public Access Possible? ☑
Site Impacted by Livestock? ☐
Collect Sediment? ☐
Gauge Present? ☐

Landowner/Contact Information

First Name
Last Name
Street Address
City
State
Zip
Telephone
E-Mail Address
Pamphlet Distributed? ☐
Please Call In Advance? ☐
Results Requested? ☐

Rating, Results, Comments, and Planning

Site Rating By Category (1=easy, 10=difficult)	
Access Route	2
Safety Factor	4
Sampling Effort	3

Reconnaissance Decision

- Pre-Recon
- Recon in process
- [✓ Approved Site]
- No, Landowner denied access
- No, Dry
- No, Stream channel missing
- No, Physical barriers
- No, Impounded stream
- No, Marsh/Wetland
- No, Bridge gone or not accessible
- No, Unsafe due to traffic or location
- No, Site impacted by backwater
- No, Other

Equipment Selected

Circle Equipment Needed

- [✓ Backpack]
- Boat
- Totebarge
- Longline
- Scanoe
- Seine
- Weighted Handline
- Waders
- Gill Net

Comments

Sketch of Stream & Access Route – Indicate Flow, Direction, Obstacles, & Land Use (Use Back of Page, if Necessary)

All crews park off of the CR 550 W bridge, frozen during recon so it was hard to tell where the best parking is. May have to park at the cemetary N of site if there isn't a good pull off. Site ~ 250feet W of bridge. Site was zipped back to the ditch during recon. Walk N bank to site, do not have S bank permission.

ENT KAG 3.16.15
QC1 KRW 3/16.15
QC2 TAF 3/19/15

40 43 17.540711
-85 19 39.426530

1/16/2015 15:34:42 PM Site Reconnaissance Form, Page 2 of 101

Attachment 2. IDEM Stream Sampling Field Data Sheet

Stream Sampling Field Data Sheet

Analysis Set #	*EPA Site ID*	*Rank*

Sample #	*Site #*	*Sample Medium*	*Sample Type*	*Duplicate Sample #*

Stream Name:		*River Mile:*		*County:*	
Site Description:					

Survey Crew Chief	Sample Collectors				Sample Collected		Hydrolab #	Water Depth/Gage Ht (ft)	Water Flow (cf/sec)	Flow Estimated?	Algae?	Aquatic Life?
	1	2	3	4	Date	Time						
										☐	☐	☐

Sample Taken?	Aliquots	Water Flow Type	Water Appearance	Canopy Closed %
◇ Yes ◇ No; Frozen ◇ No; Stream Dry ◇ No; Other ◇ No; Owner refused Access	◇ 1 ◇ 2 ◇ 3 ◇ 4 ◇ 6 ◇ 8 ◇ 12 ◇ 24 ◇ 48 ◇ 72 ◇ AS-Flow	◇ Riffle ◇ Dry ◇ Stagnant ◇ Pool ◇ Run ◇ Flood ◇ Glide ◇ Eddy ◇ Other	◇ Clear ◇ Green ◇ Sheen ◇ Murky ◇ Black ◇ Other ◇ Brown ◇ Gray (Septic/Sewage)	◇ 0-20% ◇ 60-80% ◇ 20-40% ◇ 80-100% ◇ 40-60%

Special Notes:	

Field Data:

Date (m/d/yy)	24-hr Time (hh:mm)	D.O. (mg/l)	pH	Water Temp (°C)	Spec Cond (μohms/cm)	Turbidity (NTU)	% Sat.	Chlorine (mg/l)	Chloride (mg/l)	Chlorophyll (mg/l)	Weather Codes			
											SC	WD	WS	AT
Comments														
Comments														
Comments														
Comments														
Comments														
Comments														

Measurement Flags		
	<	< Min. Meter Measurement
	>	> Max. Meter Measurement
	E	Estimated (See Comments)
	R	Rejected (See Comments)

Weather Code Definitions									
SC Sky Conditions				WD Wind Direction		WS Wind Strength		AT Air Temp	
1	Clear	8	Rain	00	North (0 degrees)	0	Calm	1	< 32
2	Scattered	9	Snow	09	East (90 degrees)	1	Light	2	33-45
3	Partly	10	Sleet	18	South (180 degrees)	2	Mod./Light	3	46-60
4	Cloudy			27	West (270 degrees)	3	Moderate	4	61-75
5	Mist					4	Mod./Strong	5	76-85
6	Fog					5	Strong	6	> 86
7	Shower					6	Gale		

Field Calibrations:

Date (m/d/yy)	Time (hh:mm)	Calibrator Initials	Calibrations			
			Type	Meter #	Value	Units

Calibration Type	pH DO Turbidity

Preservatives/Bottle Lots:

Group: Preservative	Preservative Lot #	Bottle Type	Bottle Lot #

Groups: Preservatives		Bottle Types	
GC	General Chemistry: Ice	2000P	2000mL Plastic, Narrow Mouth
Nx	Nutrients: H2SO4	1000P	1000mL Plastic, Narrow Mouth
Metals	Metals: HNO3	500P	500mL Plastic, Narrow Mouth
CN	Cyanide: NaOH	250P	250mL Plastic, Narrow Mouth
O&G	Oil & Grease: H2SO4	1000G	1000mL Glass, Narrow Mouth
Toxics	Toxics: Ice	500G	500mL Glass, Wide Mouth
Ecoli	Bacteriology: Ice	250G	250mL Glass, Wide Mouth
VOA	Volatile Organics: HCl & Thiosulfate	125G	125mL Glass, Wide Mouth
Pest	Pesticides: Ice	40GV	40mL Glass Vial
Phen	Phenols: H2SO4	120PB	120ml Plastic (Bacteria Only)
Sed	Sediment: Ice	1000PF	1000mL Plastic, Corning Filter
Gly	Glyphosate: Thiosulfate	500PF	500mL Plastic, Corning Filter
Hg	Mercury(1631): HCl	60P	60mL Plastic
Cr6	ChromiumVI(1636): NaOH	250T	250mL Teflon
MeHg	Methyl Mercury(1630): HCl	500T	500mL Teflon
		125T	125mL Teflon

Data Entered By: ____________________ QC1: ____________________
QC2: ____________________

Attachment 3. IDEM Algal Biomass Lab Data Sheet

Algal Biomass Lab Datasheet

Sample #	Site	Stream

Supporting Site Information

Traditional Forestry % Closed Canopy: ☐ <=10m ☐ >10m (Measure center only if width <=10m, record to nearest whole percent)

	North	East	South	West	Average x 1.04 =
Left Bank					
Center					
Right Bank					
Total %CC (Average from above, or Center only = %CC)				100 - %CC	

Phytoplankton Information

Sampling Method: ☐ Grab Sample (Dip) ☐ Multiple Verticles Number of Verticles:

Chlorophyll A	Blank	Filter 1	Filter 2	Filter 3	Filter 4
Sample Time					
Sample Volume (mL)					

Periphyton Information

Periphyton Habitat: ☐ Epilithic (Area-Scape) ☐ Epidendric (Cylinder Scrape) ☐ Epipsammic (Petri Dish)

Diatom Sample Collected: ☐ Yes ☐ No | Diatom Volume: mL | Formalin Volume: mL | Slurry Volume mL

Chlorophyll A	Blank	Filter 1	Filter 2	Filter 3	Filter 4
Sample Time					
Sample Volume (mL)					

Periphyton Area Calculation

Cylinder Scrape

Snag #	Length (cm)(L)	Circumference			U	Area (L * U)
		U_1	U_2	U_3		
1						
2						
3						
4						
5						
					Total Area (cm²)	

Area Scrape (Using SG-92)

Rock#	1	2	3	4	5
Area (cm²)	7.38	7.38	7.38	7.38	7.38
Total (cm²)	36.9				

Petri Dish

Number of Discrete Samples (n):	
Total Area of One Sampler (a):	19.01 cm²
Total Sample Area (n * a):	

Stream Discharge / Rainfall Information

Nearest USGS Gage Site: ☐ Upstream ☐ Downstream ☐ No USGS Gage Near

River miles from site: | Discharge CFS at sampling: CFS

Gage location: | Discharge days since 50% flow exceeded: days

Rainfall data source: ☐ NOAA ☐ CoCoRaHS ☐ Indiana State Climate Office ☐ USGS gage rain gauge ☐ Other:

Total precipitation at sampling: in. on date: | Cumulative rain 7 days previous to sampling: in.

Inches since last rainfall previous to sampling: in.

Days since last rainfall previous to sampling: days

Rain station location, county:

Identifier	Date	Reviewer 1	Date	Reviewer 2	Date	Notes:
		☐ Review 1 Completed		☐ Review 2 Completed		

Attachment 4. IDEM Fish Collection Data Sheet (front)

IDEM
OWQ-WATERSHED ASSESSMENT AND PLANNING BRANCH

Event ID______________ Voucher jars_______ Unknown jars________ Equipment________________ Page _____ of ______
Voltage_______ Time fished (sec)________ Distance fished (m)_________ Max. depth (m)_________ Avg. depth (m)________
Avg. width (m)______ Bridge in reach_____ Is reach representative_____ If no, why_______________________________
Elapsed time at site (hh:mm)____:____ Comments____
____
____

Museum data: Initials__________ ID date__________ Jar count__________ Fish Total__________

Coding for Anomalies: D – deformities E – eroded fins L – lesions T – tumor M – multiple DELT anomalies O – other (A – anchor worm C – leeches W – swirled scales Y – popeye S – emaciated F – fungus P – parasites) H – heavy L – light (these codes may be combined with above codes)

TOTAL # OF FISH				WEIGHT (s)					ANOMALIES					
				(mass g)				(length mm)						
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												
								Min length	D	E	L	T	M	O
								Max length						
V		P												

KRW: Rev/09.26.18 Calculation:________ QC1 + Entry________ QC 1 ________ QC 2________

Attachment 5. IDEM OWQ Biological Qualitative Habitat Evaluation Index (front)

OWQ Biological QHEI (Qualitative Habitat Evaluation Index)

Sample # **bioSample #** **Stream Name** **Location**

Surveyor **Sample Date** **County** **Macro Sample Type**

☐ **Habitat Complete**

QHEI Score:

1] *SUBSTRATE* Check ONLY Two predominant substrate TYPE BOXES and check every type present

PREDOMINANT	BEST TYPES	PRESENT P/G R/R	PREDOMINANT	OTHER TYPES	PRESENT P/G R/R
☐☐	BLDR/SLABS [10]	☐☐	☐☐	HARDPAN [4]	☐☐
☐☐	BOULDER [9]	☐☐	☐☐	DETRITUS [3]	☐☐
☐☐	COBBLE [8]	☐☐	☐☐	MUCK [2]	☐☐
☐☐	GRAVEL [7]	☐☐	☐☐	SILT [2]	☐☐
☐☐	SAND [6]	☐☐	☐☐	ARTIFICIAL [0]	☐☐
☐☐	BEDROCK [5]	☐☐		(Score natural substrates; ignore sludge from point-sources)	

NUMBER OF BEST TYPES: ☐ 4 or more [2]
☐ 3 or less [0]

Check ONE (Or 2 & average)

ORIGIN
- ☐ LIMESTONE [1]
- ☐ TILLS [1]
- ☐ WETLANDS [0]
- ☐ HARDPAN [0]
- ☐ SANDSTONE [0]
- ☐ RIP/RAP [0]
- ☐ LACUSTRINE [0]
- ☐ SHALE [-1]
- ☐ COAL FINES [-2]

QUALITY

SILT
- ☐ HEAVY [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ FREE [1]

EMBEDDEDNESS
- ☐ EXTENSIVE [-2]
- ☐ MODERATE [-1]
- ☐ NORMAL [0]
- ☐ NONE [1]

Substrate Maximum 20

Comments

2] *INSTREAM COVER* Indicate presence 0 to 3: 0–Absent; 1–Very small amounts or if more common of marginal quality; 2–Moderate amounts, but not of highest quality or in small amounts of highest quality; 3–Highest quality in moderate or greater amounts (e.g., very large boulders in deep or fast water, large diameter log that is stable, well developed root wad in deep/fast water, or deep, well-defined, functional pools.)

___ UNDERCUT BANKS [1]
___ OVERHANGING VEGETATION [1]
___ SHALLOWS (IN SLOW WATER) [1]
___ ROOTMATS [1]
___ POOLS > 70cm [2]
___ ROOTWADS [1]
___ BOULDERS [1]
___ OXBOWS, BACKWATERS [1]
___ AQUATIC MACROPHYTES [1]
___ LOGS OR WOODY DEBRIS [1]

AMOUNT
Check ONE (Or 2 & average)
- ☐ EXTENSIVE > 75% [11]
- ☐ MODERATE 25 - 75% [7]
- ☐ SPARSE 5 - < 25% [3]
- ☐ NEARLY ABSENT < 5% [1]

Cover Maximum 20

Comments

3] *CHANNEL MORPHOLOGY* Check ONE in each category (Or 2 & average)

SINUOSITY
- ☐ HIGH [4]
- ☐ MODERATE [3]
- ☐ LOW [2]
- ☐ NONE [1]

DEVELOPMENT
- ☐ EXCELLENT [7]
- ☐ GOOD [5]
- ☐ FAIR [3]
- ☐ POOR [1]

CHANNELIZATION
- ☐ NONE [6]
- ☐ RECOVERED [4]
- ☐ RECOVERING [3]
- ☐ RECENT OR NO RECOVERY [1]

STABILITY
- ☐ HIGH [3]
- ☐ MODERATE [2]
- ☐ LOW [1]

Channel Maximum 20

Comments

4] *BANK EROSION AND RIPARIAN ZONE* Check ONE in each category for EACH BANK (Or 2 per bank & average)

River right looking downstream

EROSION (L R)
- ☐☐ NONE/LITTLE [3]
- ☐☐ MODERATE [2]
- ☐☐ HEAVY/SEVERE [1]

RIPARIAN WIDTH (L R)
- ☐☐ WIDE > 50m [4]
- ☐☐ MODERATE 10-50m [3]
- ☐☐ NARROW 5-10m [2]
- ☐☐ VERY NARROW [1]
- ☐☐ NONE [0]

FLOOD PLAIN QUALITY (L R)
- ☐☐ FOREST, SWAMP [3]
- ☐☐ SHRUB OR OLD FIELD [2]
- ☐☐ RESIDENTIAL, PARK, NEW FIELD [1]
- ☐☐ FENCED PASTURE [1]
- ☐☐ OPEN PASTURE, ROWCROP [0]

(L R)
- ☐☐ CONSERVATION TILLAGE [1]
- ☐☐ URBAN OR INDUSTRIAL [0]
- ☐☐ MINING /CONSTRUCTION [0]

Indicate predominant land use(s) past 100m riparian.

Riparian Maximum 10

Comments

5] *POOL/GLIDE AND RIFFLE/RUN QUALITY*

MAXIMUM DEPTH
Check ONE (ONLY!)
- ☐ > 1m [6]
- ☐ 0.7 - < 1m [4]
- ☐ 0.4 - < 0.7m [2]
- ☐ 0.2 - < 0.4m [1]
- ☐ < 0.2m [0] [metric = 0]

CHANNEL WIDTH
Check ONE (Or 2 & average)
- ☐ POOL WIDTH > RIFFLE WIDTH [2]
- ☐ POOL WIDTH = RIFFLE WIDTH [1]
- ☐ POOL WIDTH < RIFFLE WIDTH [0]

CURRENT VELOCITY
Check ALL that apply
- ☐ TORRENTIAL [-1]
- ☐ VERY FAST [1]
- ☐ FAST [1]
- ☐ MODERATE [1]
- ☐ SLOW [1]
- ☐ INTERSTITIAL [-1]
- ☐ INTERMITTENT [-2]
- ☐ EDDIES [1]

Indicate for reach – pools and riffles.

