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Standard Operating Procedures Fish Monitoring 2019

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Standard Operating Procedures
Fish Monitoring

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1.0 Introduction

1.1 Rationale for Biological Monitoring

Historically, the health of aquatic systems was monitored primarily through chemical means. However, chemical monitoring provides only a "snapshot" of conditions at the time of sampling and may fail to detect acute pollution events (e.g., runoff from heavy rain, spills), non-chemical pollution (e.g., habitat alteration) and non-point source pollution.

In order to address the limitations of chemical monitoring, NJDEP began supplementing its chemical monitoring with biological monitoring in 1992. Such monitoring is based on the premise that biological communities are shaped by the long-term conditions of their environment and more accurately reflect the health of an ecosystem for applications such as aquatic life use assessments. Initially, Water Monitoring and Standards' (WM&S) Bureau of Freshwater and Biological Monitoring (BFBM) only monitored benthic macroinvertebrate assemblages (aquatic insects, worms, clams, etc.) at stations throughout New Jersey. Benthic macroinvertebrate assemblages are generally reflective of short-term and local impairment.

The federal Clean Water Act (CWA) Title 40, section 130.4 requires states to monitor all waters, which includes using biological monitoring. The U.S. EPA's National Guidance on the 10 elements of a State Water Monitoring and Assessment Program suggests states should be using at least three (3) trophic levels, including fish, macroinvertebrates, and periphytic algae. Consequently, in order to assess environmental conditions on a larger spatial and temporal scale as envisioned by the CWA, in 2000 the state began to supplement benthic macroinvertebrate monitoring (Ambient Macroinvertebrate Network (AMNET) program) with a new sampling program called the Fish Index of Biotic Integrity (FIBI).

The monitoring of stream fish assemblages is an integral component of many water quality management programs for a variety of reasons (see Table 1), and its importance is reflected in the aquatic life use support designations adopted by many states. Narrative expressions such as "maintaining coldwater fisheries", "fishable", or "fish propagation" are prevalent in many state standards. In New Jersey, surface water quality criteria are closely aligned with descriptors such as *trout production, trout maintenance* and *non-trout* waterways. Fish assemblages can be stand-alone indicators of a waterbody's health and/or fishability. In addition to fish, amphibians (See Table 2) and crayfish may be combined with other biological and chemical indicators to assist in the identification of waters for upgrade to Category One antidegradation classification (N.J.A.C. 7:9B) based on exceptional ecological significance.

The general methodology currently employed in the compilation of these studies and reports is the USEPA Rapid Bioassessment Protocol described in Barbour et al. (1999) with some modifications for regional conditions (Kurtenbach 1994). The principal evaluation mechanism utilizes the technical framework of the *Index of Biotic Integrity (IBI),* a fish assemblage approach developed by Karr (1981). The IBI incorporates the zoogeographic, ecosystem, community and population aspects of the fish assemblage into a single ecologically based index. Calculation and interpretation of the IBI involves a sequence of activities including: fish sample collection, data tabulation, and regional modification and

calibration of metrics and expectation values. This concept has provided the overall multimetric index frameworks for rapid bioassessment programs outlined in this document.

A fish IBI is an index designed to measure the health of a stream based on multiple attributes of the resident fish assemblage. Each site sampled is scored based on its deviation from reference conditions (i.e., what would be found in an unimpacted stream) and is subsequently classified as "very poor", "poor", "fair", "good" or "excellent". In addition, the habitat at each site is evaluated and later classified as "poor", "marginal", "suboptimal" or "optimal". Presently the Bureau has two fish-based monitoring programs, 1) a southern index of biotic integrity (SIBI) and 2) a northern index of biotic integrity (NIBI). Each Index is designed to accurately describe the health of the resident fish population and is comprised of varying metrics, due to differences in regional fish populations throughout New Jersey. Southern IBI monitoring takes place in streams located in southern New Jersey, south of the geologic fall line, within the inner coastal plain but excluding the pinelands boundary, and requires a drainage basin greater than 2 mi^2 (5.2 km^2). NIBI monitoring takes place in medium to large high gradient streams and rivers located in northern New Jersey, north of the geologic fall line including the following physiographic provinces: Piedmont, Highlands and Ridge and Valley, and requires a drainage basin greater than 4mi^2 (10.4 km^2), typically Strahler stream orders 4 and 5.

Additionally, in 2014 the Headwaters Index of Biotic Integrity (HIBI) was implemented to complement the existing fish IBI programs to assess stream condition, water quality and habitat in high gradient headwater streams (typically Strahler stream orders 1-3) north of the geological fall line with drainages less than 4mi^2 (10.4 km^2). The HIBI, like the NIBI and SIBI, is also a multi-metric index, however, the HIBI utilizes the assemblage of fish, crayfish, and amphibians, rather than just solely fish, present within and along a stream to assesses the overall condition of the headwater stream. This biological assemblage is utilized because small order streams often have naturally low fish species richness and cannot be accurately assessed with a solely fish based IBI. Therefore, other biota (crayfish, frogs, and salamanders) occupy critical niches and can be used as indicators of stream impairment. The creation of the HIBI program, along with the existing fish IBI programs has allowed biologists at BFBM the potential to monitor all wadeable streams north of the geological fall line via IBI metrics to accurately assess ecosystem health (Figure 1).

Region Assessed by Northern Fish Index of Biotic Integrity (N_IBI)
Streams > 4mi² drainage area

Region Assessed by Headwaters Index of Biotic Integrity (HIBI)
Streams < 4mi² drainage area

Region Assessed by Southern Fish Index of Biotic Integrity (S_IBI)
Streams > 2mi² drainage area

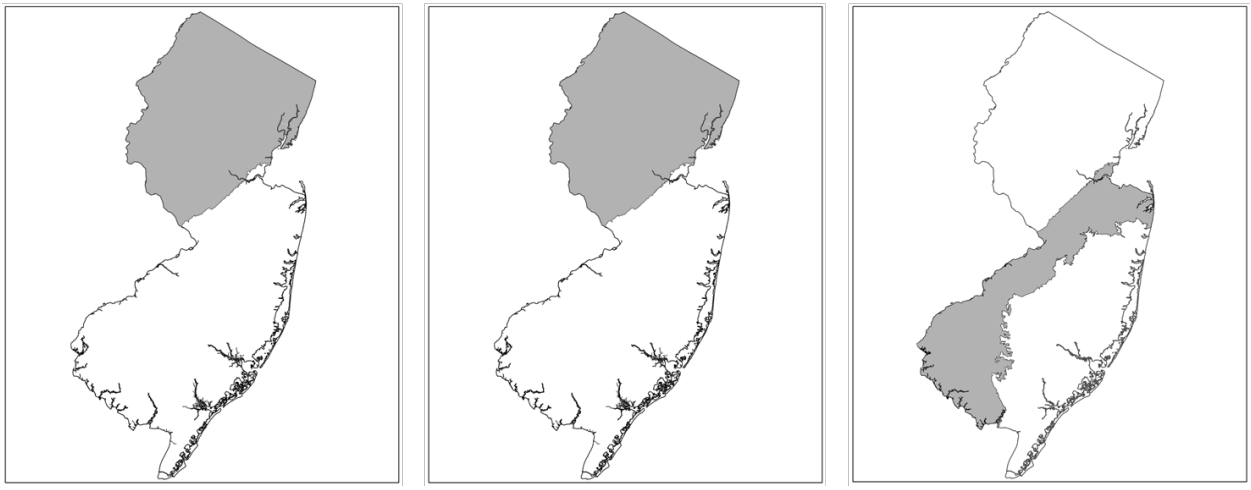


FIGURE 1. Maps depicting the location where sampling occurs for all NJDEP BFBM fish IBI monitoring programs. NIBI and HIBI sampling occur in northern NJ, north of the geologic fall-line and SIBI sampling occurs in southern NJ, south of the geologic fall-line excluding the pinelands boundary.

Table 1. Advantages of using fish as indicators of environmental health.

1. Fish are good indicators of long-term (several years) effects and broad habitat conditions because they are relatively long-lived and mobile (Karr et al. 1986).
2. Fish assemblages generally include a range of species that represent a variety of trophic levels (omnivores, herbivores, insectivores, planktivores, and piscivores). They tend to integrate effects of lower trophic levels; thus, fish assemblage structure is reflective of integrated environmental health.
3. Fish are at the top of the aquatic food chain and are consumed by humans, making them important subjects in assessing contamination.
4. Fish are relatively easy to collect and identify to the species level. Most specimens can be sorted and identified in the field and released unharmed. • Environmental requirements of common fish are comparatively well known. • Life history information is extensive for most species. • Information on fish distributions is commonly available.
5. Aquatic life uses (water quality standards) are typically characterized in terms of fisheries (e.g. coldwater, coolwater, warmwater, sport, forage). • Monitoring fish assemblages provides direct evaluation of “fishability", which emphasizes the importance of fish to anglers and commercial fisherman.
6. Fish account for nearly half of the endangered vertebrate species and subspecies in the United States (Warren and Burr 1994).

Table 2. Advantages of using amphibians as indicators of environmental health

1. Trophic status- Salamanders and frogs are often the top predator (carnivore) in fish-less streams (Southerland et al., 2004)
2. Life history- Amphibians typically have a biphasic life cycle where they live both in aquatic and terrestrial environments. Aquatic larvae can live in streams for extended periods of time, some species up to 4 years. Amphibians are relatively long-lived compared to invertebrates and fish (Petranka, 1998; Welsh and Ollivier, 1998).
3. Physiology- Adult plethodontids (lungless salamanders) have moist permeable skin and breathe cutaneously through their skin, making them susceptible to toxins in the environment and desiccation from drought.
4. Abundance- Streamside salamanders have stable populations, small home ranges and are found in almost all but the most perturbed streams
5. Sensitivity- Sensitive to multiple stressors including chemical contaminants, acid mine drainage, logging, flooding, drought, and land development (Petranka, 1998; Rocco and Brooks, 2000). Amphibians are experiencing global declines and approximately one third of amphibian species have significantly declined or have gone extinct in recent decades (Stuart et al., 2004)
6. Sampling- Amphibians are typically easily sampled using minimal equipment and are readily identified in the field.