Recreation Potential
(Check one and comment on back)
- ☐ Primary Contact
- ☐ Secondary Contact

Pool/ Current Maximum 12

Comments

Indicate for functional riffles; Best areas must be large enough to support a population of riffle-obligate species:

Check ONE (Or 2 & average)

☐ NO RIFFLE [metric = 0]

RIFFLE DEPTH
- ☐ BEST AREAS > 10cm [2]
- ☐ BEST AREAS 5 - 10cm [1]
- ☐ BEST AREAS < 5cm [metric = 0]

RUN DEPTH
- ☐ MAXIMUM > 50cm [2]
- ☐ MAXIMUM < 50cm [1]

RIFFLE/RUN SUBSTRATE
- ☐ STABLE (e.g., Cobble, Boulder) [2]
- ☐ MOD. STABLE (e.g., Large Gravel) [1]
- ☐ UNSTABLE (e.g., Fine Gravel, Sand) [0]

RIFFLE/RUN EMBEDDEDNESS
- ☐ NONE [2]
- ☐ LOW [1]
- ☐ MODERATE [0]
- ☐ EXTENSIVE [-1]

Riffle/ Run Maximum 8

Comments

6] *GRADIENT* (ft/mi)

DRAINAGE AREA (mi^2)

- ☐ VERY LOW - LOW [2 – 4]
- ☐ MODERATE [6 - 10]
- ☐ HIGH - VERY HIGH [10 - 6]

%POOL: %GLIDE:

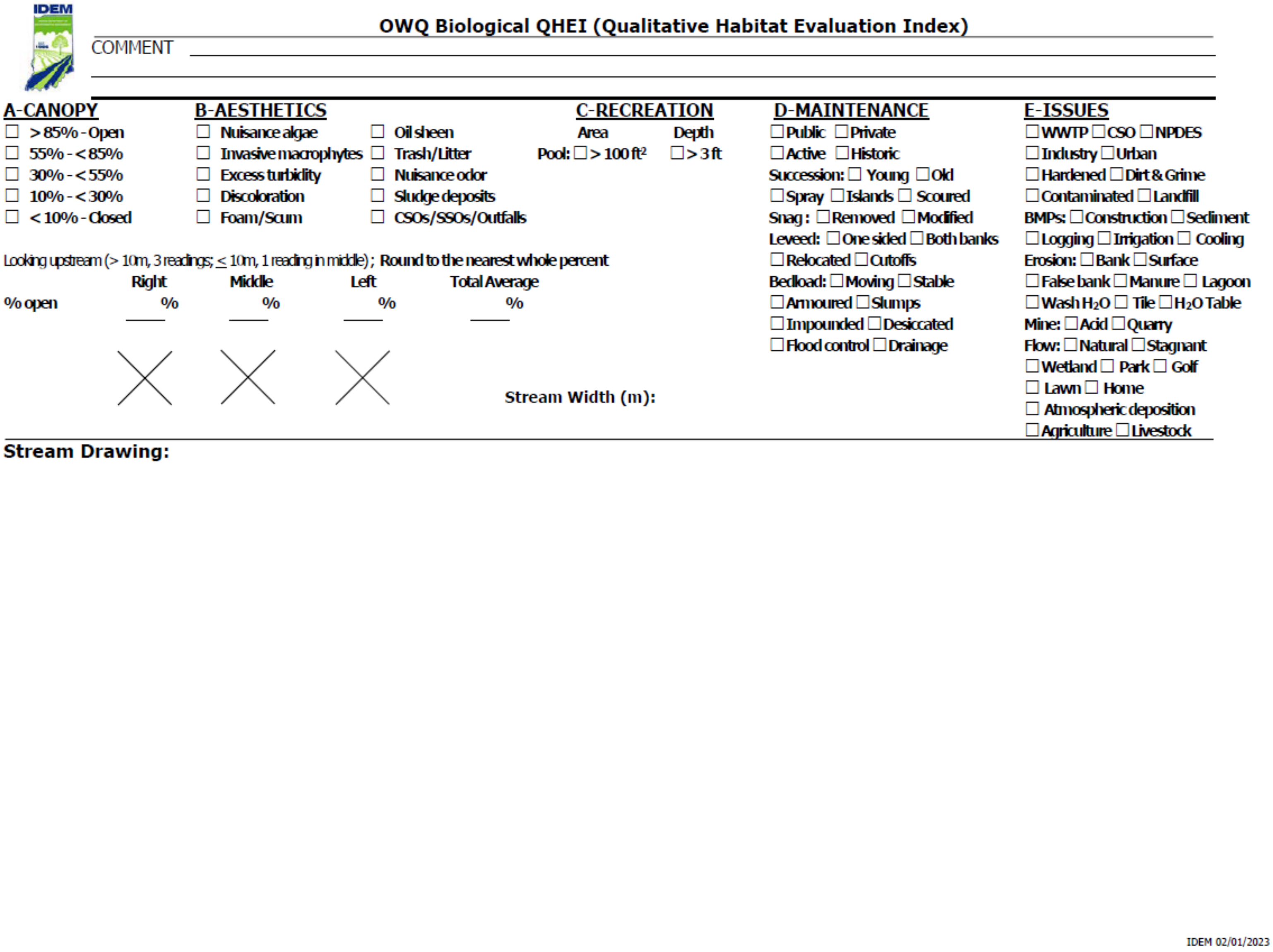
%RUN: %RIFFLE:

Gradient Maximum 10

Entered ______________ QC1 ______________ QC2 ______________

IDEM 02/01/2023

Attachment 5. IDEM OWQ Biological QHEI (back)



IDEM

OWQ Biological QHEI (Qualitative Habitat Evaluation Index)

COMMENT ______________________________

A-CANOPY
- ☐ > 85% - Open
- ☐ 55% - < 85%
- ☐ 30% - < 55%
- ☐ 10% - < 30%
- ☐ < 10% - Closed

B-AESTHETICS
- ☐ Nuisance algae
- ☐ Invasive macrophytes
- ☐ Excess turbidity
- ☐ Discoloration
- ☐ Foam/Scum
- ☐ Oil sheen
- ☐ Trash/Litter
- ☐ Nuisance odor
- ☐ Sludge deposits
- ☐ CSOs/SSOs/Outfalls

C-RECREATION

	Area	Depth
Pool:	☐ > 100 ft²	☐ > 3 ft

D-MAINTENANCE
- ☐ Public ☐ Private
- ☐ Active ☐ Historic
- Succession: ☐ Young ☐ Old
- ☐ Spray ☐ Islands ☐ Scoured
- Snag : ☐ Removed ☐ Modified
- Leveed: ☐ One sided ☐ Both banks
- ☐ Relocated ☐ Cutoffs
- Bedload: ☐ Moving ☐ Stable
- ☐ Armoured ☐ Slumps
- ☐ Impounded ☐ Desiccated
- ☐ Flood control ☐ Drainage

E-ISSUES
- ☐ WWTP ☐ CSO ☐ NPDES
- ☐ Industry ☐ Urban
- ☐ Hardened ☐ Dirt & Grime
- ☐ Contaminated ☐ Landfill
- BMPs: ☐ Construction ☐ Sediment
- ☐ Logging ☐ Irrigation ☐ Cooling
- Erosion: ☐ Bank ☐ Surface
- ☐ False bank ☐ Manure ☐ Lagoon
- ☐ Wash H_2O ☐ Tile ☐ H_2O Table
- Mine: ☐ Acid ☐ Quarry
- Flow: ☐ Natural ☐ Stagnant
- ☐ Wetland ☐ Park ☐ Golf
- ☐ Lawn ☐ Home
- ☐ Atmospheric deposition
- ☐ Agriculture ☐ Livestock

Looking upstream (> 10m, 3 readings; ≤ 10m, 1 reading in middle); Round to the nearest whole percent

	Right	Middle	Left	Total Average
% open	___ %	___ %	___ %	___ %

Stream Width (m):

Stream Drawing:

IDEM 02/01/2023

Attachment 6. IDEM OWQ Chain of Custody Form

Indiana Department of Environmental Management

OWQ Chain of Custody Form

Project:

OWQ Sample Set or Trip #:

I Certify that the sample(s) listed below was/were collected by me, or in my presence. Date:__________________________

Signature:____Section:________________________

Sample Media (☐ Water, ☐ Algae,☐ Fish, ☐ Macro, ☐ Cyanobacteria/Microcystin, ☐ Sediment)

Lab Assigned Number / Event ID	IDEM Control Number	Sample Type	ID	1000 ml P.N.M.	1000 ml G.N.M.	40 ml Vial	120 ml P (Bact)	2000 ml Nalgene	250 ml Nalgene	125 ml Glass	Date and Time Collected		One check per bottle present
											Date	Time	

P = Plastic	G = Glass	N.M. = Narrow Mouth	Bact = Bacteriological Only	Should samples be iced?	Y	N
M = MS/MSD	B = Blank	D = Duplicate	R = Revisit			

Carriers

I certify that I have received the above sample(s).

Signature	Date	Time	Seals Intact		Comments
Relinquished By:			Y	N	
Received By:					
Relinquished By:			Y	N	
Received By:					
Relinquished By:			Y	N	
Received By:					
IDEM Storage Room #					

Lab Custodian

I certify that I have received the above sample(s), which has/have been recorded in the official record book. The same sample(s) will be in the custody of competent laboratory personnel at all times, or locked in a secured area.

Signature:____________________________________ Date:_______________ Time:_______________

Lab:____ Address:______________________________________

Revision Date: 4/27/2016

Attachment 7. 2024 Reference Sites Water Sample Analysis Request Form

Indiana Department of Environmental Management
Office of Water Quality
Watershed Planning and Assessment Branch
www.idem.IN.gov

Water Sample Analysis Request **PROFILE #284**

Project Name: **2024 Reference Sites** **Composite** ☐ **Grab** ☒

OWQ Sample Set	24SPW001	IDEM Sample Nos.	
Crew Chief	Cameron Yeakle	Lab Sample Nos.	
Collection Date	April 1-3, 2024	Lab Delivery Date	April 4, 2024

Anions and Physical Parameters

Parameter	Test Method	Total	Dissolved
Alkalinity (as $CaCO_3$)	SM2320B	☒ **	☐
Total Solids	SM2540B	☒ **	
Suspended Solids	SM2540D	☒ **	
Dissolved Solids	SM2540C		☒ **
Sulfate (as SO_4)	300.0	☐ **	☒ **
Chloride (as Cl)	300.0	☐ **	☒**
Hardness (Calculated)	SM-2340B	☒ **	☐**
Fluoride (as F)	SM4500-F-C	☐ **	☐**

Priority Pollutant Metals Water Parameters

Parameter	Test Method	Total	Dissolved
Antimony (as Sb)	200.8	☒	☒
Arsenic (as As)	200.8	☒	☒
Beryllium (as Be)	200.8	☐	☐
Cadmium (as Cd)	200.8	☒	☒
Chromium (as Cr)	200.8	☒	☒
Copper (as Cu)	200.8	☒	☒
Lead (as Pb)	200.8	☒	☒
Mercury, Low Level	1631, Rev E.	☐	☐
Nickel (as Ni)	200.8	☒	☒
Selenium (as Se)	200.8	☒	☒
Silver (as Ag)	200.8	☒	☒
Thallium (as Tl)	200.8	☐	☐
Zinc (as Zn)	200.8	☒	☒

Cations and Secondary Metals Parameters

Parameter	Test Method	Total	Dissolved
Aluminum (as Al)	**200.8**	☒	☒
Barium (as Ba)	200.8	☐	☐
Boron (as B)	200.8	☐	☐
Calcium (as Ca)	**200.7**	☒ ***	☐
Cobalt (as Co)	200.8	☐	☐
Iron (as Fe)	200.7	☐	☐
Magnesium (as Mg)	**200.7**	☒ ***	☐
Manganese (as Mn)	200.8	☐	☐
Sodium (as Na)	200.7	☐	☐
Silica, Total Reactive (as SiO_2)	200.7	☐	☐
Strontium (as Sr)	200.8	☐	☐

Send reports (Fed. Ex. or UPS) to:

Tim Bowren - IDEM
Bldg. 20, STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219

Deliver reports to:

Tim Bowren - IDEM
Bldg. 20, STE 100
2525 North Shadeland Ave.
Indianapolis, IN 46219

Organic Water Parameters

Parameter	Test Method	Total
Priority Pollutants: Oranochlorine Pesticides and PCBs	608	☐
Priority Pollutants: VOCs - Purgeable Organics	624	☐
Priority Pollutants: Base/Neutral Extractables	625	☐
Priority Pollutants: Acid Extractables	625	☐
Phenolics, 4AAP	420.4	☐
Oil and Grease, Total	1664A	☐

Nutrient & Organic Water Chemistry Parameters

Parameter	Test Method	Total	Dissolved
Ammonia Nitrogen	350.1	☒	☐
$CBOD_5$	SM5210B	☐	
Total Kjeldahl Nitrogen (TKN)	351.2	☒	☐
Nitrogen, Nitrate + Nitrite as N	353.2	☒	☐
Total Phosphorus	365.1	☒	☐
TOC (Total Organic Carbon)	SM 5310C	☒	
DOC (Dissolved Organic Carbon)	SM 5310C		☒
COD	410.4	☒	☐
Cyanide (Total)	335.4	☐	☐
Cyanide (Free)	SM4500CN-I	☐ *	☐
Cyanide (Amenable)	SM4500CN-G	☐ *	☐
Sulfide, Total	376.2	☐	☐

RFP 22-68153 Contract Number:	58463 (Pace-Indy) PO # 20003041 Line #7 (Pace-Indy)

30 day reporting time required.

Notes:

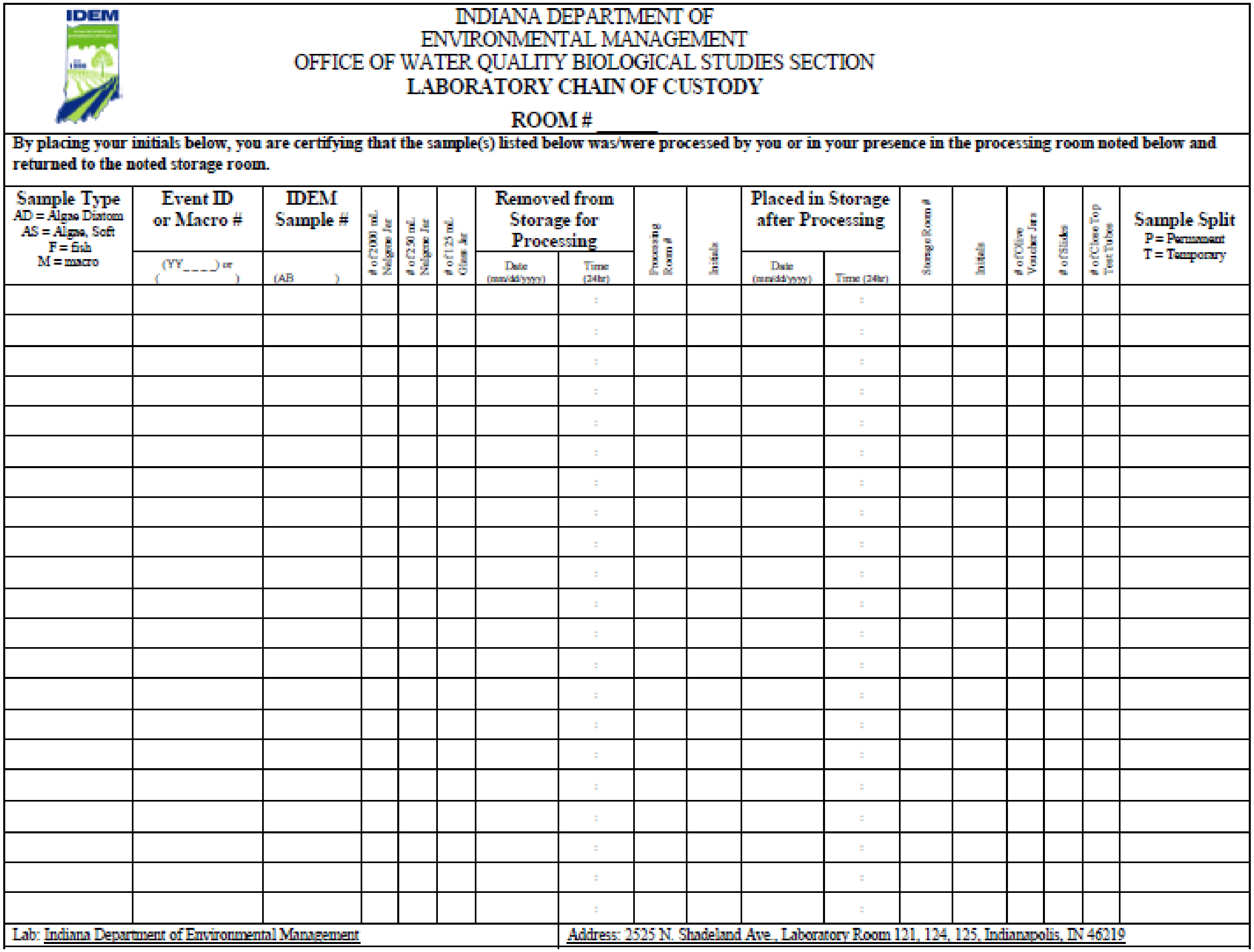
**** = DO NOT RUN PARAMETER IF SAMPLE IDENTIFIED AS A BLANK ON THE CHAIN OF CUSTODY**

*** = RUN ONLY IF TOTAL CYANIDE IS DETECTED**

*** = *Report Calcium, Magnesium components of Total Hardness (Calculated)*

Testing Laboratory: Pace Analytical Services, Inc.
Attn: Olivia Deck
Phone: 317-228-3102 7726 Moller Road
Indianapolis, IN 46268

Attachment 8. Biological Samples Laboratory Chain of Custody Form



INDIANA DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER QUALITY BIOLOGICAL STUDIES SECTION
LABORATORY CHAIN OF CUSTODY

ROOM # ______

By placing your initials below, you are certifying that the sample(s) listed below was/were processed by you or in your presence in the processing room noted below and returned to the noted storage room.

Sample Type AD = Algae Diatom AS = Algae, Soft F = fish M = macro	Event ID or Macro #	IDEM Sample #	# of 2000 mL Nalgene Jar	# of 250 mL Nalgene Jar	# of 125 mL Glass Jar	Removed from Storage for Processing		Processing Room #	Initials	Placed in Storage after Processing		Storage Room #	Initials	# of Olive Voucher Jars	# of Slides	# of Clear Top Test Tubes	Sample Split P = Permanent T = Temporary
	(YY____) or ( )	(AB)				Date (mm/dd/yyyy)	Time (24hr)			Date (mm/dd/yyyy)	Time (24hr)						
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Lab: Indiana Department of Environmental Management

Address: 2525 N. Shadeland Ave., Laboratory Room 121, 124, 125, Indianapolis, IN 46219

Attachment 9. Pace Laboratory Inc., Indianapolis: Certification

State of Kansas

Department of Health and Environment

CERTIFICATE

This is to certify that Certification No.: E-10177

Pace Analytical Services, Inc - Indianapolis

7726 Moller Road
Indianapolis, IN 46268-4163

has been accredited in accordance with K.S.A. 65-1,109a under the standards adopted in K.A.R. 28-15-36 for performing environmental analyses for the parameters listed on the most current scope of accreditation. Continuous accreditation depends on successful, ongoing participation in the program. Clients are urged to verify with this agency the laboratory's certification status for particular methods and analytes.

Effective Date: 5/1/2023

Expiration Date: 4/30/2024

Leo G Henning

Leo Henning
Acting Director
Office of Laboratory Services

Carissa Robertson
Certification Section Chief
Office of Laboratory Services

Attachment 9. Pace Laboratory Inc., Indianapolis: Accreditation Documents

Division of Environment
Kansas Health and Environmental Laboratories
Environmental Laboratory Improvement Program
6810 SE Dwight Street
Topeka, KS 66620

Kansas
Department of Health
and Environment

Phone: 785-296-3811
Fax: 785-559-5207
KDHE.ELIPO@KS.GOV
www.kdheks.gov/envlab

Janet Stanek, Secretary

Laura Kelly, Governor

The Kansas Department of Health and Environment encourages all clients and data users to verify the most current scope of accreditation for certification number E-10177

The analytes tested and the corresponding matrix and method which a laboratory is authorized to perform at any given time will be those indicated in the most recently issued scope of accreditation. The most recent scope of accreditation supersedes all previously issued scopes of accreditation. It is the certified laboratory's responsibility to review this document for any discrepancies. This scope of accreditation will be recalled in the event that your laboratory's certification is revoked.

Accreditation Start: 5/1/2023 Accreditation End: 4/30/2024

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177**

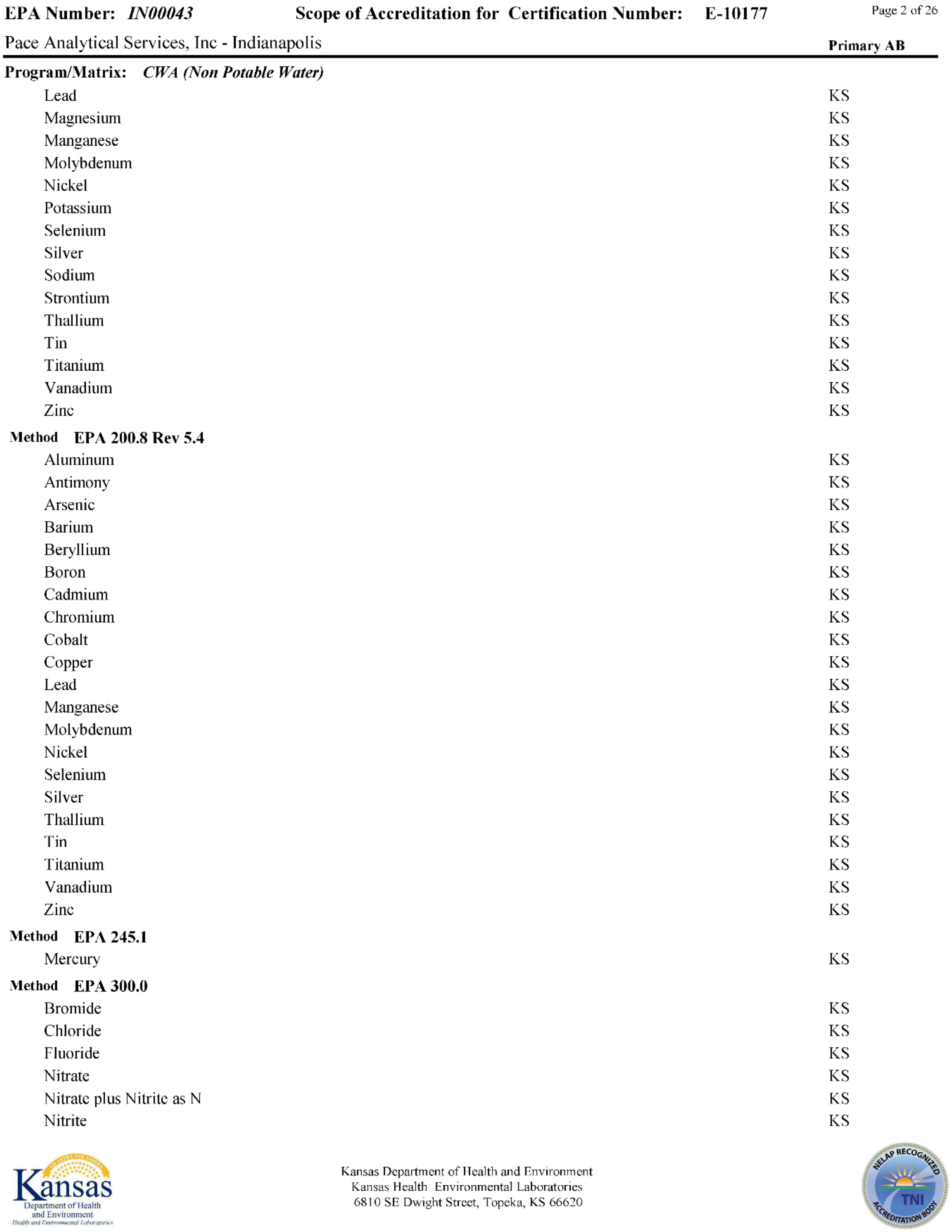
Page 1 of 26

Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***CWA (Non Potable Water)***

	Primary AB
Method ASTM D516-16	
Sulfate	KS
Method EPA 120.1	
Conductivity	KS
Method EPA 1631E	
Mercury	KS
Method EPA 1664A	
Oil & Grease	KS
Method EPA 1664A (SGT-HEM)	
n-Hexane Extractable Material - Silica Gel Treated (HEM-SGT)	KS
Method EPA 180.1 Rev. 2 - 1993	
Turbidity	KS
Method EPA 200.7 Rev 4.4	
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Boron	KS
Cadmium	KS
Calcium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Copper	KS
Iron	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



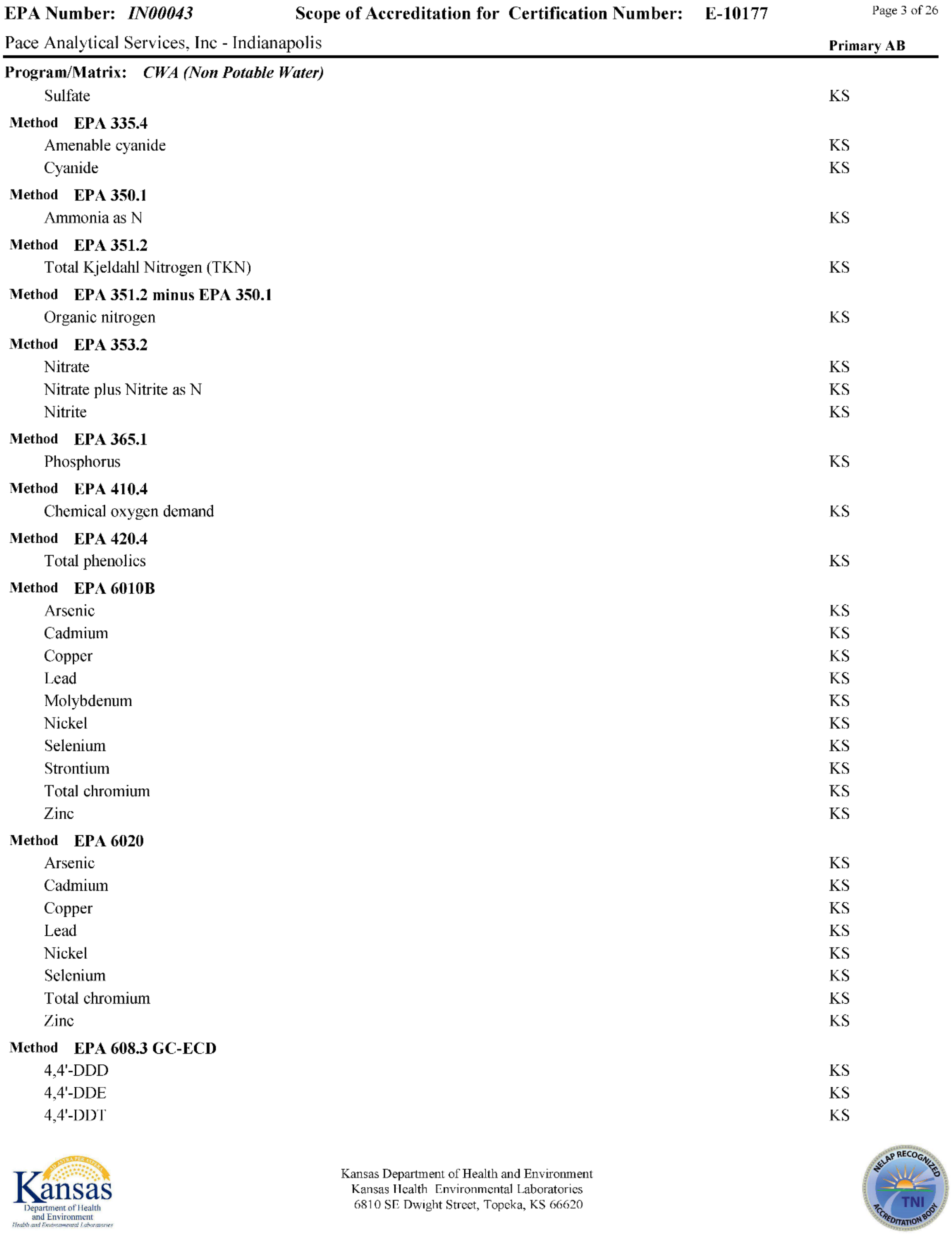
EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 2 of 26

Pace Analytical Services, Inc - Indianapolis

	Primary AB
Program/Matrix: ***CWA (Non Potable Water)***	
Lead	KS
Magnesium	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Potassium	KS
Selenium	KS
Silver	KS
Sodium	KS
Strontium	KS
Thallium	KS
Tin	KS
Titanium	KS
Vanadium	KS
Zinc	KS
Method EPA 200.8 Rev 5.4	
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Boron	KS
Cadmium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Lead	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Selenium	KS
Silver	KS
Thallium	KS
Tin	KS
Titanium	KS
Vanadium	KS
Zinc	KS
Method EPA 245.1	
Mercury	KS
Method EPA 300.0	
Bromide	KS
Chloride	KS
Fluoride	KS
Nitrate	KS
Nitrate plus Nitrite as N	KS
Nitrite	KS

Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
6810 SE Dwight Street, Topeka, KS 66620

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



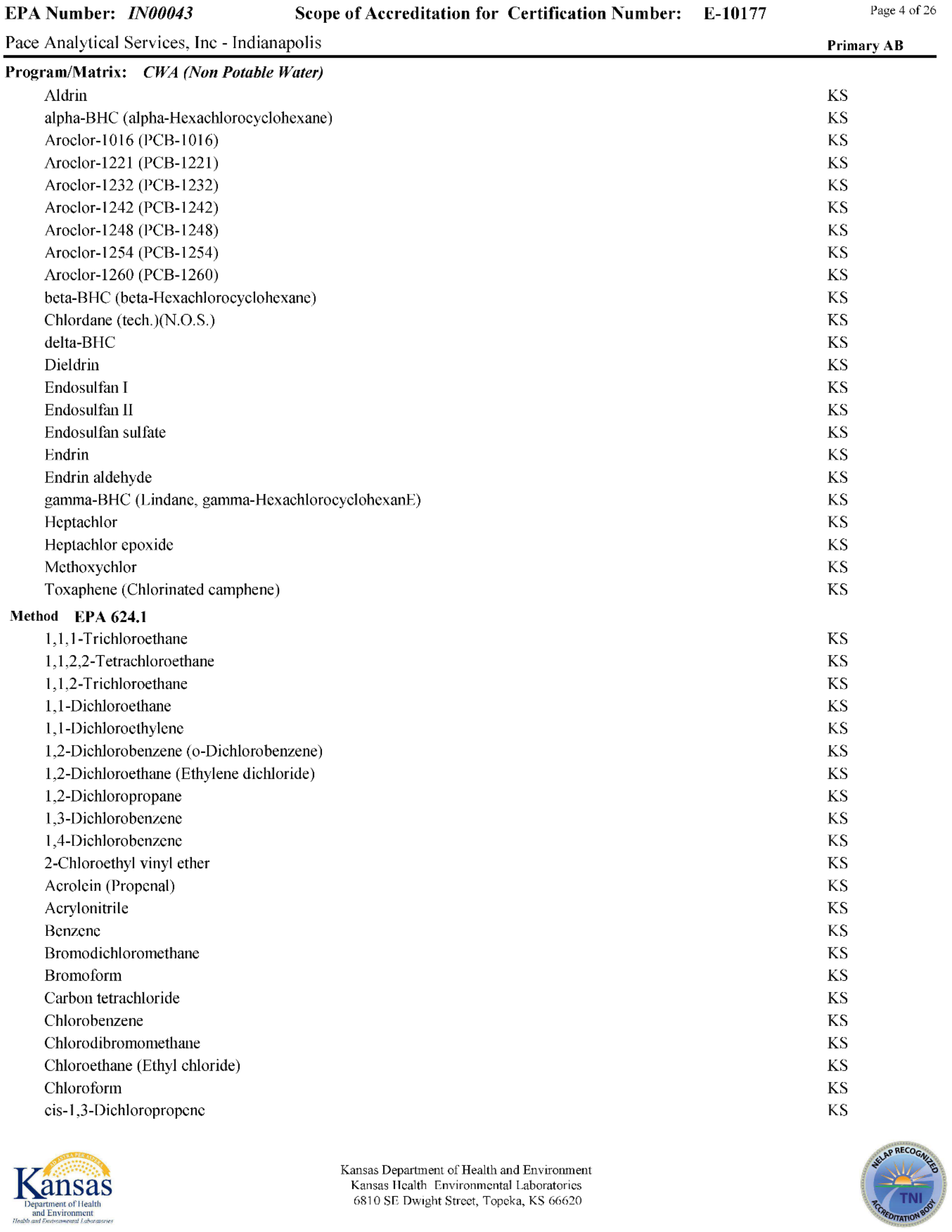
EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number:** **E-10177** Page 3 of 26