2.0 Aquatic Organisms as Environmental Indicators

Northern IBI Fish Indicative of GOOD Water Quality

Northern IBI Fish Indicative of POOR Water Quality

Southern IBI Species indicative of GOOD water quality


Bluespotted Sunfish


Banded Sunfish


Tadpole Madtom

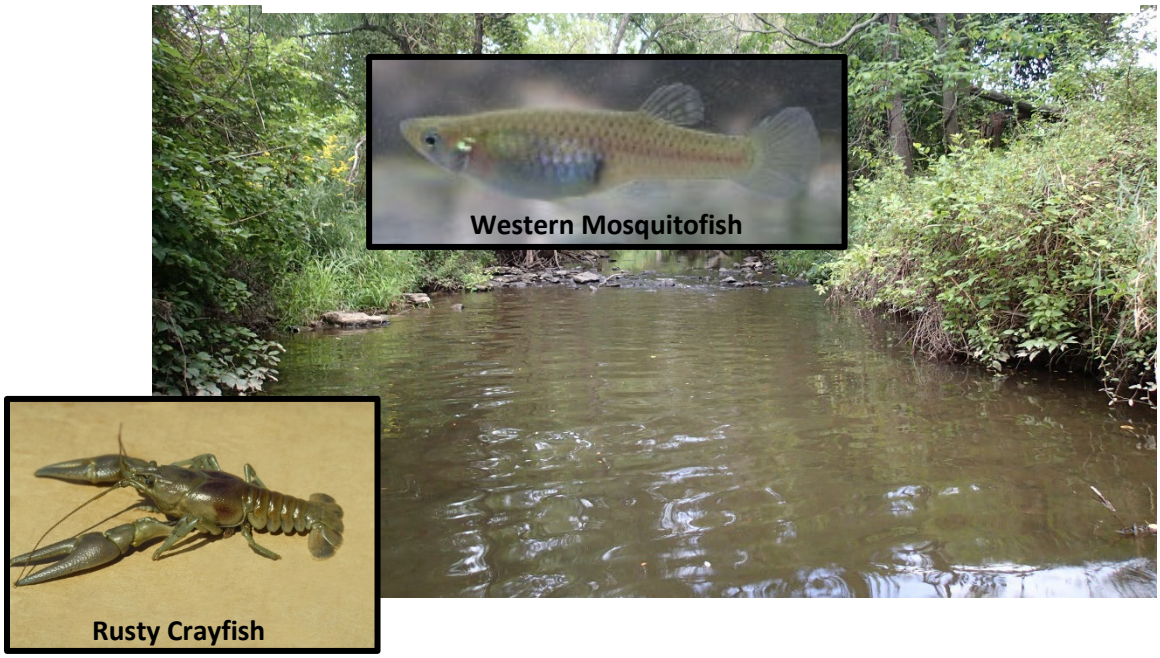
Southern IBI Species indicative of POOR water quality


Mummichog


Banded Killifish

Headwaters Species indicative of GOOD water quality

Headwaters Species indicative of Poor Water Quality



3.0 Scope and Objectives

The objective of the fish and headwaters IBI programs are to enhance the ability of the Division of Water Monitoring & Standards to evaluate environmental conditions at streams throughout the state by providing an additional level of biological assessment. This is performed by implementing three different regional Index of Biotic Integrity (IBI) programs for New Jersey fish, amphibian, and crayfish assemblages: 1) Northern Fish IBI (NIBI), 2) Southern Fish IBI (SIBI), and 3) Headwaters IBI (HIBI). NIBI, SIBI, and HIBI monitoring programs provide a rapid, cost effective assessment of the water quality and condition of New Jersey's streams. The SIBI is applicable to fish found in streams and rivers in the inner coastal plain of southern NJ. These non-tidal Delaware drainage waters are south of the geologic fall-line, exclude the pinelands boundary, and are greater than two square miles in drainage size. Low gradient waters of the inner coastal plain are home to different fish communities than the high gradient streams and rivers in the northern part of the state. The NIBI is applicable to fish found in streams and rivers north of the geologic fall-line with drainage areas greater than four square miles. HIBI evaluates fish, amphibians, and crayfish and is applicable to streams with drainage areas less than four square miles located north of the geologic fall-line.

Presently, fish IBI monitoring has a combined 302 site network consisting of 230 fixed sites, 50 probabilistic sites, and 22 sentinel sites located in the Highlands, Piedmont, Ridge and Valley, and Inner Coastal Plain physiographic provinces of New Jersey.

4.0 Data Usage

These IBIs have been developed as a tool to assess aquatic life use in New Jersey waters as mandated under the Federal Clean Water Act (CWA) and the data collected from this monitoring program is intended for use by the Department's Division of Water Monitoring and Standards – Bureau of Environmental Analysis, Restoration, and Standards (BEARS) in their biennial report to the USEPA entitled, "New Jersey Integrated Water Quality and Monitoring and Assessment Report." The integrated report consists of section 303 (d) (40 CFR: 130.7) List of Water Quality Limited Waters and the section 305 (b) (40 CFR: 130.8) The Integrated List of Waters Report and provides the status of water quality and designated uses for New Jersey waterbodies. The data collected is also expected to inform Surface Water Quality Standards (SWQS), N.J.A.C. 7:9B (NJDEP 1996), stream classifications, designated uses and anti-degradation categories for the State's surface water.

The information gathered will be compiled in data summary reports, which will be made available on the Bureau of Freshwater and Biological Monitoring website: (http://www.nj.gov/dep/wms//bfbm/ibipagemain.htm).

The fish and headwaters IBI data is of great public importance, not only for the public to check the health and condition of local waters, but also to find locations of waterbodies with a high potential for successful fishing opportunities.

5.0 Site Selection

5.1 Network Design

In order to expand the Fish IBI to new waters not currently assessed, while at the same time being able to track trends over time, and monitor reference sites for long term changes in the environment, the Fish IBI network was redesigned in 2012 to mimic the network developed by the Maryland Biological Stream Survey (MBSS). To accomplish these goals, three types of sites have been developed: 1) Fixed, 2) Probabilistic, and 3) Sentinel. Presently, the three monitoring networks have a combined 230 site fixed network, a 50 site probabilistic network and a 22 site sentinel network throughout New Jersey, for a combined 302 station network (Table 3).

Table 3. Fish IBI sampling network breakdown

Program	Type of Site		
	Fixed	**Probabilistic**	**Sentinel**
Northern IBI	105 Sites/5 Year Rotation	50 Sites/3 Year Rotation	10 Sites/2 Year Rotation
Southern IBI	35 Sites/5 Year Rotation		2 Sites/2 Year Rotation
Headwaters IBI	90 Sites/5 Year Rotation		10 Sites/2 Year Rotation
Total Sites	230	50	22

Fixed- The fixed network is comprised of sites which have been previously sampled by the Fish IBI Program and are important for assessing long-term trends. Stream access was given some consideration in the site selection process with a greater emphasis placed on those sites with public access, as several sampling locations have been dropped from the network in recent years due to changes in private landowner permission. In addition, sites were selected over a range of disturbance gradients to achieve an adequate distribution of scores/ratings among network sites to aid in future metric re-evaluation. The fixed network for the northern IBI and headwaters IBI is divided into three specific DEP water regions: Upper Delaware (Northwest), Raritan, and Northeast. The fixed network for the southern IBI is located in the Inner Coastal Plain (Lower Delaware). The number of sites in each water region varies depending on overall size of the region and data needs of the department. Fixed sites are sampled on a five-year rotating basis, with monitoring focused on one water region each year.

Sentinel- Sentinel sites are considered high quality waterbodies located in fully or partially protected watersheds which are sampled on a routine basis to assess environmental changes, natural variability through time, and to evaluate trends in NJ streams. Northern and southern IBI sentinel sites are sampled every other year and site selection criteria includes:

- Sites must have scored in the "good" or "excellent" Fish IBI rating range
- Recent data must contain at least two intolerant species (hatchery raised trout are not included)
- The most recent habitat score must be above 150
- If stocked trout were collected at the site, wild trout must have also been collected at that site
- Percent urban land use must be less than 20%
- Site should have some level of protection i.e. Wildlife Management Area

HIBI sentinel sites are sampled on a three-year rotating basis and site selection criteria includes:

- Previous sampling must indicate at least three sensitive taxa
- Is designated by NJDEP Surface Water Quality Standards as FW1-TP waters (nondegradation waters) or category one (C1) waters with trout production status
- The percent Urban Land Cover within the stream's drainage area must not exceed 10%

Probabilistic- Probabilistic sites are important for assessing aquatic life use in the waters of New Jersey. Probabilistic sites are selected using USEPA probabilistic site selection methodology {Generalized Random Tessellation Stratified (GRTS) survey design}. Candidate streams include all rivers and streams on NJDEP GIS coverage north of the fall-line that are non-tidal, while candidate sites south of the fall-line are non-tidal, greater than 2.0 square miles in drainage, and do not fall with the pinelands boundary. Probabilistic sites (50) are sampled on a five-year basis. When sampling is completed for a five-year probabilistic draw, a new probabilistic draw of 50 sites is created utilizing the same site selection methodology and criteria. Since probabilistic sites are selected randomly, a site evaluation is required prior to sampling to ensure accessibility.

Exact site locations are initially determined via the Global Positioning System (GPS) using a Trimble unit and the appropriate correction sources utilized by NJDEP. All positions are logged into the Geographic Information System (GIS). Hand-held GPS units, either Garmin model "Oregon 450", Garmin GPSmap 62s, or Trimble "Geo XT", will be used to confirm correct locations for sampling. All selected sites will address the varied program needs of the Bureau of Freshwater and Biological Monitoring.

6.0 Field Methods

6.1 Field Sampling

6.1.1 Index Period

Northern and Southern IBI- Fish IBI sampling is conducted during daylight hours from June through early October, during normal or low flows, and never under atypical conditions such as drought, high flows or excessive turbidity caused by significant precipitation. Fish collections made in the summer and early fall are easier, safer, and less likely to disturb spawning fish. The postponement of a sampling event is determined by the professional judgment of the field crew leader following a visual inspection of the waterbody. Waters stocked with trout or known or suspected to have naturalized populations of trout are sampled between July and early October.