Pace Analytical Services, Inc - Indianapolis

	Primary AB
Program/Matrix: ***CWA (Non Potable Water)***	
Sulfate	KS
Method EPA 335.4	
Amenable cyanide	KS
Cyanide	KS
Method EPA 350.1	
Ammonia as N	KS
Method EPA 351.2	
Total Kjeldahl Nitrogen (TKN)	KS
Method EPA 351.2 minus EPA 350.1	
Organic nitrogen	KS
Method EPA 353.2	
Nitrate	KS
Nitrate plus Nitrite as N	KS
Nitrite	KS
Method EPA 365.1	
Phosphorus	KS
Method EPA 410.4	
Chemical oxygen demand	KS
Method EPA 420.4	
Total phenolics	KS
Method EPA 6010B	
Arsenic	KS
Cadmium	KS
Copper	KS
Lead	KS
Molybdenum	KS
Nickel	KS
Selenium	KS
Strontium	KS
Total chromium	KS
Zinc	KS
Method EPA 6020	
Arsenic	KS
Cadmium	KS
Copper	KS
Lead	KS
Nickel	KS
Selenium	KS
Total chromium	KS
Zinc	KS
Method EPA 608.3 GC-ECD	
4,4'-DDD	KS
4,4'-DDE	KS
4,4'-DDT	KS

Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
6810 SE Dwight Street, Topeka, KS 66620

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 4 of 26

Pace Analytical Services, Inc - Indianapolis

	Primary AB
Program/Matrix: ***CWA (Non Potable Water)***	
Aldrin	KS
alpha-BHC (alpha-Hexachlorocyclohexane)	KS
Aroclor-1016 (PCB-1016)	KS
Aroclor-1221 (PCB-1221)	KS
Aroclor-1232 (PCB-1232)	KS
Aroclor-1242 (PCB-1242)	KS
Aroclor-1248 (PCB-1248)	KS
Aroclor-1254 (PCB-1254)	KS
Aroclor-1260 (PCB-1260)	KS
beta-BHC (beta-Hexachlorocyclohexane)	KS
Chlordane (tech.)(N.O.S.)	KS
delta-BHC	KS
Dieldrin	KS
Endosulfan I	KS
Endosulfan II	KS
Endosulfan sulfate	KS
Endrin	KS
Endrin aldehyde	KS
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	KS
Heptachlor	KS
Heptachlor epoxide	KS
Methoxychlor	KS
Toxaphene (Chlorinated camphene)	KS
Method EPA 624.1	
1,1,1-Trichloroethane	KS
1,1,2,2-Tetrachloroethane	KS
1,1,2-Trichloroethane	KS
1,1-Dichloroethane	KS
1,1-Dichloroethylene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Dichloroethane (Ethylene dichloride)	KS
1,2-Dichloropropane	KS
1,3-Dichlorobenzene	KS
1,4-Dichlorobenzene	KS
2-Chloroethyl vinyl ether	KS
Acrolein (Propenal)	KS
Acrylonitrile	KS
Benzene	KS
Bromodichloromethane	KS
Bromoform	KS
Carbon tetrachloride	KS
Chlorobenzene	KS
Chlorodibromomethane	KS
Chloroethane (Ethyl chloride)	KS
Chloroform	KS
cis-1,3-Dichloropropene	KS

Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
6810 SE Dwight Street, Topeka, KS 66620

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

	Primary AB
Program/Matrix: ***CWA (Non Potable Water)***	
Ethylbenzene	KS
Methyl bromide (Bromomethane)	KS
Methyl chloride (Chloromethane)	KS
Methylene chloride (Dichloromethane)	KS
Naphthalene	KS
Tetrachloroethylene (Perchloroethylene)	KS
Toluene	KS
trans-1,2-Dichloroethylene	KS
trans-1,3-Dichloropropylene	KS
Trichloroethene (Trichloroethylene)	KS
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	KS
Vinyl chloride	KS
Xylene (total)	KS
Method **EPA 625.1**	
1,2,4-Trichlorobenzene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,3-Dichlorobenzene	KS
1,4-Dichlorobenzene	KS
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	KS
2,4,6-Trichlorophenol	KS
2,4-Dichlorophenol	KS
2,4-Dimethylphenol	KS
2,4-Dinitrophenol	KS
2,4-Dinitrotoluene (2,4-DNT)	KS
2,6-Dinitrotoluene (2,6-DNT)	KS
2-Chloronaphthalene	KS
2-Chlorophenol	KS
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	KS
2-Methylphenol (o-Cresol)	KS
2-Nitrophenol	KS
3,3'-Dichlorobenzidine	KS
4-Bromophenyl phenyl ether	KS
4-Chloro-3-methylphenol	KS
4-Chlorophenyl phenylether	KS
4-Methylphenol (p-Cresol)	KS
4-Nitrophenol	KS
Acenaphthene	KS
Acenaphthylene	KS
Anthracene	KS
Benzidine	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
bis(2-Chloroethoxy)methane	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

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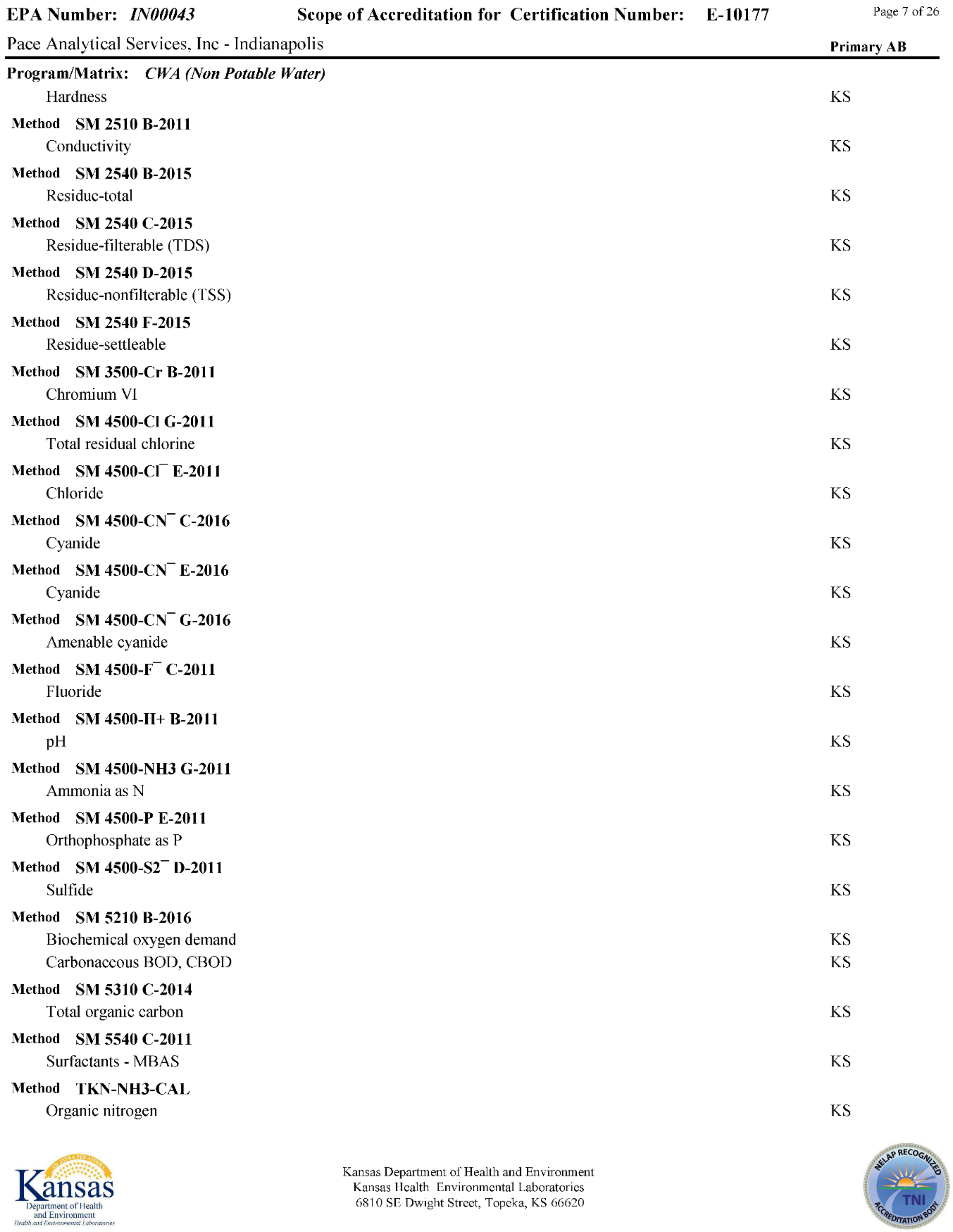
Pace Analytical Services, Inc - Indianapolis

	Primary AB
Program/Matrix: ***CWA (Non Potable Water)***	
bis(2-Chloroethyl) ether	KS
Butyl benzyl phthalate	KS
Carbazole	KS
Chrysene	KS
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	KS
Dibenz(a,h) anthracene	KS
Diethyl phthalate	KS
Dimethyl phthalate	KS
Di-n-butyl phthalate	KS
Di-n-octyl phthalate	KS
Fluoranthene	KS
Fluorene	KS
Hexachlorobenzene	KS
Hexachlorobutadiene	KS
Hexachlorocyclopentadiene	KS
Hexachloroethane	KS
Indeno(1,2,3-cd) pyrene	KS
Isophorone	KS
Naphthalene	KS
n-Decane	KS
Nitrobenzene	KS
n-Nitrosodimethylamine	KS
n-Nitrosodi-n-propylamine	KS
n-Nitrosodiphenylamine	KS
n-Octadecane	KS
Pentachlorophenol	KS
Phenanthrene	KS
Phenol	KS
Pyrene	KS
Method EPA 7470A	
Mercury	KS
Method EPA 7471A	
Mercury	KS
Method EPA 8015D	
Propylene glycol	KS
Method EPA 8260C	
1,3,5-Trichlorobenzene	KS
Method EPA 8270C	
1-Methylnaphthalene	KS
Carbazole	KS
Method SM 2310 B-2011	
Acidity, as CaCO3	KS
Method SM 2320 B-2011	
Alkalinity as CaCO3	KS
Method SM 2340 B-2011	

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 7 of 26

Pace Analytical Services, Inc - Indianapolis

	Primary AB
Program/Matrix: ***CWA (Non Potable Water)***	
Hardness	KS
Method SM 2510 B-2011	
Conductivity	KS
Method SM 2540 B-2015	
Residue-total	KS
Method SM 2540 C-2015	
Residue-filterable (TDS)	KS
Method SM 2540 D-2015	
Residue-nonfilterable (TSS)	KS
Method SM 2540 F-2015	
Residue-settleable	KS
Method SM 3500-Cr B-2011	
Chromium VI	KS
Method SM 4500-Cl G-2011	
Total residual chlorine	KS
Method SM 4500-Cl$^-$ E-2011	
Chloride	KS
Method SM 4500-CN$^-$ C-2016	
Cyanide	KS
Method SM 4500-CN$^-$ E-2016	
Cyanide	KS
Method SM 4500-CN$^-$ G-2016	
Amenable cyanide	KS
Method SM 4500-F$^-$ C-2011	
Fluoride	KS
Method SM 4500-H+ B-2011	
pH	KS
Method SM 4500-NH3 G-2011	
Ammonia as N	KS
Method SM 4500-P E-2011	
Orthophosphate as P	KS
Method SM 4500-S2$^-$ D-2011	
Sulfide	KS
Method SM 5210 B-2016	
Biochemical oxygen demand	KS
Carbonaceous BOD, CBOD	KS
Method SM 5310 C-2014	
Total organic carbon	KS
Method SM 5540 C-2011	
Surfactants - MBAS	KS
Method TKN-NH3-CAL	
Organic nitrogen	KS

Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
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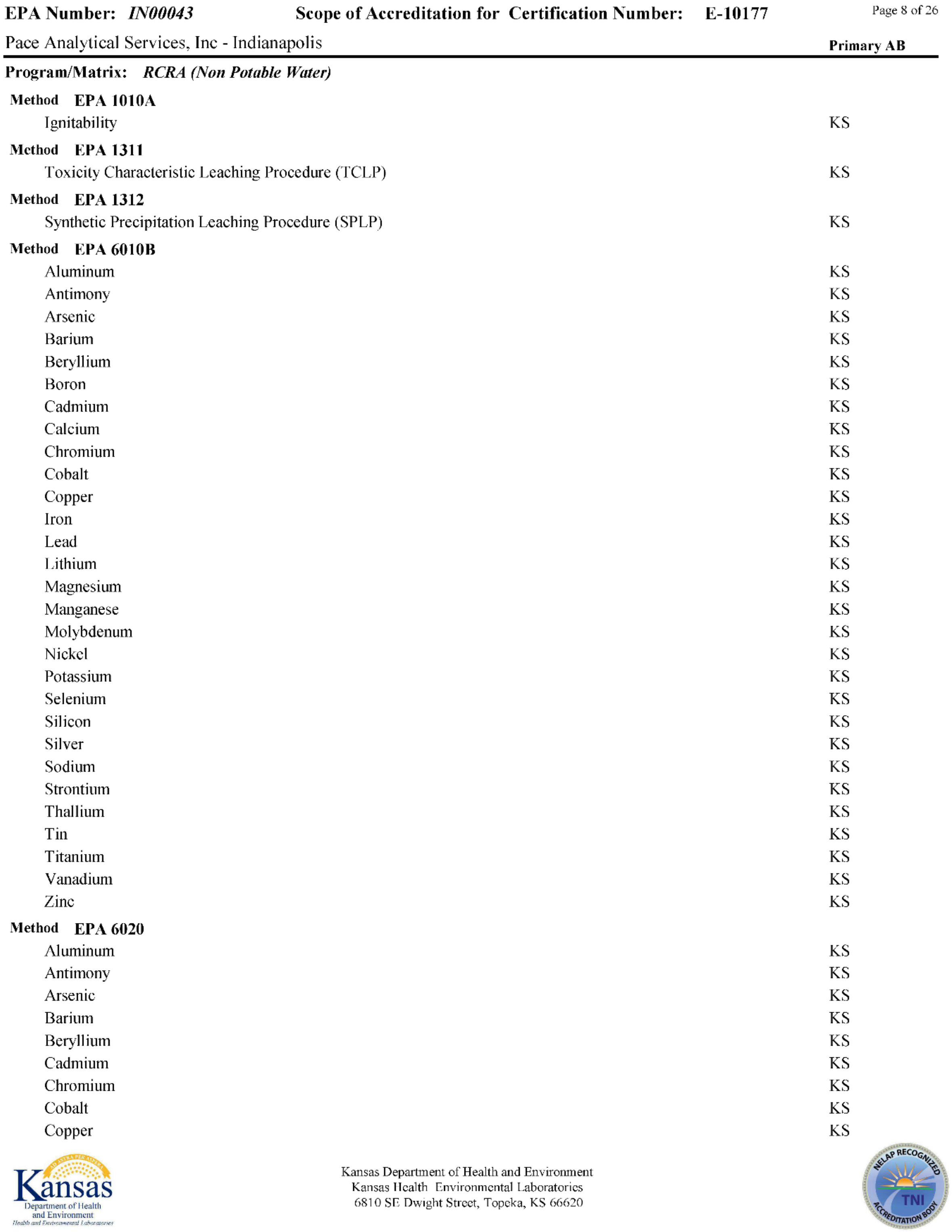
Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number:** **E-10177** Page 8 of 26

Pace Analytical Services, Inc - Indianapolis **Primary AB**

Program/Matrix: ***RCRA (Non Potable Water)***

Method EPA 1010A

	Primary AB
Ignitability	KS

Method EPA 1311

	Primary AB
Toxicity Characteristic Leaching Procedure (TCLP)	KS

Method EPA 1312

	Primary AB
Synthetic Precipitation Leaching Procedure (SPLP)	KS

Method EPA 6010B

	Primary AB
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Boron	KS
Cadmium	KS
Calcium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Iron	KS
Lead	KS
Lithium	KS
Magnesium	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Potassium	KS
Selenium	KS
Silicon	KS
Silver	KS
Sodium	KS
Strontium	KS
Thallium	KS
Tin	KS
Titanium	KS
Vanadium	KS
Zinc	KS

Method EPA 6020

	Primary AB
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Cadmium	KS
Chromium	KS
Cobalt	KS
Copper	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

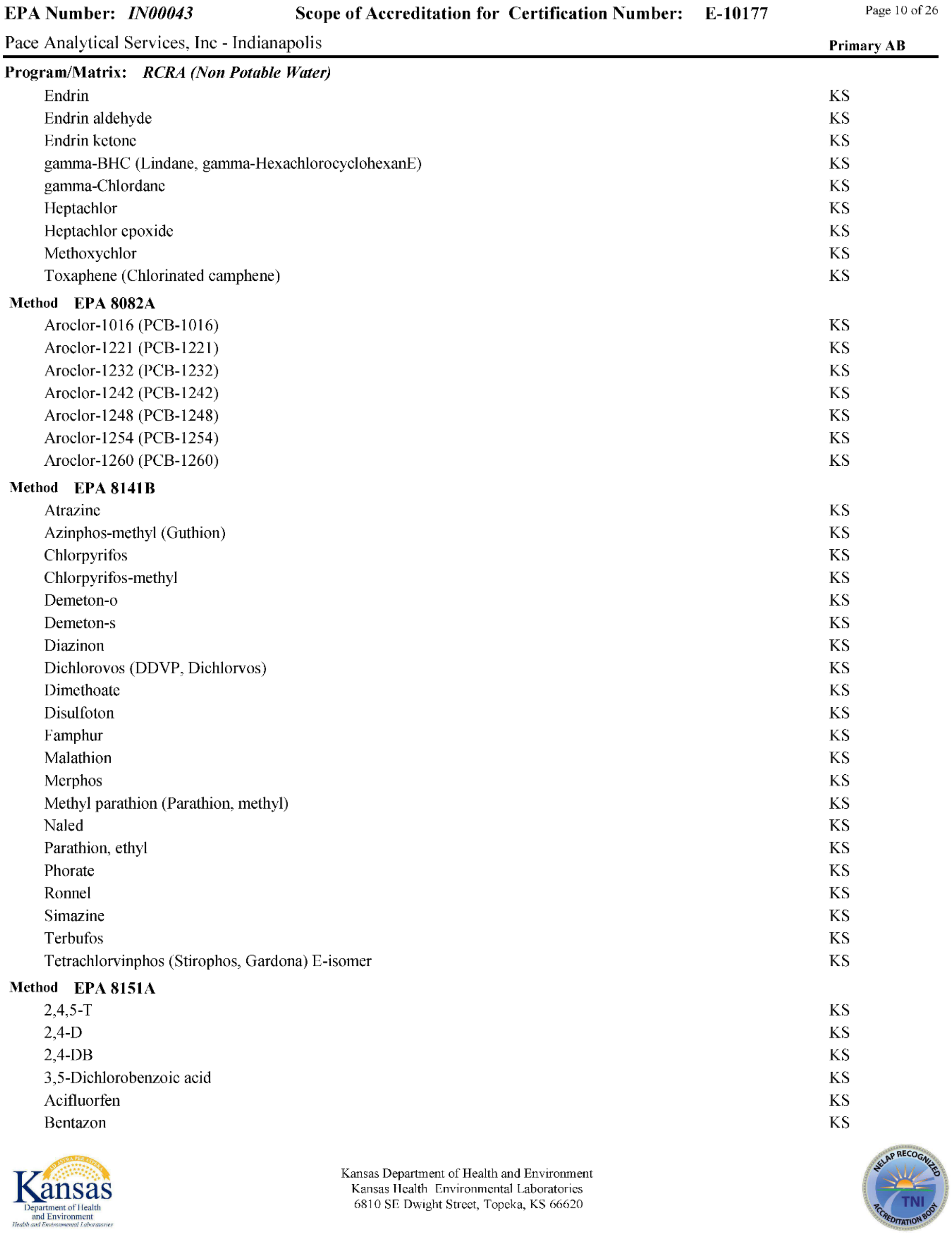
EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177**

Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
Lead	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Selenium	KS
Silver	KS
Thallium	KS
Thorium	KS
Uranium	KS
Vanadium	KS
Zinc	KS
Method EPA 7196A	
Chromium VI	KS
Method EPA 7470A	
Mercury	KS
Method EPA 7471A	
Mercury	KS
Method EPA 8011	
1,2-Dibromo-3-chloropropane (DBCP)	KS
1,2-Dibromoethane (EDB, Ethylene dibromide)	KS
Method EPA 8015D	
Diesel range organics (DRO)	KS
Ethanol	KS
Ethylene glycol	KS
Gasoline range organics (GRO)	KS
Isobutyl alcohol (2-Methyl-1-propanol)	KS
Isopropyl alcohol (2-Propanol, Isopropanol)	KS
Methanol	KS
n-Butyl alcohol (1-Butanol, n-Butanol)	KS
n-Propanol (1-Propanol)	KS
Propylene glycol	KS
Method EPA 8081B	
4,4'-DDD	KS
4,4'-DDE	KS
4,4'-DDT	KS
Aldrin	KS
alpha-BHC (alpha-Hexachlorocyclohexane)	KS
alpha-Chlordane, cis-Chlordane	KS
beta-BHC (beta-Hexachlorocyclohexane)	KS
Chlordane (tech.)(N.O.S.)	KS
delta-BHC	KS
Dieldrin	KS
Endosulfan I	KS
Endosulfan II	KS
Endosulfan sulfate	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



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Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
Endrin	KS
Endrin aldehyde	KS
Endrin ketone	KS
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	KS
gamma-Chlordane	KS
Heptachlor	KS
Heptachlor epoxide	KS
Methoxychlor	KS
Toxaphene (Chlorinated camphene)	KS
Method EPA 8082A	
Aroclor-1016 (PCB-1016)	KS
Aroclor-1221 (PCB-1221)	KS
Aroclor-1232 (PCB-1232)	KS
Aroclor-1242 (PCB-1242)	KS
Aroclor-1248 (PCB-1248)	KS
Aroclor-1254 (PCB-1254)	KS
Aroclor-1260 (PCB-1260)	KS
Method EPA 8141B	
Atrazine	KS
Azinphos-methyl (Guthion)	KS
Chlorpyrifos	KS
Chlorpyrifos-methyl	KS
Demeton-o	KS
Demeton-s	KS
Diazinon	KS
Dichlorovos (DDVP, Dichlorvos)	KS
Dimethoate	KS
Disulfoton	KS
Famphur	KS
Malathion	KS
Merphos	KS
Methyl parathion (Parathion, methyl)	KS
Naled	KS
Parathion, ethyl	KS
Phorate	KS
Ronnel	KS
Simazine	KS
Terbufos	KS
Tetrachlorvinphos (Stirophos, Gardona) E-isomer	KS
Method EPA 8151A	
2,4,5-T	KS
2,4-D	KS
2,4-DB	KS
3,5-Dichlorobenzoic acid	KS
Acifluorfen	KS
Bentazon	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177**

Pace Analytical Services, Inc - Indianapolis

	Primary AB
Program/Matrix: ***RCRA (Non Potable Water)***	
Dalapon	KS
DCPA di acid degradate	KS
Dicamba	KS
Dichloroprop (Dichlorprop)	KS
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	KS
MCPA	KS
MCPP	KS
Pentachlorophenol	KS
Picloram	KS
Silvex (2,4,5-TP)	KS
Method **EPA 8260C**	
1,1,1,2-Tetrachloroethane	KS
1,1,1-Trichloroethane	KS
1,1,2,2-Tetrachloroethane	KS
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	KS
1,1,2-Trichloroethane	KS
1,1-Dichloroethane	KS
1,1-Dichloroethylene	KS
1,1-Dichloropropene	KS
1,2,3-Trichlorobenzene	KS
1,2,3-Trichloropropane	KS
1,2,4-Trichlorobenzene	KS
1,2,4-Trimethylbenzene	KS
1,2-Dibromo-3-chloropropane (DBCP)	KS
1,2-Dibromoethane (EDB, Ethylene dibromide)	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Dichloroethane (Ethylene dichloride)	KS
1,2-Dichloropropane	KS
1,3,5-Trichlorobenzene	KS
1,3,5-Trimethylbenzene	KS
1,3-Dichlorobenzene	KS
1,3-Dichloropropane	KS
1,4-Dichlorobenzene	KS
1,4-Dioxane (1,4- Diethyleneoxide)	KS
1-Methylnaphthalene	KS
2,2-Dichloropropane	KS
2-Butanone (Methyl ethyl ketone, MEK)	KS
2-Chloroethyl vinyl ether	KS
2-Chlorotoluene	KS
2-Hexanone	KS
2-Methylnaphthalene	KS
4-Chlorotoluene	KS
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	KS
4-Methyl-2-pentanone (MIBK)	KS
Acetone	KS
Acetonitrile	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
Acrolein (Propenal)	KS
Acrylonitrile	KS
Allyl chloride (3-Chloropropene)	KS
Benzene	KS
Bromobenzene	KS
Bromochloromethane	KS
Bromodichloromethane	KS
Bromoform	KS
Carbon disulfide	KS
Carbon tetrachloride	KS
Chlorobenzene	KS
Chlorodibromomethane	KS
Chloroethane (Ethyl chloride)	KS
Chloroform	KS
Chloroprene (2-Chloro-1,3-butadiene)	KS
cis-1,2-Dichloroethylene	KS
cis-1,3-Dichloropropene	KS
Cyclohexane	KS
Dibromomethane (Methylene bromide)	KS
Dichlorodifluoromethane (Freon-12)	KS
Diethyl ether	KS
Ethyl acetate	KS
Ethyl methacrylate	KS
Ethylbenzene	KS
Hexachlorobutadiene	KS
Iodomethane (Methyl iodide)	KS
Isobutyl alcohol (2-Methyl-1-propanol)	KS
Isopropylbenzene	KS
Methacrylonitrile	KS
Methyl acetate	KS
Methyl bromide (Bromomethane)	KS
Methyl chloride (Chloromethane)	KS
Methyl methacrylate	KS
Methyl tert-butyl ether (MTBE)	KS
Methylcyclohexane	KS
Methylene chloride (Dichloromethane)	KS
m-Xylene	KS
Naphthalene	KS
n-Butyl alcohol (1-Butanol, n-Butanol)	KS
n-Butylbenzene	KS
n-Hexane	KS
n-Propylbenzene	KS
o-Xylene	KS
Propionitrile (Ethyl cyanide)	KS
p-Xylene	KS
sec-Butylbenzene	KS
Styrene	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number:** **E-10177** Page 13 of 26

Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
tert-Butyl alcohol	KS
tert-Butylbenzene	KS
Tetrachloroethylene (Perchloroethylene)	KS
Tetrahydrofuran (THF)	KS
Toluene	KS
trans-1,2-Dichloroethylene	KS
trans-1,3-Dichloropropylene	KS
trans-1,4-Dichloro-2-butene	KS
Trichloroethene (Trichloroethylene)	KS
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	KS
Vinyl acetate	KS
Vinyl chloride	KS
Xylene (total)	KS

Method **EPA 8270C**

1,2,4,5-Tetrachlorobenzene	KS
1,2,4-Trichlorobenzene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Diphenylhydrazine	KS
1,3,5-Trinitrobenzene (1,3,5-TNB)	KS
1,3-Dichlorobenzene	KS
1,3-Dinitrobenzene (1,3-DNB)	KS
1,4-Dichlorobenzene	KS
1,4-Naphthoquinone	KS
1,4-Phenylenediamine	KS
1-Methylnaphthalene	KS
1-Naphthylamine	KS
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	KS
2,3,4,6-Tetrachlorophenol	KS
2,4,5-Trichlorophenol	KS
2,4,6-Trichlorophenol	KS
2,4-Dichlorophenol	KS
2,4-Dimethylphenol	KS
2,4-Dinitrophenol	KS
2,4-Dinitrotoluene (2,4-DNT)	KS
2,6-Dichlorophenol	KS
2,6-Dinitrotoluene (2,6-DNT)	KS
2-Acetylaminofluorene	KS
2-Chloronaphthalene	KS
2-Chlorophenol	KS
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	KS
2-Methylaniline (o-Toluidine)	KS
2-Methylnaphthalene	KS
2-Methylphenol (o-Cresol)	KS
2-Naphthylamine	KS
2-Nitroaniline	KS
2-Nitrophenol	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

EPA Number: ***IN00043*** **Scope of Accreditation for Certification Number: E-10177** Page 14 of 26

Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
2-Picoline (2-Methylpyridine)	KS
3,3'-Dichlorobenzidine	KS
3,3'-Dimethylbenzidine	KS
3-Methylcholanthrene	KS
3-Methylphenol (m-Cresol)	KS
3-Nitroaniline	KS
4-Aminobiphenyl	KS
4-Bromophenyl phenyl ether	KS
4-Chloro-3-methylphenol	KS
4-Chloroaniline	KS
4-Chlorophenyl phenylether	KS
4-Dimethyl aminoazobenzene	KS
4-Methylphenol (p-Cresol)	KS
4-Nitroaniline	KS
4-Nitrophenol	KS
4-Nitroquinoline 1-oxide	KS
5-Nitro-o-toluidine	KS
7,12-Dimethylbenz(a) anthracene	KS
a-a-Dimethylphenethylamine	KS
Acenaphthene	KS
Acenaphthylene	KS
Acetophenone	KS
Aniline	KS
Anthracene	KS
Aramite	KS
Atrazine	KS
Benzaldehyde	KS
Benzidine	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
Benzoic acid	KS
Benzyl alcohol	KS
Biphenyl	KS
bis(2-Chloroethoxy)methane	KS
bis(2-Chloroethyl) ether	KS
Butyl benzyl phthalate	KS
Caprolactam	KS
Carbazole	KS
Chlorobenzilate	KS
Chrysene	KS
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	KS
Diallate	KS
Dibenz(a,h) anthracene	KS
Dibenzofuran	KS

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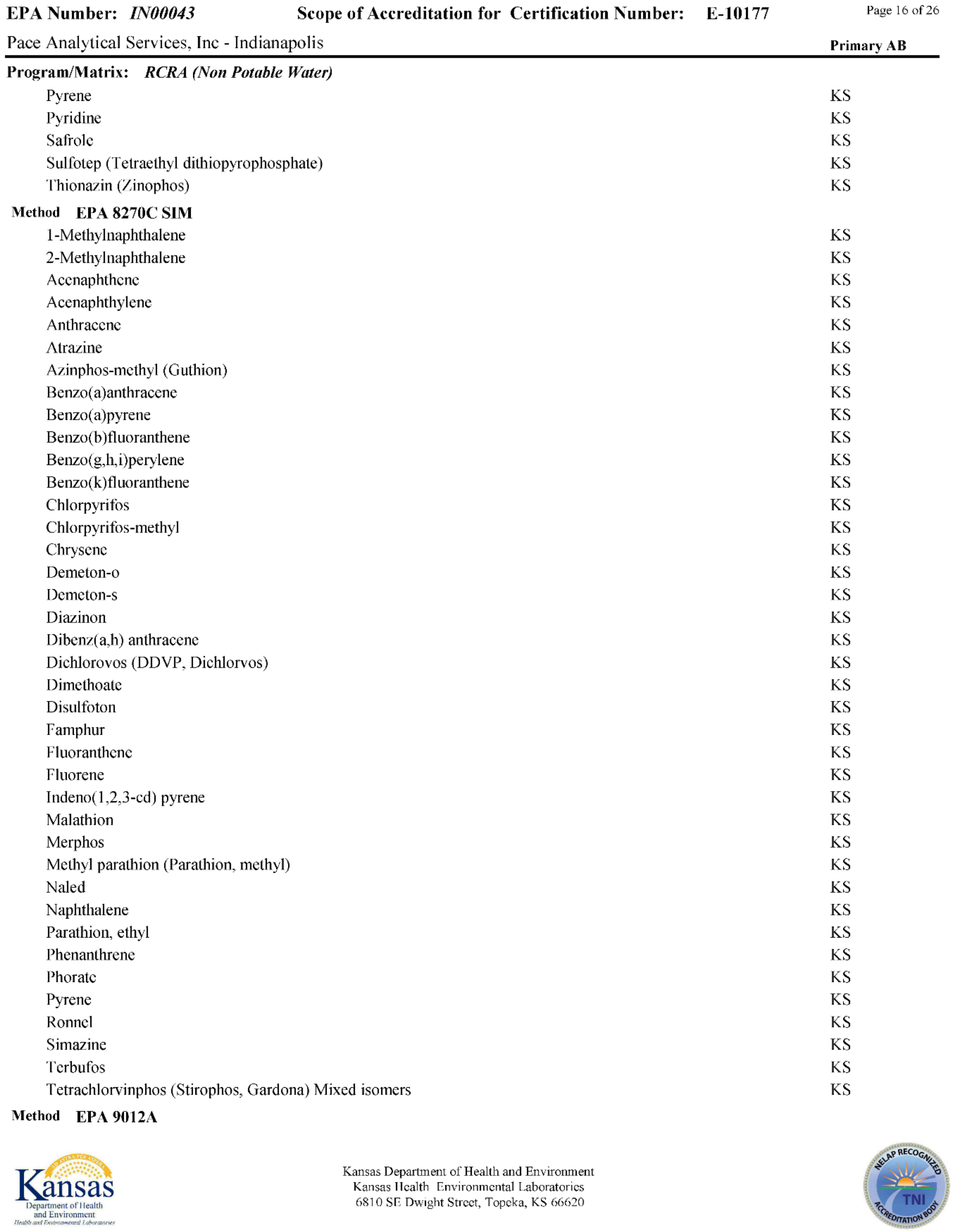
Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
Diethyl phthalate	KS
Dimethoate	KS
Dimethyl phthalate	KS
Di-n-butyl phthalate	KS
Di-n-octyl phthalate	KS
Diphenylamine	KS
Disulfoton	KS
Ethyl methanesulfonate	KS
Famphur	KS
Fluoranthene	KS
Fluorene	KS
Hexachlorobenzene	KS
Hexachlorobutadiene	KS
Hexachlorocyclopentadiene	KS
Hexachloroethane	KS
Hexachlorophene	KS
Hexachloropropene	KS
Indeno(1,2,3-cd) pyrene	KS
Isodrin	KS
Isophorone	KS
Isosafrole	KS
Kepone	KS
Methapyrilene	KS
Methyl methanesulfonate	KS
Methyl parathion (Parathion, methyl)	KS
Naphthalene	KS
Nitrobenzene	KS
n-Nitrosodiethylamine	KS
n-Nitrosodimethylamine	KS
n-Nitroso-di-n-butylamine	KS
n-Nitrosodi-n-propylamine	KS
n-Nitrosodiphenylamine	KS
n-Nitrosomethylethylamine	KS
n-Nitrosomorpholine	KS
n-Nitrosopiperidine	KS
n-Nitrosopyrrolidine	KS
o,o,o-Triethyl phosphorothioate	KS
Parathion, ethyl	KS
Pentachlorobenzene	KS
Pentachloronitrobenzene	KS
Pentachlorophenol	KS
Phenacetin	KS
Phenanthrene	KS
Phenol	KS
Phorate	KS
p-Phenylenediamine	KS
Pronamide (Kerb)	KS