Headwaters IBI- Headwaters IBI sampling takes place between May and October. This sampling schedule reduces the occurrence of spawning migratory fish (e.g. white sucker *Catostomus commersonii*) in headwater streams and presumes a resident fish assemblage. In addition, the sampling timeline provides stable flows that permit safe wading conditions and increases electrofishing sampling efficiency. Sampling will not be conducted in trout production waters after September 1st to prevent disturbance of spawning trout and destruction of redds. All sampling is conducted during daylight hours.

6.1.2 Electrofishing

Fish are sampled with electrofishing gear using pulsed direct current (DC) output. This method of collection has proved to be the most comprehensive and effective single method for collecting stream fishes. Direct current is safer, more effective, especially in turbid water, and less harmful to the fish. Sampling gear and crew size is directly related to stream width, but is at the discretion of the field team leader. A typical sampling crew consists of four to seven people, depending on the gear being utilized. A minimum of two people are required for netting the stunned fish.

Stream width (m)	Gear*	Crew size*
≤ 3	1 backpack	3
3 to 10	2 backpacks	5
10 to 15	3 backpacks/barge	5+
> 15	barge	5+
* At the discretion of the Team Leader Team Leader not responsible for cancelled sampling events due to insufficient crew size.		

Electrofishing is conducted in an upstream manner for 150-m in which the operator(s) systematically samples by placing the electrodes in all available fish habitat. Often as electrofishing crews proceed upstream, changes in flow regime, water chemistry, and/or fish reaction require adjustments in electrofishing settings to ensure efficient sampling. These changes in voltage, pulse width, duty cycle, frequency, and pulse rate should only be performed by experienced full-time fisheries staff. Block nets are placed at the end of the reach to prevent fish from escaping upstream of the sampled area. Stunned

fish are netted at and below the electrodes as they drift downstream. Netters attempt to capture fish representing all size classes. All fish captured are immediately placed in water filled containers strategically located along the stream bank in order to reduce fish mortality. Sampling time generally requires four to five hours per station. This includes the measurement of chemical and physical parameters.

Primary objectives of the fish collections are to obtain samples with representative species and abundances, at a reasonable level of effort. Sampling effort is standardized by using similar stream lengths, collection methods, and habitat types. Stream segments selected for sampling are representative of the habitat of the reach. In addition, sample sites will be representative of the habitat of the reach being sampled, and will have a riffle, run, and pool sequence where possible. In addition, atypical habitats such as dams and mouths of tributaries are avoided, unless the intent of the study is to determine the influence these habitats have on the fish assemblage. Most often, sampling atypical habitats results in the collection of fish species not represented in typical stream reaches.

Headwaters IBI- The same electrofishing method is also employed by HIBI sampling protocols. The only major difference is that in addition to fish being collected, any crayfish, frogs or salamanders are also netted when shocked. Since headwaters are also smaller in size, sampling typically only uses one or two backpack electrofishing units with a crew of two to five individuals.

6.1.3 Boat Electrofishing

Fish are sampled in non-wadeable rivers and lakes using DC boat electrofishing. Sampling in non-wadeable rivers is conducted in a downstream manner. Fish specimens are collected by one or two netters in the bow of the boat while the boat is slowly moving down river. The boat operator must watch for underwater hazards suck as boulders, while also reading the river for rapids and other dangerous areas, while also keeping watch over the netter(s).

Small shallow ponds and lakes are typically sampled with a small electrofishing boat during the day, as the size and depth of the waterbody prevents predatory fishes from escaping. Large deep lakes and reservoirs are often sampled at night when predatory fish species move into shallow littoral zones to feed and are therefore vulnerable to electrofishing. Nighttime electrofishing should only be conducted by experienced crew leaders and netters with several years of experience. Electrofishing in lentic systems is typically conducted around the perimeter of the waterbody in the shallow littoral zone. Although all fish habitat types are targeted, areas with excessive weed beds are sometimes avoided when using electrofishing boats with water cooled generators, as the cooling systems can clog and cause overheating.

Fish specimens are netted and held in a livewell on the boat. Once an adequate number of target specimens has been collected or a sample reach has been completed, the fish are processed for the appropriate project and any positively identified specimens not being used for contaminant analysis are released back into the waterbody. Specimens kept for tissue analysis are transported, processed, and packaged according to the specific project and/or analyte and these procedures can be found in the project specific quality assurance project plan (QAPP).

6.1.4 Area Constrained Survey

Headwaters IBI- In addition to electrofishing, HIBI sampling also includes area constrained surveys. An area of 90 m^2 (2 transects measuring 15 x 1 m area in the water and a 15 x 2 m area along the shore) is sampled by area constrained survey (ACS) by a crew of two individuals. All available cover (rocks, logs, debris) within the 90m^2 area greater than 15 $inches^2$ were turned over by hand and all crayfish, salamanders and frogs were captured with the aid of dip nets. All objects turned in the survey are returned to their original position to reduce habitat disturbance. The two transects of the ACS are conducted one on each bank, targeting the best available and diverse habitats. If the 30m^2 search area on shore contained insufficient moveable cover, then the search area was moved onto the adjacent floodplain.

6.1.5 Equipment Decontamination

Upon return from field sampling, all equipment (waders, boots, nets etc.) is decontaminated by scrubbing/cleaning with a dilute solution of Simple Green, followed by a rinse with fresh water and allowed to thoroughly dry. The Bureau is currently developing new decontamination protocols for field sampling equipment and is evaluating the use of pressurized hot water treatment for killing and removal of invasive organisms.

6.1.6 Sample Processing

Electrofishing- Fish are identified to the species level, counted, examined for disease and anomalies (Appendix A), measured (game fish), released and recorded on fish data sheets in the field. The sampling protocol employed is ineffective in capturing a representative sample of smaller fish because they are difficult to see and tend to congregate. Consequently, only fish greater than 25 mm or 1" in length are counted. Reference specimens and difficult to identify individuals are placed in jars containing 10 percent formalin (37% stock) where they are fixed for 48 hours, then removed and rinsed well with tap water, transferred to soak in DI water for several hours, changing the water as often as possible and finally preserved in 50% Isopropyl alcohol with proper labeling. These specimens are then later confirmed at the laboratory using taxonomic keys (Werner 1980; Cooper 1983; Smith 1985; Page and Burr 1991; Jenkins and Burkhead 1993) (Appendix B). Upon return to the laboratory, Species particularly difficult to identify are forwarded to fisheries experts outside WM&S' Bureau of Freshwater and Biological Monitoring for confirmation (at present, Philadelphia Academy of Natural Sciences).

Area Constrained surveys - Taxa observed that escaped catchment are recorded and identified to the lowest taxonomic level based on observed characters. All biota sampled by ACS are identified to species and enumerated. The life stage (larval or adult) of each amphibian sampled is recorded. Larval specimens not readily identified in the field will be preserved in 10% formalin for later identification in the laboratory using taxonomic keys (Altig, 1970; Petranka, 1998). Photo vouchers will be taken for all New Jersey State listed threatened (e.g. Eastern mud salamander *Pseuadotriton montanus montanus* and longtail salamander *Eurycea longicauda longicauda*) and endangered species (e.g. Blue-spotted salamander *Ambystoma laterale*). Photo vouchers will consist of several photos for each specimen highlighting the distinguishing characteristics of each species so that positive identification can be made without sacrificing the animal. Each photo voucher will contain site information (e.g. waterbody name, date) in the picture along with the animal. Animals will be released in close proximity to the object or

habitat from which it was captured (e.g. rock, log, debris) so that the animal may return to the underside of an object on its own.

6.1.7 Field Measurements (Physical and Chemical Parameters)/QAQC

Dissolved oxygen (DO), pH, water temperature, and specific conductivity will be measured in-field at each site by biomonitoring staff, concurrent with faunal sampling, in accordance with N.J.A.C. 7:18 *Regulations Governing the Certification of Laboratories and Environmental Measures* (NJDEP, 2003), Subchapter 8, Analyze-Immediately Environmental Measurements, and NJDEP's *Field Sampling Procedures Manual* (NJDEP, 2005). These physical/chemical parameters will be taken *in situ*, mid-depth, in a free-flowing area of the stream. BFBM is certified by the Office of Quality Assurance for each parameter sampled (Certified Lab ID # 11896). Water temperature, pH, specific conductance, and dissolved oxygen are measured using a Hydrolab MS5 (or equivalent). The Hydrolab MS5 is a multi-parameter water quality system that combines temperature, pH, conductance, and luminescent dissolved oxygen (LDO) probes into one meter. The pH, specific conductance, and dissolved oxygen probes will be calibrated on a weekly basis per the manufacturer recommendations.

pH- pH will be measured in-stream using a Hydrolab MS5 Water Quality Monitoring System. The meter and probe will be maintained and calibrated in accordance with the Operating Manual (February 2006 Edition 3, HACH Environmental, Loveland, CO). The probe is calibrated on a weekly basis per the manufacturer recommendations. The probe is also checked each day of use with a buffer which corresponds to the expected range of the values to be measured. After three hours of continuous use, the pH of the certified buffer will be checked. Records of all calibrations and calibration checks shall be maintained in the BFBM IBI Field Log.

Dissolved Oxygen- Dissolved oxygen will be measured in-stream using a Hydrolab MS5 Water Quality Monitoring System. The meter and probe will be maintained and air calibrated at each site in accordance with the Operating Manual (February 2006 Edition 3, HACH Environmental, Loveland, CO). The meter is barometrically compensated and checked at each sampling site. The meter will be checked weekly against a Winkler DO analysis. Calibration records are maintained in the BFBM IBI Field Log.

Water Temperature- Water temperature will be measured in-stream using a Hydrolab MS5 Water Quality Monitoring System. The meter and probe will be maintained and calibrated in accordance with the Operating Manual (February 2006 Edition 3, HACH Environmental, Loveland, CO). Water temperature will be checked against a NIST certified thermometer. Calibration records are maintained in the BFBM IBI Field Log.

Ambient Air Temperature- Air temperature will be measured streamside using a Traceable Flip-Stick thermometer (Fisher Scientific, Friendswood, Texas). The thermometer accurately measures ambient air temperature. The thermometer will be maintained and sent for recalibration in accordance with operating procedures. Air temperature will be checked against a NIST certified thermometer. Calibration records are maintained in the BFBM IBI Field Log.