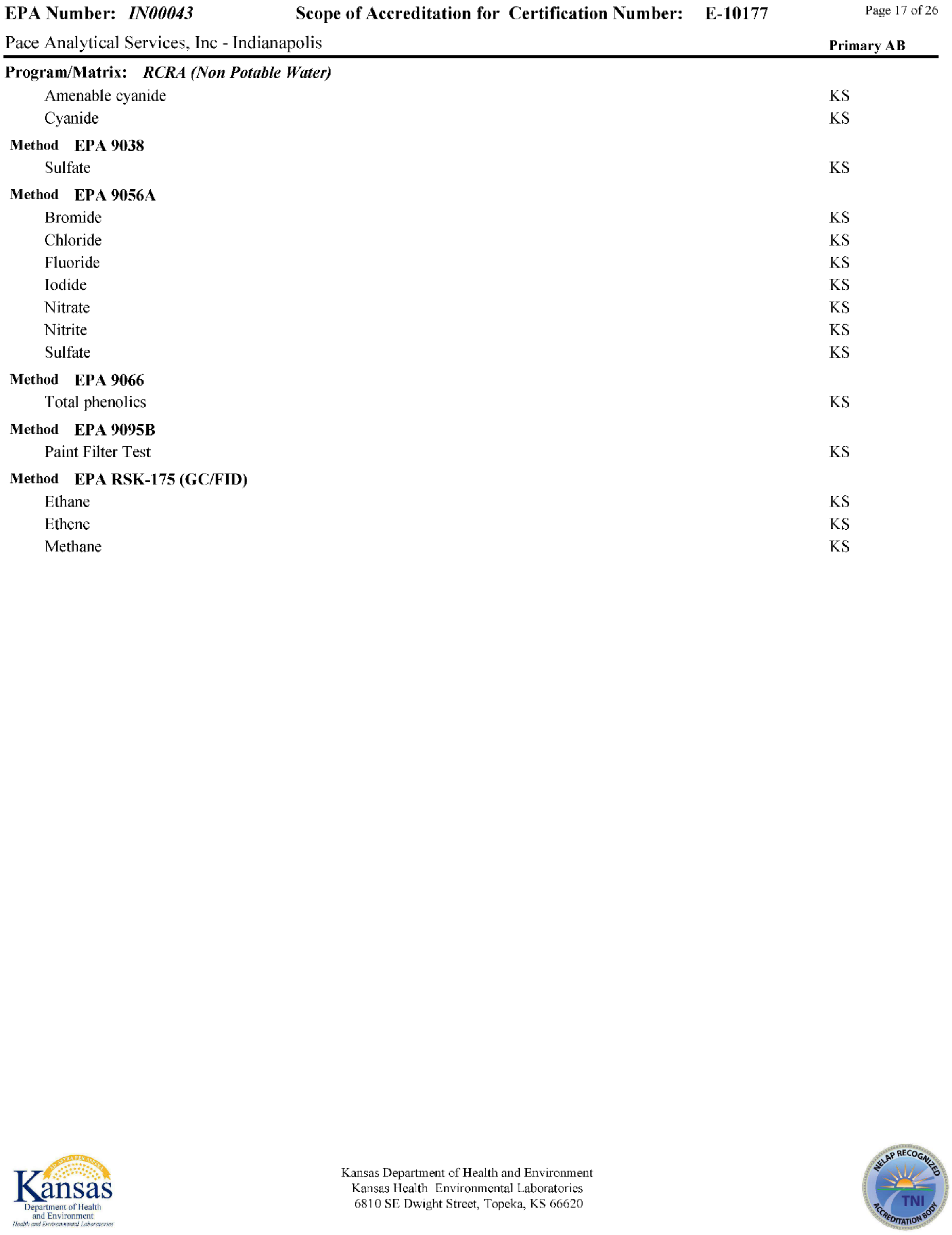
Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
Pyrene	KS
Pyridine	KS
Safrole	KS
Sulfotep (Tetraethyl dithiopyrophosphate)	KS
Thionazin (Zinophos)	KS
Method EPA 8270C SIM	
1-Methylnaphthalene	KS
2-Methylnaphthalene	KS
Acenaphthene	KS
Acenaphthylene	KS
Anthracene	KS
Atrazine	KS
Azinphos-methyl (Guthion)	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
Chlorpyrifos	KS
Chlorpyrifos-methyl	KS
Chrysene	KS
Demeton-o	KS
Demeton-s	KS
Diazinon	KS
Dibenz(a,h) anthracene	KS
Dichlorovos (DDVP, Dichlorvos)	KS
Dimethoate	KS
Disulfoton	KS
Famphur	KS
Fluoranthene	KS
Fluorene	KS
Indeno(1,2,3-cd) pyrene	KS
Malathion	KS
Merphos	KS
Methyl parathion (Parathion, methyl)	KS
Naled	KS
Naphthalene	KS
Parathion, ethyl	KS
Phenanthrene	KS
Phorate	KS
Pyrene	KS
Ronnel	KS
Simazine	KS
Terbufos	KS
Tetrachlorvinphos (Stirophos, Gardona) Mixed isomers	KS
Method EPA 9012A	

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



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Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Non Potable Water)***

	Primary AB
Amenable cyanide	KS
Cyanide	KS
Method EPA 9038	
Sulfate	KS
Method EPA 9056A	
Bromide	KS
Chloride	KS
Fluoride	KS
Iodide	KS
Nitrate	KS
Nitrite	KS
Sulfate	KS
Method EPA 9066	
Total phenolics	KS
Method EPA 9095B	
Paint Filter Test	KS
Method EPA RSK-175 (GC/FID)	
Ethane	KS
Ethene	KS
Methane	KS

Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
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Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

EPA Number: *IN00043* **Scope of Accreditation for Certification Number:** **E-10177**

Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
Method EPA 1010A	
Ignitability	KS
Method EPA 1311	
Toxicity Characteristic Leaching Procedure (TCLP)	KS
Method EPA 1312	
Synthetic Precipitation Leaching Procedure (SPLP)	KS
Method EPA 6010B	
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Boron	KS
Cadmium	KS
Calcium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Iron	KS
Lead	KS
Magnesium	KS
Manganese	KS
Molybdenum	KS
Nickel	KS
Potassium	KS
Selenium	KS
Silver	KS
Sodium	KS
Strontium	KS
Thallium	KS
Tin	KS
Titanium	KS
Vanadium	KS
Zinc	KS
Method EPA 6020	
Aluminum	KS
Antimony	KS
Arsenic	KS
Barium	KS
Beryllium	KS
Cadmium	KS
Chromium	KS
Cobalt	KS
Copper	KS
Lead	KS
Manganese	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

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Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
Nickel	KS
Selenium	KS
Silver	KS
Thallium	KS
Vanadium	KS
Zinc	KS
Method EPA 7196A	
Chromium VI	KS
Method EPA 7470A	
Mercury	KS
Method EPA 7471A	
Mercury	KS
Method EPA 8015D	
Diesel range organics (DRO)	KS
Ethanol	KS
Ethylene glycol	KS
Gasoline range organics (GRO)	KS
Isobutyl alcohol (2-Methyl-1-propanol)	KS
Isopropyl alcohol (2-Propanol, Isopropanol)	KS
Methanol	KS
n-Butyl alcohol (1-Butanol, n-Butanol)	KS
n-Propanol (1-Propanol)	KS
Propylene glycol	KS
Method EPA 8081B	
4,4'-DDD	KS
4,4'-DDE	KS
4,4'-DDT	KS
Aldrin	KS
alpha-BHC (alpha-Hexachlorocyclohexane)	KS
alpha-Chlordane, cis-Chlordane	KS
beta-BHC (beta-Hexachlorocyclohexane)	KS
Chlordane (tech.)(N.O.S.)	KS
delta-BHC	KS
Dieldrin	KS
Endosulfan I	KS
Endosulfan II	KS
Endosulfan sulfate	KS
Endrin	KS
Endrin aldehyde	KS
Endrin ketone	KS
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	KS
gamma-Chlordane	KS
Heptachlor	KS
Heptachlor epoxide	KS
Methoxychlor	KS
Toxaphene (Chlorinated camphene)	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

Method **EPA 8082A**	
Aroclor-1016 (PCB-1016)	KS
Aroclor-1221 (PCB-1221)	KS
Aroclor-1232 (PCB-1232)	KS
Aroclor-1242 (PCB-1242)	KS
Aroclor-1248 (PCB-1248)	KS
Aroclor-1254 (PCB-1254)	KS
Aroclor-1260 (PCB-1260)	KS
Method **EPA 8141B**	
Atrazine	KS
Azinphos-methyl (Guthion)	KS
Chlorpyrifos	KS
Chlorpyrifos-methyl	KS
Demeton-o	KS
Demeton-s	KS
Diazinon	KS
Dichlorovos (DDVP, Dichlorvos)	KS
Dimethoate	KS
Disulfoton	KS
Famphur	KS
Malathion	KS
Merphos	KS
Methyl parathion (Parathion, methyl)	KS
Naled	KS
Parathion, ethyl	KS
Phorate	KS
Ronnel	KS
Simazine	KS
Terbufos	KS
Tetrachlorvinphos (Stirophos, Gardona) E-isomer	KS
Method **EPA 8151A**	
2,4,5-T	KS
2,4-D	KS
2,4-DB	KS
3,5-Dichlorobenzoic acid	KS
Acifluorfen	KS
Bentazon	KS
Dalapon	KS
DCPA di acid degradate	KS
Dicamba	KS
Dichloroprop (Dichlorprop)	KS
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	KS
MCPA	KS
MCPP	KS
Pentachlorophenol	KS
Picloram	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
Silvex (2,4,5-TP)	KS
Method EPA 8260C	
1,1,1,2-Tetrachloroethane	KS
1,1,1-Trichloroethane	KS
1,1,2,2-Tetrachloroethane	KS
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	KS
1,1,2-Trichloroethane	KS
1,1-Dichloroethane	KS
1,1-Dichloroethylene	KS
1,1-Dichloropropene	KS
1,2,3-Trichlorobenzene	KS
1,2,3-Trichloropropane	KS
1,2,4-Trichlorobenzene	KS
1,2,4-Trimethylbenzene	KS
1,2-Dibromo-3-chloropropane (DBCP)	KS
1,2-Dibromoethane (EDB, Ethylene dibromide)	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Dichloroethane (Ethylene dichloride)	KS
1,2-Dichloropropane	KS
1,3,5-Trichlorobenzene	KS
1,3,5-Trimethylbenzene	KS
1,3-Dichlorobenzene	KS
1,3-Dichloropropane	KS
1,4-Dichlorobenzene	KS
1,4-Dioxane (1,4- Diethyleneoxide)	KS
1-Methylnaphthalene	KS
2,2-Dichloropropane	KS
2-Butanone (Methyl ethyl ketone, MEK)	KS
2-Chloroethyl vinyl ether	KS
2-Chlorotoluene	KS
2-Hexanone	KS
2-Methylnaphthalene	KS
4-Chlorotoluene	KS
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	KS
4-Methyl-2-pentanone (MIBK)	KS
Acetone	KS
Acetonitrile	KS
Acrolein (Propenal)	KS
Acrylonitrile	KS
Allyl chloride (3-Chloropropene)	KS
Benzene	KS
Bromobenzene	KS
Bromochloromethane	KS
Bromodichloromethane	KS
Bromoform	KS
Carbon disulfide	KS