Specific Conductance- Specific conductance will be measured in-stream using a Hydrolab MS5 Water Quality Monitoring System. The meter and probe will be maintained and calibrated in accordance with

the Operating Manual (February 2006 Edition 3, HACH Environmental, Loveland, CO). Specific conductance will be calibrated weekly using the conductivity standard (0 and 1800 μmhos/cm). To ensure accuracy, the probe will be checked each day of use with the certified standard (1800 μmhos/cm). Calibration records are maintained in the BFBM IBI Field Log.

Habitat- Visual based habitat assessments will be performed at each site using the format given in the Rapid Bioassessment Protocols (Barbour et al, 1999) for high gradient and low gradient streams. Habitat assessments provide useful information on probable causes of impairment to instream biota when water quality parameters do not indicate a problem. Habitats will be assessed at each site at the time that fish are collected from the site. The habitat assessment consists of an evaluation of the following physical features along the 150-meter reach: substrate, channel morphology, stream flow, bank stability, canopy, and stream side cover. Individual parameters within each of these groups are scored and summed to produce a total score, which is assigned a habitat quality category. In addition, a number of quantitative/qualitative measurements will be made including: canopy cover, discharge, stream gradient, weather conditions, substrate, water clarity, and presence of aquatic vegetation.

Canopy- The percentage of open or closed forest canopy cover over the stream channel will be measured using either a convex Forestry Suppliers Spherical Crown Densiometer. Measurements will be taken at the starting point and at intervals 50, 100, and 150 meters along the sampled reach.

Discharge- Stream discharge will be measured at each stream reach sampled. A typical stream cross-section will be located at each sampling site and the cross-section width measured and divided into approximately 10 equal segments (the number of segments may be reduced for small streams with a width of less than 20 feet). At each segment, the average velocity will be measured using a Marsh McBirney Flo-Mate 2000; the depth of the water at each segment will also be measured. This data will be used to calculate discharge in cubic feet or meters per second. Stream discharge is not measured at Headwater IBI sites.

Gradient- The gradient of a 150-m stream reach is measured using standard surveying equipment (sighting level, tripod, and stadia) and techniques described in Bovee and Milhous (1978).

Chemical sampling- Grab samples for Total Phosphorus, Nitrite-Nitrate, and Total Kjeldahl will be collected mid-depth, mid-stream, during biological sample collection or during reconnaissance visits up to three weeks prior to sampling. If collected at time of biological sampling, nutrients will be collected prior to sampling to avoid disturbance of the substrate (See BFBM Biological Nutrient Correlation QAPP, 2015).

Potential stressors, such as storm sewer outfalls, are identified and mapped using a GPS.

7.0 Safety

(Note – The safety concerns surrounding fish tissue monitoring while aboard an electrofishing boat are included in this section as well)

Electrofishing is inherently dangerous, exposure to low electrical current (like that used in electrofishing) may cause death due to respiratory arrest or cardiac fibrillation (AFS Professional Safety Committee 2008). For that reason, members participating in an electrofishing activity must be medically cleared and trained prior to an electrofishing event. The training at a minimum, must cover safe electrofishing techniques, personal protective equipment use and care, First Aid CPR/AED and boater safety as applicable. As an additional safety precaution, only experienced full-time fisheries staff or an individual trained and vetted by the electrofishing team leader are permitted to operate the electrofishing equipment (Level 1b). In addition, all electrofishing crews must have at least one team leader (Level 1a) as an operator of electrofishing equipment. Electrofishing crew members are defined as the following:

Team Members	**Definition**
Team Leader Level 1a	Certified Electrofishing Full-Time Fisheries employee
Seasoned Team Member Level 1b	Experienced PT or Full-Time Fisheries employee trained and vetted by Team Leader 1a
Team Member (Barge) Level 2	Barge Operator- Experienced PT Fisheries or Full-Time employee vetted by Team Leader 1a
Team Member Level 3	Netter or Bucket Carrier

In addition, all full-time and part time staff must adhere to all requirements outline in the current *NJDEP Water Resource Management Division of Water Monitoring and Standards Bureau of Freshwater and Biological Monitoring Field Work Health and Safety Plan (HASP)*. The HASP outlines all Personal Protective Equipment (PPE) needs, occupational health and safety needs, and related training required for performing field work.

7.1. Health and Safety Procedures of Electrofishing

Purpose - Establishes the requirements for electrofishing safety. All personnel designated as: Team Leaders (1a), Team Members (full-time and part-time 1b, 2 & 3) must adhere to all requirements outlined in the Standard Operating Procedures, Fish index of Biotic Integrity.

Administration Designations and Requirements

Director – Provide equipment, training, and qualified staff as needed to accomplish electrofishing tasks in a safe and effective manner, and inform WRM Assistant Commissioner of those needs, as necessary.

Bureau Chief – Per safety requirements and recommendations in the SOP and the Bureau of Freshwater and Biological Monitoring Field Work Health and Safety Plan (HASP), informs the Director of the staff, necessary safety equipment, and training resources needed to ensure team leaders can accomplish assigned tasks in a safe and effective manner by Personnel Safety Designations and Requirements.

Electrofishing Team Leader (1a) – The team leader ensures that all safety checks are completed and strictly enforces all safety procedures, makes initial settings on the equipment, organizes the team, verifies team members are medically cleared and trained, and makes all final decisions requiring a judgement call. The team leader must know and follow the manufacturer's operating instructions for electrofishing equipment and ensure that team members follow all safety procedures. Serves as the onsite person in charge of electrofishing operations and is responsible for the overall welfare of all team members by:

Training and Medical Clearance Requirements –

- Maintaining a certification in Principles & Techniques of Electrofishing from either United States Fish & Wildlife Services or Electrofishing equipment manufacture equivalent course
- Obtaining medical clearance by contract medical provider
- Maintaining certification in First Aid/CPR/AED
- Completing training for bloodborne pathogens
- Maintaining Boating Safety Certificate and New Jersey Boating License
- Completing training as required for team leader position (Appendix D2)
- Providing and/or securing for all team members (full-time, part-time) an Electrofishing Safety Course and Electrofishing Safety Practicum.
- Ensuring that all full-time and part-time team members are certified in First AID/CPR/AED and maintain copies of the certificate for all members.
- Keeping a record of team members signed Electrofishing Safety Orientation form (Appendix D3), their Health Status/Recommendation form completed by contracted medical provider, and First Aid/CPR/AED certificate.

Equipment

- Ensuring that only commercially built electrofishing units are used and any repairs, modifications or upgrades are conducted by the manufacturer or those qualified personnel, with several years of maintenance experience and vetted by field team leader(s).
- Maintaining electrofishing equipment by conducting annual (Appendix D4.2, D5.2, D6.2) and daily checks of the equipment (Appendix D4.1, D5.1, D6.1).
- Ensuring/maintaining personal protective equipment [gloves, waders, boots, personal flotation devices (PFD's) and throw bags] are in good working condition.
- Maintaining First Aid Kit, AED, throwbag and fire extinguisher.

- Coordinating the purchase of and repair of electrofishing equipment and personal safety equipment.

Safety:

- Ensuring that all team members (full-time, part-time) are medically cleared by the contracted medical provider.
- Ensuring that all team members follow safety procedures and use proper safety equipment
    - Backpack Electrofishing Units (Appendix D4)
    - Electrofishing Tote Barge (Appendix D5)
    - Electrofishing Boat (Appendix D6)
- Identifying hazardous conditions with electrofishing operations, determining measures to protect electrofishing team member and briefing team members as appropriate.
- Ensuring that team is in agreement on the communication system that will be used during Electrofishing operations.
- Ensuring shut down of electrical power if a member of the public approaches closer than 30 feet for backpack electrofishing and 100 feet to all other electrofishing operations. Ensuring precautions are taken to avoid harm to domestic animals or wildlife.
- Suspending electrofishing operations for dangerous weather conditions such heavy rain or lightning.
- Following personal floatation device requirement of, all person will wear U.S. Coast Guard approved personal flotation devices (Type III minimum) when working near, or over water, except in those cases where a site specific job hazard analysis defines conditions for an exemption. Following Appendix D7, Electrofishing Personal Flotation Device Exemption requirements.

Emergency Plan and Safety Procedures

- Establishing an emergency list which includes location of all medical facilities by county for the entire state (Appendix D8)
- When working entirely outside of normal business hours, i.e. nights and weekends. Follow requirements in the BFBM Standard Operating Procedures for After Business Hours Staff Safety Accountability.
- When returning late to the office (after 5:00PM); Team Leader must call before 5:00 PM to inform Management all members and equipment are out of the water and anticipated time returning to office.

Team Members (Level 1b, Level 2, Level 3) – Perform electrofishing task, such as, netter (Level 1b or level 3), electrofisher (Level 1b), bucket holder (Level 3), and/or barge operator (Level 1b or Level 2) using safe practices as understood from training and outlined by the team leader.

Training and Medical Clearance Requirements

- Obtain medical clearance by contracted medical provider and submit Heath Status/Recommendation form to Team Leader
- Complete training for bloodborne pathogens (Level b, Level 2, and Level 3)
- Complete training as required for assigned position on the electrofishing team (Appendix D2)
- Submit signed Electrofishing Safety Course Orientation form (Appendix D3) to Team Leader
- Complete First Aid/CPR/AED training as soon as classes are available
- Submit First Aid/CPR/AED Certificate to Team Leader

Equipment

- Follow electrofishing safe practices as outlined by the Team Leader and Appendices D4, D5, and D6.
- Check personal protective equipment provided (gloves, waders, boots, ear plugs, UVA/UVB safety polarized sunglasses, personal floatation devices) are in good working condition.

Safety

- Report potential work hazards, accidents, incidents and job-related illnesses or injuries to the team leader.
- Follow personal floatation device requirement of, all persons will wear U.S. Coast Guard approved personal flotation devices (Type III minimum) when working near, or over water, except in those cases where a site specific job hazard analysis defines conditions for an exemption. Follow Appendix D8, Electrofishing Personal Flotation Device Exemption requirements.
- Immediately voice safety concerns to the electrofishing team leader.

Guest: DEP, or other agency staff, that does not have a Team Member designation, or equivalent, as vetted by Team Leader 1a. For safely purposes, guests are limited to observing activities per requirements below.