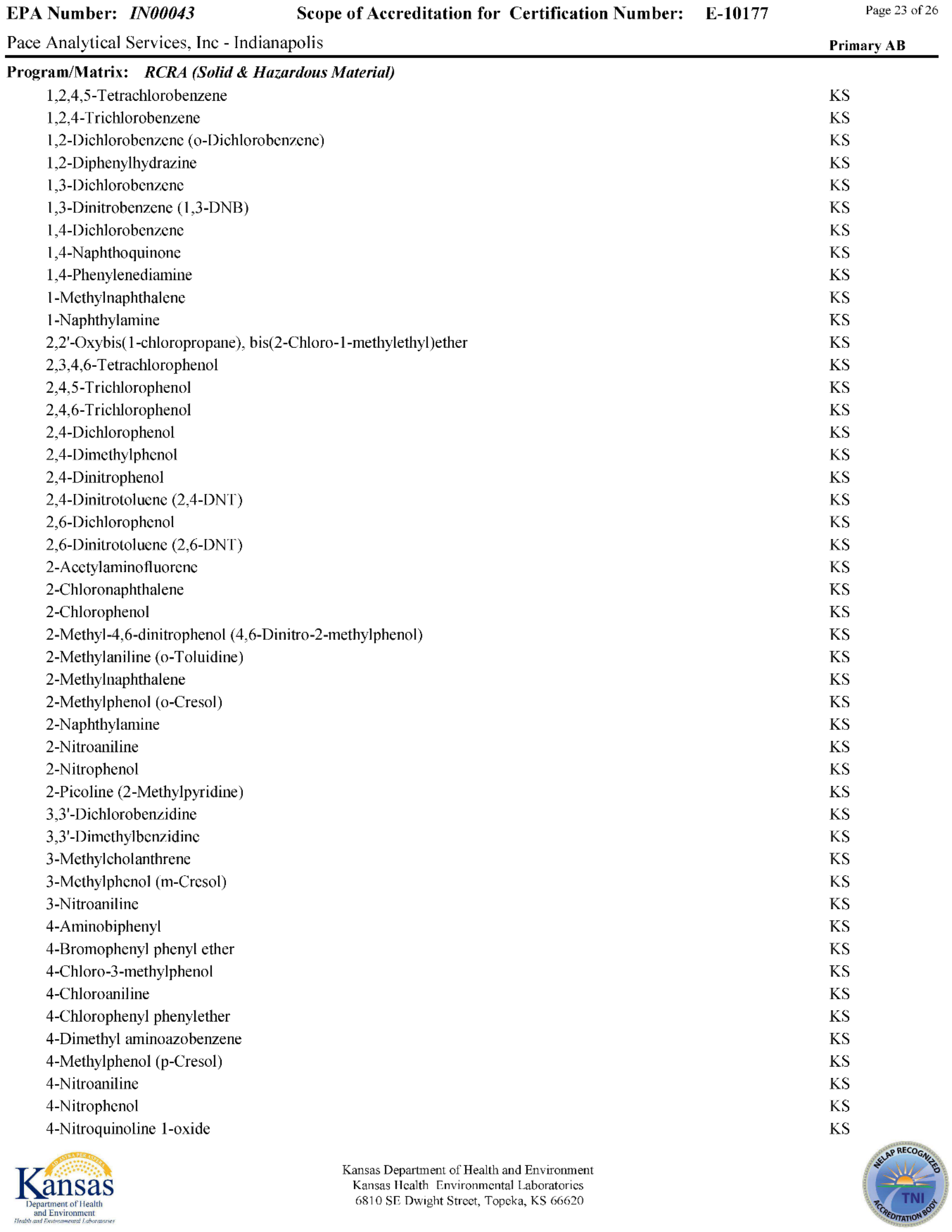
Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
Carbon tetrachloride	KS
Chlorobenzene	KS
Chlorodibromomethane	KS
Chloroethane (Ethyl chloride)	KS
Chloroform	KS
cis-1,2-Dichloroethylene	KS
cis-1,3-Dichloropropene	KS
Dibromomethane (Methylene bromide)	KS
Dichlorodifluoromethane (Freon-12)	KS
Diethyl ether	KS
Ethyl acetate	KS
Ethyl methacrylate	KS
Ethylbenzene	KS
Hexachlorobutadiene	KS
Iodomethane (Methyl iodide)	KS
Isopropylbenzene	KS
Methacrylonitrile	KS
Methyl bromide (Bromomethane)	KS
Methyl chloride (Chloromethane)	KS
Methyl methacrylate	KS
Methyl tert-butyl ether (MTBE)	KS
Methylene chloride (Dichloromethane)	KS
m-Xylene	KS
Naphthalene	KS
n-Butyl alcohol (1-Butanol, n-Butanol)	KS
n-Butylbenzene	KS
n-Hexane	KS
n-Propylbenzene	KS
o-Xylene	KS
Propionitrile (Ethyl cyanide)	KS
p-Xylene	KS
sec-Butylbenzene	KS
Styrene	KS
tert-Butyl alcohol	KS
tert-Butylbenzene	KS
Tetrachloroethylene (Perchloroethylene)	KS
Toluene	KS
trans-1,2-Dichloroethylene	KS
trans-1,3-Dichloropropylene	KS
trans-1,4-Dichloro-2-butene	KS
Trichloroethene (Trichloroethylene)	KS
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	KS
Vinyl acetate	KS
Vinyl chloride	KS
Xylene (total)	KS

Method **EPA 8270C**

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



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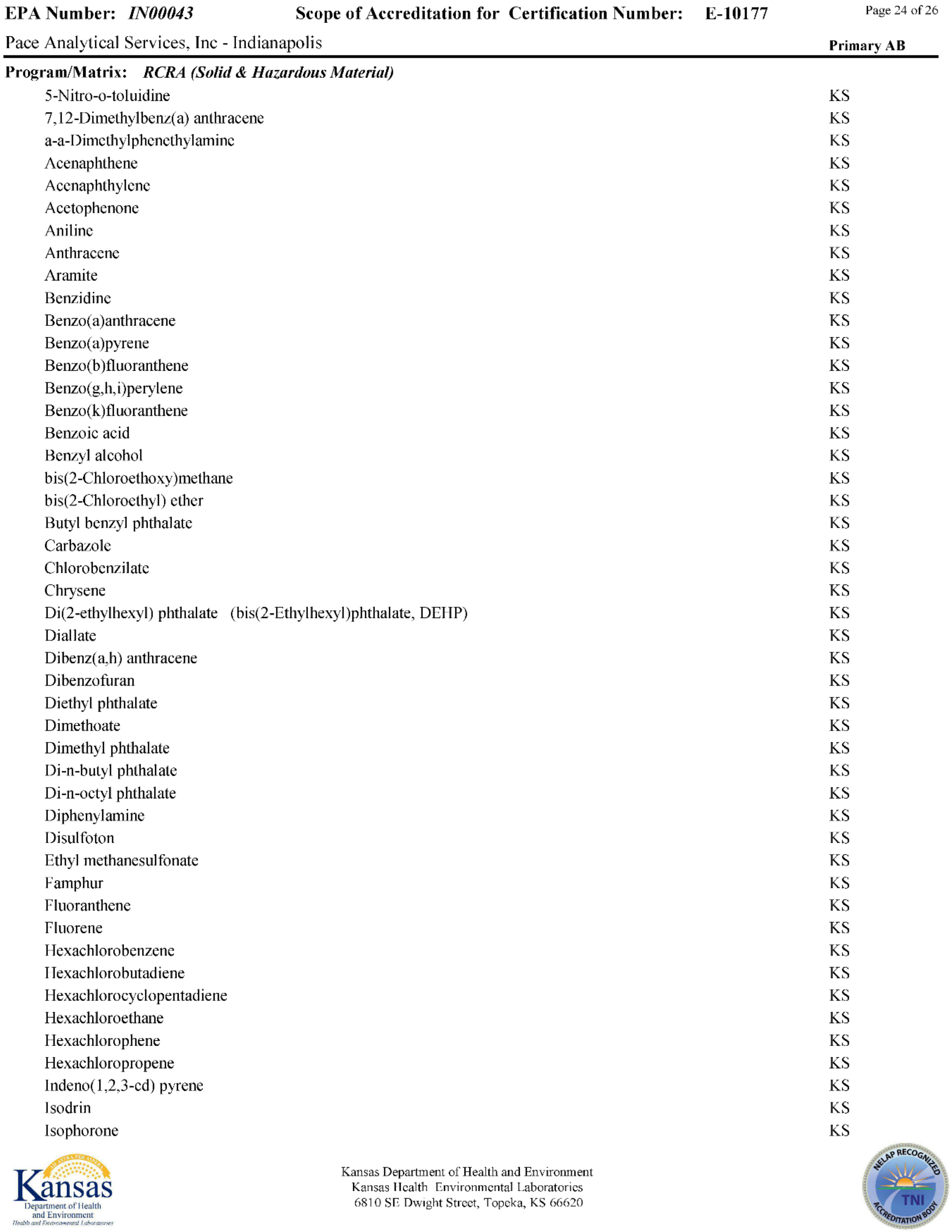
Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
1,2,4,5-Tetrachlorobenzene	KS
1,2,4-Trichlorobenzene	KS
1,2-Dichlorobenzene (o-Dichlorobenzene)	KS
1,2-Diphenylhydrazine	KS
1,3-Dichlorobenzene	KS
1,3-Dinitrobenzene (1,3-DNB)	KS
1,4-Dichlorobenzene	KS
1,4-Naphthoquinone	KS
1,4-Phenylenediamine	KS
1-Methylnaphthalene	KS
1-Naphthylamine	KS
2,2'-Oxybis(1-chloropropane), bis(2-Chloro-1-methylethyl)ether	KS
2,3,4,6-Tetrachlorophenol	KS
2,4,5-Trichlorophenol	KS
2,4,6-Trichlorophenol	KS
2,4-Dichlorophenol	KS
2,4-Dimethylphenol	KS
2,4-Dinitrophenol	KS
2,4-Dinitrotoluene (2,4-DNT)	KS
2,6-Dichlorophenol	KS
2,6-Dinitrotoluene (2,6-DNT)	KS
2-Acetylaminofluorene	KS
2-Chloronaphthalene	KS
2-Chlorophenol	KS
2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	KS
2-Methylaniline (o-Toluidine)	KS
2-Methylnaphthalene	KS
2-Methylphenol (o-Cresol)	KS
2-Naphthylamine	KS
2-Nitroaniline	KS
2-Nitrophenol	KS
2-Picoline (2-Methylpyridine)	KS
3,3'-Dichlorobenzidine	KS
3,3'-Dimethylbenzidine	KS
3-Methylcholanthrene	KS
3-Methylphenol (m-Cresol)	KS
3-Nitroaniline	KS
4-Aminobiphenyl	KS
4-Bromophenyl phenyl ether	KS
4-Chloro-3-methylphenol	KS
4-Chloroaniline	KS
4-Chlorophenyl phenylether	KS
4-Dimethyl aminoazobenzene	KS
4-Methylphenol (p-Cresol)	KS
4-Nitroaniline	KS
4-Nitrophenol	KS
4-Nitroquinoline 1-oxide	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



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Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
5-Nitro-o-toluidine	KS
7,12-Dimethylbenz(a) anthracene	KS
a-a-Dimethylphenethylamine	KS
Acenaphthene	KS
Acenaphthylene	KS
Acetophenone	KS
Aniline	KS
Anthracene	KS
Aramite	KS
Benzidine	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
Benzoic acid	KS
Benzyl alcohol	KS
bis(2-Chloroethoxy)methane	KS
bis(2-Chloroethyl) ether	KS
Butyl benzyl phthalate	KS
Carbazole	KS
Chlorobenzilate	KS
Chrysene	KS
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	KS
Diallate	KS
Dibenz(a,h) anthracene	KS
Dibenzofuran	KS
Diethyl phthalate	KS
Dimethoate	KS
Dimethyl phthalate	KS
Di-n-butyl phthalate	KS
Di-n-octyl phthalate	KS
Diphenylamine	KS
Disulfoton	KS
Ethyl methanesulfonate	KS
Famphur	KS
Fluoranthene	KS
Fluorene	KS
Hexachlorobenzene	KS
Hexachlorobutadiene	KS
Hexachlorocyclopentadiene	KS
Hexachloroethane	KS
Hexachlorophene	KS
Hexachloropropene	KS
Indeno(1,2,3-cd) pyrene	KS
Isodrin	KS
Isophorone	KS

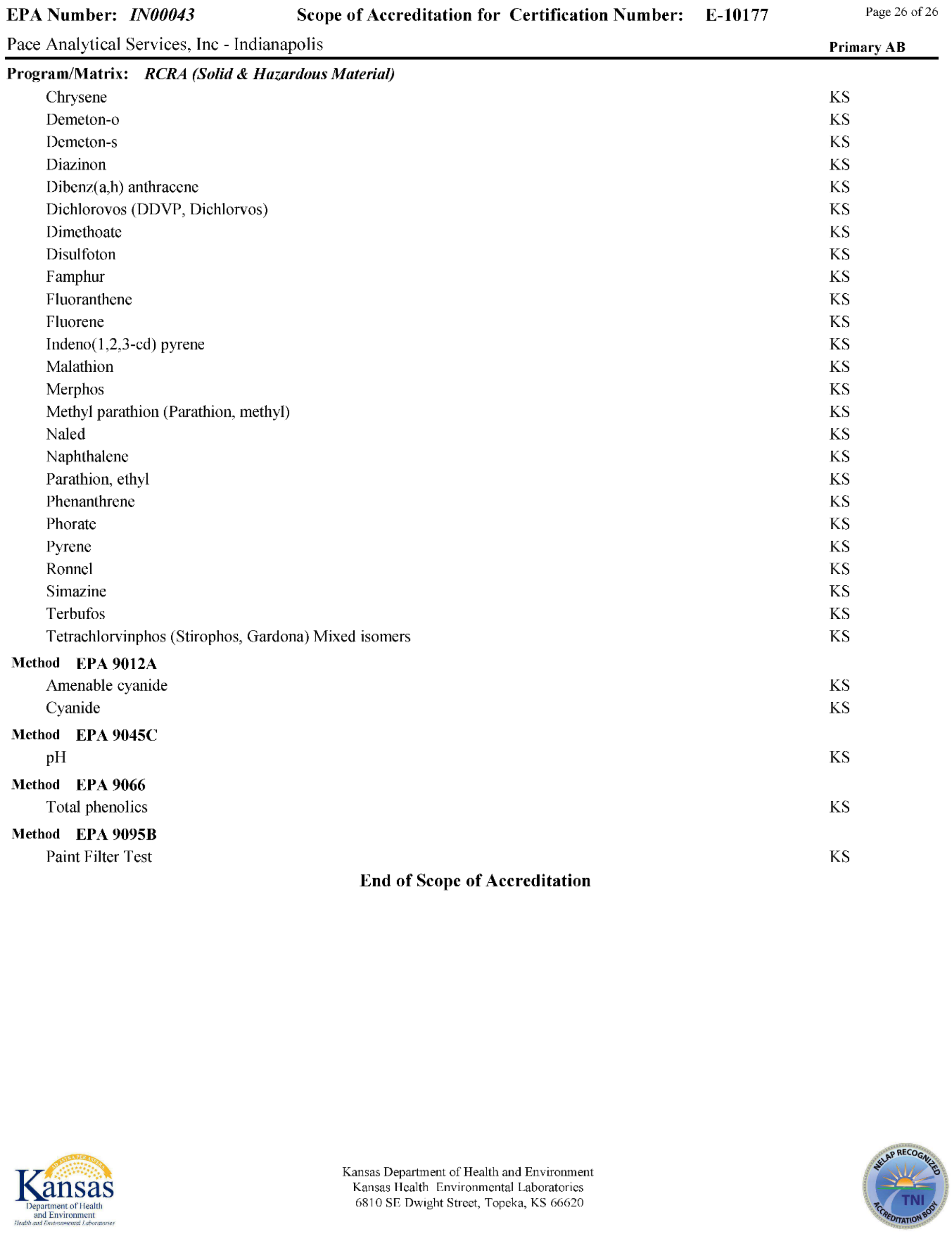
Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
6810 SE Dwight Street, Topeka, KS 66620

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
Isosafrole	KS
Kepone	KS
Methapyrilene	KS
Methyl methanesulfonate	KS
Methyl parathion (Parathion, methyl)	KS
Naphthalene	KS
Nitrobenzene	KS
n-Nitrosodiethylamine	KS
n-Nitrosodimethylamine	KS
n-Nitroso-di-n-butylamine	KS
n-Nitrosodi-n-propylamine	KS
n-Nitrosodiphenylamine	KS
n-Nitrosomethylethylamine	KS
n-Nitrosomorpholine	KS
n-Nitrosopiperidine	KS
n-Nitrosopyrrolidine	KS
o,o,o-Triethyl phosphorothioate	KS
Parathion, ethyl	KS
Pentachlorobenzene	KS
Pentachloronitrobenzene	KS
Pentachlorophenol	KS
Phenacetin	KS
Phenanthrene	KS
Phenol	KS
Phorate	KS
Pronamide (Kerb)	KS
Pyrene	KS
Pyridine	KS
Safrole	KS
Sulfotep (Tetraethyl dithiopyrophosphate)	KS
Thionazin (Zinophos)	KS
Method **EPA 8270C SIM**	
1-Methylnaphthalene	KS
2-Methylnaphthalene	KS
Acenaphthene	KS
Acenaphthylene	KS
Anthracene	KS
Atrazine	KS
Azinphos-methyl (Guthion)	KS
Benzo(a)anthracene	KS
Benzo(a)pyrene	KS
Benzo(b)fluoranthene	KS
Benzo(g,h,i)perylene	KS
Benzo(k)fluoranthene	KS
Chlorpyrifos	KS
Chlorpyrifos-methyl	KS

Attachment 9 Pace Laboratory Inc., Indianapolis: Accreditation Documents (cont.)



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Pace Analytical Services, Inc - Indianapolis

Program/Matrix: ***RCRA (Solid & Hazardous Material)***

	Primary AB
Chrysene	KS
Demeton-o	KS
Demeton-s	KS
Diazinon	KS
Dibenz(a,h) anthracene	KS
Dichlorovos (DDVP, Dichlorvos)	KS
Dimethoate	KS
Disulfoton	KS
Famphur	KS
Fluoranthene	KS
Fluorene	KS
Indeno(1,2,3-cd) pyrene	KS
Malathion	KS
Merphos	KS
Methyl parathion (Parathion, methyl)	KS
Naled	KS
Naphthalene	KS
Parathion, ethyl	KS
Phenanthrene	KS
Phorate	KS
Pyrene	KS
Ronnel	KS
Simazine	KS
Terbufos	KS
Tetrachlorvinphos (Stirophos, Gardona) Mixed isomers	KS
Method EPA 9012A	
Amenable cyanide	KS
Cyanide	KS
Method EPA 9045C	
pH	KS
Method EPA 9066	
Total phenolics	KS
Method EPA 9095B	
Paint Filter Test	KS

End of Scope of Accreditation

Kansas Department of Health and Environment
Kansas Health Environmental Laboratories
6810 SE Dwight Street, Topeka, KS 66620

*This document may be inspected at the Watershed and Assessment Branch office, located at 2525 North Shadeland Avenue, Indianapolis, IN.