Equipment

- Guest will not operate any equipment or perform any task equivalent of a team member.
- Guests are not authorized to board or operate the electrofishing boat or barge.

Safety

- Guests are permitted to observe stream electrofishing from the banks and cannot enter the water during any electrofishing activities.
- Guest visits must be approved by the electrofishing team leader to ensure a safe viewing location is available to guests.
- Guests are not authorized to board the electrofishing boat.
- Guests are permitted to observe boat electrofishing activities from a chase boat operated by a boating safety certified staff member. The chase boat may observe from a distance of no less than 100 feet from the electrofishing boat.

- Once electrofishing activities are complete and the crew leader signals it is safe to approach, guests may enter the stream or pull alongside the electrofishing boat to observe fish processing and habitat assessments.
- Guests must listen and be responsive to the directions that the Team Leader gives them.
- All guests of an electrofishing team must always wear a Coast Guard approved Personal Floatation Device (Type III minimum) while over or near the water.

8.0 Data Analysis

Once fish, crayfish and amphibians from sample collections have been identified, counted, examined for disease and anomalies, and recorded, an IBI score will be calculated using the appropriate Northern IBI, Southern IBI or headwaters IBI metrics. Assessments are performed using a multimetric index, calibrated to major physiographic regions of the State, using recognized methods.

8.1 Metrics and Scoring

8.1.1 Northern IBI

Richness

Rheophilic Species (Proportion of species adjusted for drainage size minus T. Darter) – American Brook Lamprey, Brook Trout, Blacknose Dace, Fallfish, Longnose Dace, Rainbow Trout, Slimy Sculpin

Thermal

Cold and Nontolerant Coolwater Species (Proportion of individuals adjusted for drainage size) – American Brook Lamprey, Blacknose Dace, Brook Trout, Brown Trout, Common Shiner, Creek Chub, Fallfish, Longnose Dace, Margined Madtom, Rainbow Trout, Rock Bass, Sea Lamprey, Shield Darter, Slimy Sculpin, Smallmouth Bass, Tessellated Darter, Walleye, White Perch, Yellow Perch

Trophic

Generalist Feeders (Proportion of species) – Creek Chub, Golden Shiner, Fathead Minnow, Blacknose Dace, Carp, Goldfish, Redbreast Sunfish, Brown Bullhead, Green Sunfish, Banded Killifish, Pumpkinseed, Bluegill, Mummichog, Eastern Mudminnow, Yellow Bullhead, White Sucker

Tolerance

Tolerance Index – Sum of products of each species proportional abundance and species tolerance values (sensitive = 0, intermediate = 5, tolerant = 10)

Reproduction

Lithophilic Spawners (Proportion of species minus W. Sucker) – American Brook Lamprey, Blacknose Dace, Brook Trout, Brown Trout, Comely Shiner, Common Shiner, Creek Chub, Cutlips Minnow, Fallfish, Longnose Dace, Northern Hogsucker, Rainbow Trout, Rock Bass, Shield Darter, Smallmouth Bass, Swallowtail Shiner, Walleye

Non-native Composition

Cyprinidae (Proportion of individuals adjusted for drainage size) – Eastern Silvery Minnow, Fathead Minnow, Golden Shiner, Carp, Goldfish, Creek Chub, Common Shiner, Cutlips Minnow, Comely Shiner, Satinfin Shiner, Bridle Shiner, Ironcolor Shiner, Spottail Shiner, Swallowtail Shiner, Spotfin Shiner, Blacknose Dace, Longnose Dace, Fallfish

Dominant Taxa (Proportion of individuals not including Blacknose Dace) – Top 3 taxa at each site

Habitat

Benthic Insectivores (Proportion of species) – Tessellated Darter, Creek Chubsucker, Cutlips Minnow, Longnose Dace, Margined Madtom, Northern Hogsucker, Shield Darter, Slimy Sculpin, Oriental Weatherfish

Northern Fish IBI Metrics

Metric	Response	Scoring
% Rheophilic Species (adjusted for drainage size) [a]	↓	= (Adjusted Value ÷27.19)*100
% Cold & Non-tolerant Coolwater Sp. (adjusted for drainage size) [b]	↓	= (Adjusted Value ÷85.53)*100
% Generalist Feeders	↑	= [(78- Metric)÷(78-28.38)]*100
Tolerance Index [c]	↑	= [(9.32- Metric)÷(9.32-4.48)]*100
% Lithophilic Spawners [d]	↓	= (Metric ÷69.02)*100
% Cyprinidae Species (adjusted for drainage size) [e]	↓	= (Adjusted Value ÷75.29)*100
% Dominant 3 Taxa [f]	↑	= [(92.39- Metric)÷(92.39-28.93)]*100
% Benthic Insectivore Species	↓	= (Metric ÷37.75)*100

[a] Adjusted Value = (Metric +19.83)-(Log10[Drainage miles^2]*(-8.85)+32.19), Excludes T. Darter

[b] Adjusted Value = (Metric +65.21)-(Log10[Drainage miles^2]*(-23.46)+97.99)

[c] Sum of products of each species proportional abundance and species tolerance values (sensitive = 0, intermediate = 5, tolerant = 10)

[d] Excludes W. Sucker

[e] Adjusted Value = (Metric +52.88)-(Log10[Drainage miles^2]*(-28.49)+92.68)

[f] Excludes Blacknose Dace

Assessment Rating	NIBI Score
Excellent	100-79
Good	78-60
Fair	59-38
Poor	37-19
Very poor	18-0

8.1.2 Southern IBI

Richness

Native Species Richness (adjusted for drainage size) – Excluding: Fathead Minnow, Channel Catfish, Western Mosquitofish, Warmouth, Green Sunfish, Bluegill, Largemouth Bass, Black Crappie, Carp, Goldfish

Richness

Benthic Species Richness (adjusted for drainage size) – Sea lamprey, American Brook Lamprey, Margined Madtom, Creek Chubsucker, Tadpole Madtom, Slimy Sculpin, Swamp Darter, Tessellated Darter, Yellow Perch

Tolerance

Intolerant Species Richness (adjusted for drainage size) – Bluespotted Sunfish, Banded Sunfish, Blackbanded Sunfish, Sea Lamprey, American Brook Lamprey, Tadpole Madtom, Margined Madtom, Swamp Darter

Tolerance

Percent Tolerant Individuals – Green Sunfish, Bluegill, White Sucker, Banded Killifish, Mummichog, American Eel

Trophic

Percent Insectivore Individuals – Redbreast Sunfish, Pumpkinseed, Warmouth, Mud Sunfish, Blackbanded Sunfish, Bluespotted Sunfish, Banded Sunfish, Pirate Perch, Comely Shiner, Satinfin Shiner, Ironcolor Shiner, Swallowtail Shiner, Spotfin Shiner, American Shad, Eastern Mudminnow, Blacknose Dace, Creek Chub, Fallfish, Longnose Dace, Tadpole Madtom, Margined Madtom, Western Mosquitofish, Swamp Darter

Trophic

Percent Piscivore Individuals – White Perch, Redfin Pickerel, Largemouth Bass, Striped Bass, Black Crappie, Chain Pickerel, Smallmouth Bass, Yellow Perch

Abundance

Total Fish Abundance (excluding Tolerants)

Condition

Percent DELT (Deformity, Eroded Fins, Lesions, Tumors) Anomalies

Southern Fish IBI Metrics

Metric	Response	Scoring
Native Richness (adjusted for drainage size) [a]	↓	= 100* Adjusted Value ÷15
Benthic Richness (adjusted for drainage size) [b]	↓	= 100* Adjusted Value ÷3
Intolerant Richness (adjusted for drainage size) [c]	↓	= 100* Adjusted Value ÷2
% Tolerants	↑	= 100*(93.5- Metric)÷93.5
% Insectivores	↓	= 100* Metric ÷61.2
% Piscivores	↓	= 100* Metric ÷31.8
Abundance [d]	↓	= 100* Metric ÷299
% DELTs	↑	= 100*(3.4- Metric)÷3.4

[a] Adjusted Value = 11.05+ Metric -[Log10(Drainage Area *2.7828)+8.6142]

[b] Adjusted Value = 2.29+ Metric -[Log10(Drainage Area *0.6293)+1.7354]

[c] Adjusted Value = 1.38+ Metric -[Log10(Drainage Area *0.7737)+0.7043]

[d] Excluding Tolerants

Assessment Rating	SIBI Score
Excellent	100-81
Good	80-61
Fair	60-41
Poor	40-21
Very poor	20-0

8.1.3 Headwaters IBI

Richness

Number of Intolerant Vertebrate Species – American Brook Lamprey, Brown Trout, Rainbow Trout, Brook Trout, Cutlips Minnow, Northern Hog Sucker, Shield Darter, Slimy Sculpin, Margined Madtom, Northern Dusky Salamander, Mountain Dusky Salamander, Longtail Salamander, Northern Red Salamander, Northern Spring Salamander

Trophic

Proportion of Vertebrate species as top carnivores (excluding American Eel) – Black Crappie, Brown Trout, Rainbow Trout, Brook Trout, Chain Pickerel, Largemouth Bass, Northern Pike, Redfin Pickerel, Rock Bass, Smallmouth Bass, Striped Bass, Walleye, White Catfish, White Crappie, White Perch, Yellow Perch, Bullfrog, Northern Red Salamander, Northern Spring Salamander

Tolerance

Percent Tolerant Fish – American Eel, Green Sunfish, White Sucker, Banded Killifish, Mummichog, Common Carp, Fathead Minnow, Goldfish, Pumpkinseed, Western Mosquitofish

Non-native

Proportion of total richness as native – Excludes: Black crappie, Bluegill, Brown trout, Common carp, Fathead minnow, Goldfish, Green sunfish, Largemouth bass, Northern Pike, Northern Snakehead, Oriental Weatherfish, Rock Bass, Smallmouth bass, Walleye, Western Mosquitofish, White Crappie, Rainbow Trout, Allegheny Crayfish, Rusty Crayfish, Virile Crayfish, Red Swamp Crayfish

Composition

% Native crayfish – Common Crayfish, Spinycheek Crayfish, White River Crayfish

Composition/Indicator Species

Brook trout density (individuals/100m^2)

Headwaters IBI Metrics

Metric	Response	Scoring
Intolerant Vertebrate Richness	↓	= (Metric ÷ 3) *100
Proportion of Vertebrate Richness as Top Carnivore [a]	↓	= (Metric ÷ 38.0) *100
% Tolerant Fish Individuals	↑	= (96.1- Metric)/ (96.1- 0) *100
Proportion of Total Richness as Native	↓	= (Metric ÷ 100) *100
% Native Crayfish	↓	= (Metric ÷ 100) *100
Brook Trout Density (individuals/100m^2)	↓	= (Metric ÷ 10.1) *100

[a] Excludes American eel

Assessment Rating	HIBI Score
Excellent	100-82
Good	81-51
Fair	50-29
Poor	28-13
Very poor	12-0

9.0 Quality Assurance/Control

9.1 Quality Assurance Project Plan

A Quality Assurance/Quality Control plan is approved by the DEP Office of Quality Assurance prior to sampling. A copy of this plan is available on the BFBM website, http://www.state.nj.us/dep/wms//bfbm/, or by contacting WM&S' BFBM.