H. Appendices

Appendix A. IDEM Fish Community Assessments for Aquatic Life Use

Appendix B. Calculating IDEM Macroinvertebrate Index of Biotic Integrity (mIBI)

Appendix A. IDEM Fish Community Assessments for Aquatic Life Use

IDEM collects fish assemblages, chemical parameters, nutrient parameters, macroinvertebrate assemblages, and habitat evaluations to monitor the health of streams and rivers in Indiana. The many advantages of using fish assemblages for monitoring stream health:

- Many fish have life spans of greater than three years, allowing detection of degradation in habitat or water chemistry over time which alters the expected fish community structure.
- The knowledge of fish life history, feeding, and reproductive behavior is well known and can be used to detect changes in water chemistry or habitat alterations.
- Fish species identification can usually be made in the field so that fish are returned to the stream and time utilized for laboratory identifications kept minimal.

The Indiana Administrative Code [327 IAC 2-1-3(a)(2); 327 IAC 2-1.5-5(a)(2)] contains narrative biological criteria stating, “all waters, except those designated as limited use, will be capable of supporting a well-balanced, warm water aquatic community.” The water quality standard definition of a “well-balanced aquatic community” is “an aquatic community that is diverse in species composition, contains several different trophic levels, and is not composed mainly of pollution tolerant species” [327 IAC 2-1-9(59)]. To measure whether or not the fish community meet the definition, IDEM uses an Index of Biotic Integrity (IBI) composed of 12 fish community characteristics chosen based upon the part of the state (ecoregion) from which the sample is collected and the size of stream (drainage area). The 12 different characteristics score either a 0, 1, 3, or 5, each score represents a deviation from expected fish community structure (i.e., 5 = no deviation from expectations, 1 = severe deviation from expected fish community structure). A total score can range from 0 (no fish) to 60 (excellent, comparable to least impacted conditions). Indiana expects streams to score at least 36 out of 60 to meet aquatic life use water quality standards. The chart below, modified from a table developed by Karr et al. 1986, uses total IBI score, integrity class, and attributes to define the fish community characteristics in Indiana streams and rivers.

Total IBI Score	Integrity Class	Attributes
53 – 60	Excellent	Comparable to least impacted conditions, exceptional assemblage of species.
45 – 52	Good	Decreased species richness (intolerant species in particular), sensitive species present.
36 – 44	Fair	Intolerant and sensitive species absent, skewed trophic structure.
23 – 35	Poor	Top carnivores and many expected species absent or rare, omnivores and tolerant species dominant.
12 – 22	Very Poor	Few species and individuals present, tolerant species dominant, diseased fish frequent.
<12	No Fish	No fish captured during sampling.

Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.J Schlosser. 1986. Assessing biological integrity in running waters: a method and its rationale. Illinois Natural History Survey Special Publication 5. 28 p.

Some examples of metrics and fish specimens used for the Index of Biotic Integrity (IBI) looking at species composition, trophic levels, and tolerance to water pollution or habitat disturbance.

1. *Number of Species* (generally more species = better quality stream)
2. *Number of Darter, Madtom, Sculpin Species* (species require high DO and clean, rocky substrates, so higher number = better quality stream)
   Examples: Rainbow darter, Brindled madtom, Mottled sculpin
3. *% Large River Individuals* (species require habitats typical in great rivers in terms of bottom substrates, current velocity, backwater areas, etc., so higher percentage = better quality river)
   Examples: Chestnut lamprey, Channel catfish, Bullhead minnow, Silver chub
4. *% Headwater Individuals* (species in small streams occupying permanent habitat with low environmental stress, so greater percentage = better quality stream)
   Examples: Blacknose dace, Southern redbelly dace, Fantail darter
5. *Number of Sunfish or Centrarchidae Species* (species occupy pools which act as sinks for potential pollutants and silt, so fewer number of these species = low quality stream)
   Examples: Rock bass, Bluegill, Largemouth bass
6. *Number of Sucker or Round Body Sucker Species* (species do not tolerate habitat and water quality degradation, so more species = better quality stream)
   Examples: Black redhorse, Northern hog sucker
7. *Number of Minnow Species* (generally more minnow species = better quality stream)
   Examples: Spotfin shiner, Silverjaw minnow, Hornyhead chub
8. *Number of Sensitive Species* (species sensitive to pollution, so more species = better quality stream)
   Examples: Greenside darter, Smallmouth bass, Longear sunfish
9. *% Tolerant Individuals* (species tolerant to pollution, so greater percentage = low quality stream)
   Examples: Yellow bullhead, Green sunfish, Central mudminnow

10. *<u>% Omnivore/Detritivore Individuals</u>* (species that consume at least 25% plant and 25% animal material which makes them opportunistic feeders when other food sources are scarce, so greater percentage = lower quality stream)
    Examples: Bluntnose minnow, White sucker, Gizzard shad
11. *<u>% Insectivore/Invertivore Individuals</u>* (species whose diet is mainly benthic insects, so the metric is a reflection of the food source, so lower percentage = lower quality stream)
    Examples: Blackstripe topminnow, Emerald shiner, Logperch
12. *<u>% Carnivore Individuals</u>* (species whose diet is carnivorous and also reflects the availability of the food source; too high or too low percentage of carnivores = lower quality stream and imbalance of trophic levels)
    Examples: Spotted bass, Redfin pickerel
13. *<u>% Pioneer Individuals</u>* (species that are first to colonize a stream after environmental disturbance, so higher percentage of pioneer individuals = lower quality stream)
    Examples: Creek chub, Central stoneroller, Johnny darter
14. *<u>Number of Individuals</u>* (generally more individuals = better quality stream)
15. *<u>% Simple Lithophilic Individuals</u>* (species that require clean gravel or cobble for successful reproduction since they simply broadcast their eggs on the substrate, fertilize, and provide no parental care; thus, heavy siltation or environmental disturbance will result in a lower percentage of simple lithophilic species = lower quality stream)
    Examples: Bigeye chub, Striped shiner, Orangethroat darter
16. *<u>% Individuals with Deformities, Eroded Fins, Lesions, and Tumors (DELT's)</u>* (diseased individuals with external anomalies as a result of bacterial, fungal, viral, and parasitic infections, chemical pollutants, overcrowding, improper diet, and other environmental degradation. Percentages should be absent or very low naturally, so higher percentage = low quality stream)
    Examples: deformed Blackstripe topminnow, Creek chub with tumors

Appendix B. Calculating IDEM Macroinvertebrate Index of Biotic Integrity (mIBI)

The purpose of this document is to describe the laboratory processing and data analysis procedures used by the Indiana Department of Environmental Management (IDEM) to calculate the macroinvertebrate Index of Biotic Integrity (mIBI). IDEM is currently developing a SOP for calculating the mIBI.

Multihabitat (MHAB) Macroinvertebrate Collection Procedure describes IDEM's multihabitat (MHAB) sampling method for collecting macroinvertebrate samples. The index period for collection of macroinvertebrate samples with the MHAB sampling method is July 15 to November 15. Process the entire sample in the laboratory, as subsampling was already performed in the field. Count all macroinvertebrate individuals with the exception of empty snail and clam shells; microcrustaceans (Ostracoda, Branchiopoda, Copepoda); larval and pupal insect exuviate; and terrestrial insects (including the terrestrial adults of aquatic insect larvae); and invertebrate specimens missing heads.

The level of macroinvertebrate taxonomic identification resolution may depend in large part on the condition (instar and physical condition) of the specimens and the availability of taxonomic resources comprehensive and appropriate for Indiana's fauna. Specimens are generally identified to the lowest practical taxonomic level.

- Oligochaeta (aquatic worms, Hirudinea and Branchiobdellida), Planaria and Acari are only identified to family or a higher level.
- Freshwater snails and clams are identified to genus.
- Freshwater crustacea are identified to genus (Amphipoda and Isopoda) or species (Decapoda).
- Aquatic insects are identified to family (Collembola and several Dipteran families).
- Genus and species (all other insects).

The following lists identifies insect genera often identified to species (and may contain multiple species in a sample) and taxonomic resources commonly used by IDEM biologists for their identification. Full citations for these resources are listed in the Taxonomic References at the end of this document.

Ephemeroptera

Baetidae: *Baetis* (separate *B. intercalaris* and *B. flavistriga* with Moriharra and McCafferty 1979, leave everything else at *Baetis)*

Caenidae: *Caenis:* Provonsha 1990

Heptageniidae: *Mccaffertium* (formerly *Stenonema* subgenus *Mccaffertium*): Bednarik and McCafferty 1979

Odonata

Gomphidae: *Dromogomphus*: Westfall and Tennessen 1979

Coenagrionidae: *Argia* and *Enallagma*: Westfall and May 1996

Hemiptera

Corixidae: *Trichocorixa* and *Palmacorixa*: Hungerford 1948, Hilsenhoff 1984

Megaloptera

Corydalidae: *Chauliodes* and *Nigronia*: Rasmussen and Pescador 2002

Coleoptera

Haliplidae: *Peltodytes*: Brigham 1996
Dytiscidae: *Neoporus*, *Heterosternuta*, *Laccophilus*, *Coptotomus*: Larson et al. 2000
Hydrophilidae: *Tropisternus*, *Berosus*, *Enochrus*: Hilsenhoff 1995A and 1995B
Elmidae: *Stenelmis*, *Dubiraphia*, *Optioservus*: Hilsenhoff and Schmude, Hilsenhoff 1982

Trichoptera

Philopotamidae: *Chimarra*: Hilsenhoff 1982
Leptoceridae: *Nectopsyche*: Glover and Floyd 2004
Hydropsychidae: *Hydropsyche*: Schuster and Etnier 1978

Diptera

Chironomidae: *Ablabesmyia*: Roback 1985 (subgenus/ species group)
Polypedilum: Maschwitz and Cook 2000 (subgenus/ species group)
Cricotopus/Orthocladius: Merritt et al 2007 (subgenus/ species group)

After identification of all organisms in the sample to the lowest practical taxon, taxa are then associated with their corresponding tolerance, functional feeding group, and habit values (found in the spreadsheet Indiana Macroinvertebrate Attributes). Organisms without a tolerance value, functional feeding group, or habit are not included in the calculations for specific metrics (this may become more evident while looking at the metric example provided). For taxa metrics, all of the taxa listed for a specific group (EPT, Diptera) are counted, regardless of level of identification (i.e., if 1 family level ID, 1 *Cricotopus* genus level ID, and 2 distinct species level IDs under the *Cricotopus* genus in the Chironomidae family were counted would equal 4 taxa).

Calculate the metrics as follows:

1. Total Number of Taxa: Numerical count of all identified taxa in the sample
2. Total Number of Individuals: Numerical count of the number of individual specimens in the sample
3. Total Number of EPT Taxa: Numerical count of all Ephemeroptera, Plecoptera and Trichoptera taxa in the sample
4. Total Number of Diptera Taxa: Numerical count of all Diptera taxa in the sample
5. % Orthocladiinae + Tanytarsini of Chironomidae: Number of individuals in the chironomid subfamily Orthocladiinae and tribe Tanytarsini divided by the total number of Chironomidae in the sample
6. % Non-insect (minus crayfish): Number of individuals, except for crayfish, that are not in the Class Insecta (Isopoda, Amphipoda, Acari, snails, freshwater clams, Oligochaeta, Nematoda, Nematomorpha) divided by the total number of individuals in the sample
7. % Intolerant: Number of individuals with a tolerance value of 0—3 divided by the total number of individuals in the sample
8. % Tolerant: Number of individuals with a tolerance value of 8—10 divided by the total number of individuals in the sample
9. % Predators: Number of individuals with a functional feeding group designation of Predator divided by the total number of individuals in the sample

10. % Shredders + Scrapers: Combined number of individuals in the functional feeding groups Shredder and Scraper divided by the total number of individuals in the sample
11. % Collector-Filterers: Number of individuals in the functional feeding group Collector-Filterer divided by the total number of individuals in the sample
12. % Sprawlers: Number of individuals with a habit specificity of Sprawler divided by the total number of individuals in the sample

These metric values are then scored as a 1, 3, or 5 according to the criteria in the following table:

Metric	**1**	**3**	**5**
Number of Taxa	< 21	≥ 21 and <41	≥ 41
Number of Individuals	< 129	≥ 129 and < 258	≥ 258
Number of EPT Taxa			
Drainage Area: < 5 mi^2	< 2	≥ 2 and < 4	≥ 4
Drainage Area: ≥ 5 and < 50 mi^2	< 4	≥ 4 and < 8	≥ 8
Drainage Area: ≥ 50 mi^2	< 6	≥ 6 and < 12	≥ 12
% Orthocladiinae + Tanytarsini of Chironomidae	≥ 47	≥ 24 and < 47	< 24
% Non-insects Minus Crayfish	≥ 35	≥ 18 and < 35	< 18
Number of Diptera Taxa	< 7	≥ 7 and < 14	≥ 14
% Intolerant	< 15.9	≥ 15.9 and < 31.8	≥ 31.8
% Tolerant	≥ 25.3	≥ 12.6 and < 25.3	< 12.6
% Predators	< 18	≥ 18 and < 36	≥ 36
% Shredders + Scrapers	< 10	≥ 10 and < 20	≥ 20
% Collector-Filterers	≥ 20	≥ 10 and < 20	< 10
% Sprawlers	< 3	≥ 3 and < 6	≥ 6

Most scoring classifications are the same regardless of stream drainage area; the exception is the Number of EPT Taxa metric which increases with increasing drainage area. After scoring all metrics, sum the individual metric scores and the total is the mIBI score for that particular site. Scores less than 36 are considered impaired while those greater than or equal to 36 are unimpaired.

Example of Derivation of Metric Scores for the Macroinvertebrate Index of Biotic Integrity

TAXA NAME	FEED GRP	TOL	HAB/BHV	# OF IND
Heptagenia	SC	3		1
Leucrocuta	SC	2	cn	1
Acerpenna pygmaea	OM	2	sw	1
Baetis flavistriga	GC	3	sw	1
Callibaetis	GC	6	sw	1
Ephemera simulans				1
Ischnura verticalis	PR			1
Berosus peregrinus	SH	6	sw	1
Dubiraphia	GC	5	cn	1
Macronychus glabratus	OM	3	cn	1
Ceratopsyche bronta		5		1
Pycnopsyche	SH	3	sp	1
Chrysops	GC	5		1
Procladius	PR	7	sp	1
Paraphaenocladius	GC		sp	1
Lirceus	GC	8	cr	1
Ferrissia rivularis	SC	6		1
Physella	SC	8		1
Corbicula fluminea	FC	6		1
NAIDIDAE	GC	8		1
Acariformes		4		1
Maccaffertium pulchellum	SC	2		2
Tricorythodes	GC	3	sw	2
Boyeria vinosa	PR	4	cb	2
Rheumatobates	PR		sk	2
Trepobates	PR			2
Stenelmis	SC	5	cn	2
Polypedilum flavum				2
Stictochironomus	OM	4	bu	2
Caenis latipennis	GC			3
Palmacorixa nana	PI	4	sw	3
Cheumatopsyche	FC	3	cn	3
Orconectes	GC	4		3
Hetaerina americana	PR			4
Ancyronyx variegatus	OM	4		5
Baetis intercalaris	OM	3	sw	6

Peltodytes duodecimpunctata				6
Trepobates inermis				7
Dubiraphia minima				7
Hyalella azteca	GC	8	cr	9
Polypedilum illinoense		7		16
Stenelmis sexlineata				18
Grand Total				127

Metrics	**Metric Values**	**Metric Scores**
Total Number of Taxa	42	**3**
Total Abundance of Individuals	127	**1**
Number of EPT Taxa	13	**5**
% Orthocladinae + Tanytarsinii of Chironomidae	4.55	**5**
% Noninsects-Crayfish	11.81	**5**
Number of Diptera Taxa	6	**1**
% Intolerant Taxa (Score 0—3)	14.96	**1**
% Tolerant Taxa (Score 8—10)	9.45	**5**
% Predators	9.45	**1**
% Shredders + Scrapers	7.87	**1**
% Collector-Filterers	3.15	**5**
% Sprawlers	2.36	**1**
mIBI Score		**34**

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