9.2 Taxonomic Identification

A voucher collection containing two representatives of each fish specimen collected during a sampling year will be sent to a contract lab to be verified (currently the Philadelphia Academy of Natural Sciences at Drexel University, Philadelphia, PA) for independent verification of identifications. In the event of disagreement over species identification, the BFBM will request assistance from a 3rd party. Chain of custody will be used for samples preserved for independent analysis of speciation.

Additionally, a reference voucher collection of identified organisms is maintained in the laboratory for use in confirming identifications.

9.3 Physical/Chemical Parameters

All equipment is calibrated, maintained, and used following manufacturer's instructions and in accordance with the specifications given in N.J.A.C. 7:18-8 (NJDEP, 1996) (http://www.nj.gov/dep/rules/rules/njac7_18.pdf).

10.0 Reports

All physical/chemical data and site observations will be recorded on the appropriate BFBM's Biological Field Data Sheet, and also recorded electronically in a Microsoft Access database.

All fish and fauna identifications will be recorded on the appropriate BFBM's Data Sheet and entered into a Microsoft Access database. Following the QA/QC verification of fish identifications, data will be entered into New Jersey's Water Quality Data Exchange (WQDE) and USEPA STORET Data Warehouse, and available via the Water Quality Portal (WQP) by June of the following year it is verified.

A data summary table, including index scores and ratings, will be posted on the BFBM website (http://www.nj.gov/dep/wms//bfbm/ibipagemain.htm) after completion of all sample analyses for the Water Region and data review.

A data report will be issued and will contain: taxa and counts of fish, field chemistry results, biological condition scores and rating, habitat assessment scores and ratings, and GIS maps of the study area.

NJDEP Water Resource Management
Bureau of Freshwater and Biological Monitoring
Standard Operating Procedures
Fish Index of Biotic Integrity
Signature Page

Director, Date
Division of Water Monitoring and Standards

Bureau Chief, Date
Bureau of Freshwater and Biological Monitoring

Section Chief, Date
Bureau of Freshwater and Biological Monitoring

Bureau Safety Officer Date
Bureau of Freshwater and Biological Monitoring

Electrofishing Team Leader Date
Bureau of Freshwater and Biological Monitoring

Program Manager, Date
Office of Occupational Health & Safety

Appendix A – DELT Examples

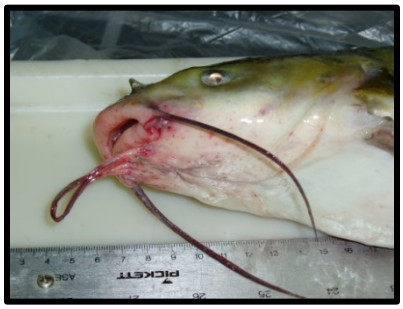
Fish condition anomalies (DELTS) usually indicative of poor water quality

D=deformity



E=eroded fins


L=lesion




T=tumor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Appendix C – References

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Appendix D1: Medical Clearance for Electrofishing Team

Electrofishing is inherently dangerous. Exposure to low electrical current (like that used in electrofishing) may cause death due to respiratory arrest, ventricular fibrillation and asphyxia (AFS Professional Safety Committee 2008). Due to these dangers, all team members entering the water, must be medical cleared prior to participating in and/or observing an electrofishing event following the frequency below.

Individuals must not participate in an electrofishing event if they possess a medical condition that puts them at risk. Such conditions must be reported during the medical clearance exam and subsequent periodic exam.

Electrofishing Team Assignments	Prior to Electro fishing Activities	Periodic Exam Frequency	Submit Updated Health Questionnaire
Team Leader	Initial Clearance Exam	Biennial	On non-exam years
Team Members	Initial Clearance Exam	Every Five Years	On non-exam years
Newly assigned electrofishing team members that have a medical exam date of more than two years will need a current medical exam to obtain clearance.			
Newly assigned electrofishing team members that have had a medical exam within the last two years, may only need a medical file review by DEP's medical provider to obtain clearance.			

Appendix D2: Health and Safety Training for Electrofishing Team

Electrofishing is inherently dangerous and, therefore, team leaders must be trained in safe electrofishing techniques and practices to ensure safe working conditions for themselves and the field staff (AFS Professional Safety Committee 2008). Exposure to low electrical current (like that used in electrofishing) may cause death due to respiratory arrest, ventricular fibrillation and asphyxia (AFS Professional Safety Committee 2008). Due to these dangers, all team members must be trained and certified in Electrofishing safety, First Aid/CPR/AED procedures and additional health and safety training as listed in the following chart:

Health and Safety Course	Frequency	Team Leader (Level 1a)	Seasoned Member (Level 1b)	Barge Operator (Level 2)	Netter/ Bucket Holder (Level 3)
Certificate in Principles & Techniques of Electrofishing (FWS CSP2C01), Electrofishing Principles and Safety (Smith-Root) or equivalent*	Initial then recertification every 5 years	X			
Electrofishing Safety Course (FWS CSP2202) or equivalent	Annual or before each Electrofishing Season	X	X	X	X
DEP's Electrofishing Practicum	Annual or before each Electrofishing Season		X	X	X
Bloodborne Pathogens 1910.1030	Annual	X	X	X	X
First Aid, CPR/AED 1910.151	Biennial	X	X	X	X
Wader Safety (FWS)	Initial	X	X	X	X
Occupational Noise Awareness	Initial	X	X	X	X
New Jersey Boating Safety Certificate and Boating License (N.J.S.A. 12:7-61)	Initial	X			

*If course is not available prior to sampling season, team leaders must secure the course certification before next electrofishing season.

Appendix D3: Acknowledgment of Electrofishing Safety Orientation

I have completed Electrofishing Safety Course (FWS CSP2202) or equivalent and orientation about electrofishing from my employer. As a result, I understand and accept the following principles:

_____

Initials of Team Member

1. Electrofishing (EF) is an inherently hazardous activity in which safety is the primary concern. The electrical energy used in EF is sufficient to cause electrocution.
2. During operation, it is critical to avoid contact with the electrodes and surrounding water. The EF field is most intense near the electrodes but can extend 5-10 meters (16-33 feet outward).
3. The electrodes are energized by the power source, a generator or battery, and controlled by safety switches; these switches must remain off until the signal to begin EF.
4. The power source has a safety switch that must be turned off immediately if an emergency occurs.
5. The electrodes are usually metal probes suspended in the water. If direct currents used from a boat/tow barge, the anodes (+) are in front of the boat/tow barge to catch fish and the cathodes (-) may be suspended from the sides; both can produce electroshock. When a metal boat hull is the cathode, it is safe to use if all metal surfaces inside the boat are electrically connected to the hull.
6. Moveable anodes on a boat are dangerous on metal boats. All electrodes on a metal-hulled EF boat should be in fixed position while EF is underway.
7. Dry skin and clothing are good protection against electroshock. Rubber insulating Class 1 gloves are to be worn during all electrofishing activities, rubber knee boots are minimal protections on EF boats and waders with non-slip footwear for wadable electrofishing activities. Hearing protection will be made available for those working near the generator.
8. Follow Electrofishing Personal Floatation Device (PFD) Exemption, (Appendix D7). However, at any time a team member can request or choice to wear a PFD, that is easily and readily available. A personal floatation device (PFD) must always be worn on an EF boat. Guest must always wear a PFD while near the water.
9. At least two members of an EF crew must be certified in First Aid/CPR/AED. In an EF boat, a fire extinguisher must be within immediate reach during an operation. Electroshock can cause heart fibrillation or respiratory arrest. The EF team must know how to activate the emergency medical system.
10. A communication system must be understood by all members of EF team. Above all, NEVER ELECTROFISH ALONE.
11. Using the anode as a dip net is a safety risk for fish and people and should be avoided for typical sampling protocols.

12. An EF operation should proceed slowly and carefully; avoid fish-chasing and other sudden maneuvers. Night activities require bright, bow-mounted, headlights. Operation should cease during lightening or thunderstorms; use discretion during rain. Avoid EF too close to bystanders and livestock (30m or 100 feet).

13. General Safety Precautions include:

    - Always sample using the "buddy system". NEVER ELECTROFISH ALONE.
    - Parking is frequently limited at sampling locations. Park in a safe legal location and use vehicle's hazard lights and traffic cones. Obtain permission when accessing private property.
    - Do not wear conductive jewelry or clothing (such as watchbands, bracelets, rings, key chains, necklaces, or cloth with conductive thread.)
    - Know the bottom of the stream. Look for any algae or other substances coating rocks and stream bottom. This can make movement very slippery and dangerous. Be careful of mud and silt, as you can sink several feet and get stuck even if the water depth is only a few inches.
    - Look for deep pools. Use the pole of your net in front of you as a guide in deep water.
    - Avoid areas where you cannot see the bottom from the surface.
    - Look for any trash or glass which may be a hazard.
    - Look for snags which may trip you.
    - If the flow is too swift and/or too deep to manage, do not sample.
    - Keep car keys and valuables with your partner on the bank, or at a secure location.

14. All EF team members must know who their team leader is and recognize their authority as final in operational decision. However, every team member has the right to ask questions or express concerns about any aspect of an EF operation. A team member has the right to decline participation in an EF operation, without fear of employer recrimination, if they feel unsafe in such participation.

Signature of Team Member_____Date_____

I have discussed the above-named principles with the employee and am satisfied that they understand them.

Signature of Team Leader_____Date_____

Appendix D4: Safety Procedures for Backpack Electrofishing Units

Preparatory Procedures:

1. Ensure that the backpack electrofishing unit passed the "Annual Checklist for Backpack Electrofishing Units" (Appendix D4).
2. A team leader must be designated for all backpack electrofishing activities
3. It is the team leader's responsibility to ensure that all equipment is in "safe working condition". Complete a daily check for backpack electrofishing units, anodes, cathodes, and batteries before and at end of day.
4. The team leader must ensure full and part-time team members are medically cleared to participate in electrofishing (Appendix D1).
5. Team leader must ensure all full-time and part-time team members received training appropriate to their level. (Appendix D2).
6. All team members must read and sign the "Electrofishing Safety Orientation" form (Appendix D3).
7. Team leader assigns each team member their job task for an electrofishing event. Backpack Electrofishing units will be worn by team leaders or designated seasoned (1b) employees. If an inexperienced employee is assigned to operate the backpack, the team leader will shadow the unexperienced team member and could only serve as a netter.
8. At a minimum the team leader and another team member (two in total), must have up-to-date First Aid/CPR/AED training.
9. The team leader will ensure fully stocked first aid kit, AED, and medical waste kits are in the state vehicle.
10. The team leader will ensure PFD's and throw bag are accounted for and are available for each sampling event.
11. Throw bags will be attached to the tote barge and electrofishing boat and will be carried (Velcro, belt, etc.) by bucket holder at backpack electrofishing sites.
12. Each electrofishing site must be visually inspected for hazards such as deep holes, submerged logs, etc. before commencing electrofishing operations.
13. To aid in identifying underwater hazards, all team leaders and team members must be equipped with polarized sunglasses. Glasses also protect against eye injury caused by sticks and branches. Wide-brimmed hats or caps are also beneficial in increasing the effectiveness of polarized glasses.
14. All team leaders and team members must be equipped with long-armed gloves that are non-conductive, waterproof and inspected to be free of leaks. Rubber insulating Class 1 gloves must be worn during all times during electrofishing operations.
15. All team leaders and team members must be equipped with chest waders that are non-conductive, waterproof and inspected to be free of leaks with non-slip footwear. Heavy weight wader made of neoprene, silicon, polyurethane or PVC are recommended.

Breathable waders **are not** to be worn. Wading belts must be worn with release to the backside.

16. A concerted effort will be made to be hydrated prior to and during a sampling event particularly on hot/humid days. The job is physically demanding. EF team members will be walking up stream in waders carrying multiple pieces of equipment (net, bucket, backpack, anode) on slippery, uneven surfaces.
17. An emergency response plan must be discussed with all team members and a statewide list of the medical facilities will be carried in the vehicle (Appendix D8).
18. All team leaders and members must agree on a system of communication during electrofishing operations.

Start-up Procedures:

19. The backpack electrofisher operator must make sure that all personnel are clear of the anode before turning on the power.
20. Check operation of all switches and gauges. This should include high voltage check, anode switch and tilt switch, audible tone generator and light. Set controls to appropriate levels. The minimum voltage possible to obtain the desired effects and to minimize the effects of accidental shock.

Operational Procedures:

21. Always use the "buddy system", NEVER electrofish alone.
22. Operate slowly and carefully. Footing in most streams is poor and most falls occur when personnel are hurrying. Operations should cease when fatigue sets in.
23. Team members must not place their bare hand(s) in the water when the power is turned on.
24. Electrofishing units must be shut off prior to entering or leaving the water and the battery terminal disconnect (or generator shut off) when not in use or when transporting the unit.
25. Coast Guard approved Personal Flotation Devices (PFD) (Type III minimum) are required in all operations near, or over water except in those cases that meet the criteria for exemption, see Appendix D7.
26. Look for deep pools. Use the pole of your net in front of you as a guide in deep water. If the flow is too swift and /or too deep to manage, do not sample. The risk of shock increases when the water is higher than waist deep and there is a higher chance of water getting into the wader even with a waist belt. Sampling in higher water can create an awkward and uncomfortable posture of the shoulder and arm for extended period of time. The ability to relieve the awkward posture is not possible since arms are not to be in the water during electrofishing event.

27. Team members must immediately leave the water if wetness is detected in gloves or waders (by leaks, rain or perspirations) and obtain dry equipment before returning. Mild dampness from perspiration or humidity is considered normal.
28. Discontinue electrofishing if anyone outside the electrofishing team approaches within 30 feet.
29. Electrofishing operations must cease during inclement weather such as any lightning or moderate rain. Ensure that team members remain out of the water for 30 minutes after the last lightning strike before resuming electrofishing activities.

End of the Day Procedures:

1. Check for visible damage to the backpack unit casing, controls, gauges
2. Check anode rings are in good working condition and are securely fastened
3. Check cathodes are in good working condition
4. Inspect backpack unit straps
5. Inspect battery for cracks and corrosion
6. Make sure battery is charging correctly.
7. Check to make sure PPE is in good, working condition.

Appendix D4.1: Backpack Electrofishing Equipment and Safety Checklist

☐ **Verify all equipment packed is in "safe working condition"** _____

Safety

- ☐ First aid kit
- ☐ AED
- ☐ PFDs (1 per person)
- ☐ Medical waste kit
- ☐ Rescue throw bag
- ☐ Fire extinguisher

Backpack Electro Fishing Gear

- ☐ (2-3) Backpack Shockers
- ☐ (2-3) Rat tails "Cathode"
- ☐ (3) Poles "Anodes"
- ☐ (3) Long yellow nets
- ☐ (4) Electrofisher Batteries
- ☐ 2 Battery Wires "Dongle"
- ☐ (2) Small yellow micromesh nets
- ☐ (2) Buckets
- ☐ (3) Livewells w/ covers
- ☐ Gloves (class 1 lineman)
- ☐ Block net (sized to stream)
- ☐ Fish measuring board
- ☐ Formaldehyde bucket
- ☐ Specimen preservation jars
- ☐ Waders
- ☐ Wading boots

Fish Processing

- ☐ Fish measuring board
- ☐ Formaldehyde bucket
- ☐ Specimen preservation jars
- ☐ Sample jar labels

Habitat

- ☐ Tape measure (meter/feet)
- ☐ Densiometer
- ☐ Flow Meter
- ☐ Flow Mate Wading Rod
- ☐ Trimble GPS
- ☐ Garmin GPS
- ☐ Digital Camera

Truck

- ☐ Navigational GPS and mount
- ☐ Truck clipboard
- ☐ Spare key

Data Sheets and Site Info

- ☐ Clipboard
- ☐ Pencils
- ☐ Site recon sheet with coordinates
- ☐ Scientific Collection Permits
- ☐ Fish/Crayfish/Amphibian field key
- ☐ Field data sheets
- ☐ Hospital list/ emergency contacts

Water Quality

- ☐ Hydrolab
- ☐ Jug of Deionized water
- ☐ Barometer
- ☐ Thermometer
- ☐ Water Chemistry Logbook
- ☐ Nitrile gloves
- ☐ 500 mL sterile (Nutrients) sample bottle
- ☐ Small cooler with ice
- ☐ Acid preservation kit
- ☐ HABs bottles

Miscellaneous

- ☐ Marking Flags
- ☐ Flagging tape
- ☐ Chem Wipes
- ☐ Sunscreen
- ☐ Bug Spray
- ☐ Technu
- ☐ Polarized glasses
- ☐ Hand Cleaner
- ☐ Wader repair kit
- ☐ (2) Small hand nets
- ☐ Polarized glasses
- ☐ AA / D batteries
- ☐ Tool bag
- ☐ Machete

Appendix D4.2: Annual Safety Checklist Backpack Electrofisher

Inspected by_____ Date_____

Make_____ Model_____

Log Book: Up to date Yes_____ No_____ Manual Present Yes_____ No_____

ELECTROFISHER

_____ 1. Electrofisher connections and wiring in good condition
_____ 2. Controls and gauges operational
_____ 3. Unit casing has no visible damage or cracks and is nonconductive
_____ 4. KILL SWITCH working
_____ 5 Audible and visual signals working
_____ 6. Tilt switch working when tipped in each direction
_____ 7. Anode pressure switch working and resets to the "off" position when released
_____ 8. Anode ring clean, in good condition, fastened securely and check for continuity
_____ 9. Anode handle in good condition and is of non-conductive materials
_____ 10. Cathode cable and insulation in good condition
_____ 11. Cathode clean, securely fastened and check for continuity
_____ 12. Backpack frame made from non-conductive materials, straps not cracked, broken or frayed. Buckles are operational.
_____ 13. Backpack quick release mechanism if available is working properly

Power Source - Battery

_____ 1. Non-spillable gel cell battery
_____ 2. Battery terminals clean
_____ 3. No visible cracks/holes in casing or wires
_____ 4. Capable of holding full charge

ADDITIONAL EQUIPMENT

_____ 1. Dip Nets in good condition and made of non-conductive material
_____ 2. First aid kit present and stocked
_____ 3. Inspect Protective gloves
_____ 3. Operators manual present
_____ 4. Review log book for completeness, problems, required maintenance
_____ 5. AED battery check

Appendix D5: Safety Procedures for Tow-Barge Electrofishing Units

Preparatory Procedures:

1. Ensure the Tow-Barge Electrofishing control box and generator pass the Annual Checklist (Appendix D5).
2. A team leader must be designated for all electrofishing activities and assign team members to their job task.
3. Only a Team Leader (1a) or Seasoned (1b) or Level 2 team member can be positioned at the stern of the Tow Barge, to push and operate the barge and have access to the power unit safety switches.
4. If a Level 3 part time or full-time fisheries employee is assigned to operate the anode of a tow barge, a team leader must be assigned to shadow the unexperienced team member for that event.
5. When the tow barge crew is over 7, the team leader's job can only be to supervise the whole operation. The team leader in this situation cannot net, push stern, operate the anode etc., only observe the situation.
6. It is the team leader's responsibility to ensure that all equipment is in "safe working condition". Complete a daily check for barge electrofishing units, anode wires, anodes, barge cathodes plate, and generator before and at the end of day.
7. The team leader must ensure full and part-time team members are medically cleared to participate in electrofishing (Appendix D1).
8. Team leader must ensure all full-time and part-time team members received training appropriate to their level (Appendix D2).
9. All team members must read and sign the "Electrofishing Safety Orientation" form (Appendix D3).
10. At a minimum, the team leader and another team member (two in total), must have up-to-date First Aid/CPR/AED training.
11. The team leader will inform team members where the first aid kit and AED are located.
12. A throw bag will be stored and easily accessible in the tow barge.
13. Each electrofishing site must be visually inspected by the team leader for hazards such as deep holes, submerged logs, or turbidity. It is the team leader's responsibility to highlight such hazards to team members before commencing electrofishing operations.
14. To aid in identifying underwater hazards, all team leaders and team members must be equipped with polarized sunglasses. Glasses also protect against eye injury caused by sticks and branches. Wide-brimmed hats or caps are also beneficial in increasing the effectiveness of polarized glasses.
15. All team leaders and team members must be equipped with long-armed gloves that are non-conductive, waterproof and inspected to be free of leaks. Rubber insulating Class 1 gloves must be worn at all times during electrofishing operations.

16. All team leaders and team members must be equipped with chest waders that are non-conductive, waterproof and inspected to be free of leaks with non-slip footwear. Heavy weight wader made of neoprene, silicon, polyurethane or PVC are recommended. Breathable waders **are not** to be worn. Wading belts must be worn with release to the backside.
17. Hearing protection will be available to all team leaders and members.
18. A concerted effort will be made to be hydrated prior to and during a sampling event particularly on hot/humid days. The job is physically demanding. EF team members will be walking up stream in waders carrying multiple pieces of equipment (net, bucket, backpack, anode) on slippery, uneven surfaces.
19. Fuel tank (UL or FM approved) must be filled prior to each sampling event. Hot surfaces will be allowed to cool before refueling. Flames, smoking, vaping etc. are not allowed during refueling. Gasoline refueling will take place on cemented flooring, not on plastic surfaces. A fire extinguisher will be available.
20. An emergency response plan must be discussed with all team members and a statewide list of the medical facilities will be carried in the vehicle (Appendix D8).
21. Team leader ensure all team members agree on a system of communication during electrofishing operations.

Start-up Procedures:

22. Use the two-person lift technique when, carrying tow barge, generator and control box down to water edge. This technique will limit strain on the musculoskeletal system.
23. Team Leader needs to establish that the control box and generator are in continuity with each other, having no potential voltage differences. If the wet well used in the tow barge is metal in design, it will need to be in continuity with control box and generator.
24. The exhaust from a gasoline powered generated will be directed away from the equipment operator.
25. Team leader alerts all team members prior to the start of electrofishing and the end of electrofishing.
26. Team leader checks operations of all switches, gauges and sets controls to appropriate levels. The minimum voltage possible to obtain the desired results should be used to avoid excessive harm to the fish and to minimize the effects of accidental shock.

Operational Procedures:

27. Always use the “buddy system”. NEVER ELECTROFISH ALONE.
28. The anode should never touch the cathode or any other metal equipment
29. Operate slowly and carefully. Footing in most streams is poor and most falls occur when personnel are hurrying. Operations should cease when fatigue sets in.

30. Look for deep pools. Use the pole of your net in front of you as a guide in deep water. If the flow is too swift and /or too deep to manage, do not sample. The risk of shock increases when the water is higher than waist deep and there is a higher chance of water getting into the wader even with a waist belt. Sampling in higher water for an extended period of time can create an uncomfortable positioning for the arms and shoulders. The ability to relieve this position is not possible since arms are not to be in the water during an electrofishing event.
31. Team members must not place their bare hand(s) in the water when the power is turned on
32. Coast Guard approved Personal Flotation Devices (PFD) (Type III minimum) are required in all operations near, or over water except in those cases that meet the criteria for exemption, see Appendix D7.
33. Team members must immediately leave the water if wetness is detected in gloves or waders (by leaks, rain or perspirations) and obtain dry equipment before returning. Mild dampness from perspiration or humidity is considered normal.
34. Electrofishing operations must cease during inclement weather such as any lightning or moderate rain. Ensure that team members remain out of the water for 30 minutes after the last lightning strike before resuming electrofishing activities.
35. Discontinue electrofishing if anyone outside the electrofishing team approaches within 100 feet

End of Day Procedures

1. Check output voltage.
2. Check to make sure cathodes plate is clean.
3. Make sure the wiring to the anode is in good working condition.
4. Check to make sure PPE is in good working condition.

Appendix D5.1: Tow Barge Electrofishing Equipment and Safety Check List

☐ **Verify all packed equipment is in "safe working condition"** _____

Safety

- ☐ First aid kit
- ☐ AED
- ☐ Medical waste kit
- ☐ PFDs (1 per person)
- ☐ Rescue throw bag
- ☐ Fire extinguisher

Barge Electro Fishing Gear

- ☐ Barge w/stakes
- ☐ Barge Handle
- ☐ Cables with floats
- ☐ Electrofisher GPP (Tan Box)
- ☐ Generator (fill w/gas)
- ☐ Generator oil
- ☐ Barge livewell (no holes)
- ☐ (3) Poles "Anodes"
- ☐ (3-4) Long yellow nets
- ☐ (2-3) Small yellow nets
- ☐ (2) Buckets
- ☐ (3) Livewells w/ covers
- ☐ Gloves (class 1 lineman)
- ☐ Block net (sized to stream)
- ☐ Waders
- ☐ Wading boots

Fish Processing

- ☐ Fish measuring board
- ☐ Formaldehyde bucket
- ☐ Specimen preservation jars
- ☐ Sample jar labels

Habitat

- ☐ Tape measure (meter/feet)
- ☐ Densiometer
- ☐ Flow Meter
- ☐ Flow Mate Wading Rod
- ☐ Trimble GPS
- ☐ Garmin GPS
- ☐ Digital Camera

Truck

- ☐ Navigational GPS and mount
- ☐ Truck clipboard
- ☐ Spare key

Data Sheets and Site Info

- ☐ Clipboard
- ☐ Pencils
- ☐ Site recon sheet with coordinates
- ☐ Scientific Collection Permits
- ☐ Fish field key
- ☐ Field data sheets
- ☐ Hospital list/ emergency contacts

Water Quality

- ☐ Hydrolab
- ☐ Jug of Deionized water
- ☐ Barometer
- ☐ Thermometer
- ☐ Water Chemistry Logbook
- ☐ Nitrile gloves
- ☐ 500 mL sterile (Nutrients) sample bottle
- ☐ Small cooler with ice
- ☐ Acid preservation kit
- ☐ HABs bottles

Miscellaneous

- ☐ Marking Flags
- ☐ Flagging tape
- ☐ Chem Wipes
- ☐ Sunscreen
- ☐ Bug Spray
- ☐ Technu
- ☐ Hand Sanitizer
- ☐ Wader repair kit
- ☐ (2) Small hand nets
- ☐ Polarized glasses
- ☐ AA / D batteries
- ☐ Tool Bag
- ☐ Machete

Appendix D5.2: Annual Tow Barge Field Safety Check List

Inspected by_____ Date_____

Make_____ Model_____

Log Book: Up to date Yes_____ No_____

Manual Present Yes_____ No_____

CRAFT

_____ 1. Hull integrity
_____ 2. All metal equipment grounded to craft
_____ 3. Towing strap/pack frame/push bar in good condition

GENERATOR/ALTERNATOR

_____ 1. Electrical connections secure and protected
_____ 2. Mountings secure
_____ 3. Generator should be grounded to frame
_____ 4. All metal components grounded to generator frame
_____ 5. Engine serviced to date/oil changed
_____ 6. Internal ground removed
_____ 7. Check output voltage

ELECTROFISHER

_____ 1. Controls and gauges operational
_____ 2. Adequate mechanical protection of wiring
_____ 3. Adequate connectors and interlocking
_____ 4. Operator's safety switch working
_____ 5. "KILL SWITCH" working
_____ 6. Anode switches working
_____ 7. Wiring to anodes in good condition
_____ 8. Anodes in good condition- attached to handle securely
_____ 9. Cathode plate clean- connection secure
_____ 10. Anode cables unwound from coil – connections tight

ADDITIONAL EQUIPMENT

_____ 1. Fire extinguisher fully charged
_____ 2. First aid kit full
_____ 3. AED battery check

Appendix D6: Safety Procedures for Electrofishing Boats

Preparatory Procedures:

1. Only commercially built electrofisher boat and equipment may be used. “Positive” kill switch must be installed for the boat operator and the dip netter. Electrode booms (anodes with DC) must be mounted in a stationary position. Ensure the electrofisher boat pass the annual boat safety inspection checklist (Appendix D6.2)
2. A team leader must be designated for all electrofishing activities and assign team members.
3. The team leader must have a boating certificate and boating license and certificate in electrofishing safety to operate the electrofishing boat
4. It is the team leader’s responsibility to ensure that all equipment is in “safe working condition”. Complete the daily checklist for Electrofisher Boat (Appendix D6.1)
5. The team leader must ensure full and part-time team members are medically cleared to participate in electrofishing. (Appendix D1)
6. Team leader must ensure all full-time and part-time team members received training appropriate to their level (Appendix D2).
7. All team members must read and sign the “Electrofishing Safety Orientation” form (Appendix D3).
8. Skid proof decking is required. A 36”-48” guardrail is required on the netting platform.
9. Each dip netter should have their own foot switch to control the output. They should be wired in a series with the boat operator’s emergency off switch.
10. Ground the generator to the boat hull. Make sure the generator is secured and the exhaust is facing away from the operator.
11. Verify that all metal parts on the boat are bonded to each other electrically.
12. Run all cables through electrical conduit or use a heavy-duty rubber covered cord recommended for wet locations.
13. Make all electrical connection in water tight junction boxes
14. When operating at night, you must have adequate lighting for work areas
15. Fuel tank (UL or FM approved) must be filled prior to each sampling event. Hot surfaces will be allowed to cool before refueling. Flames, smoking, vaping etc. are not allowed during refueling. Gasoline refueling will take place on cemented flooring, not on plastic surface.
16. A fire extinguisher must be mounted away from gas can, generators and other fire sources.
17. All team leaders and crew members must wear a US Coast Guard approved personal floatation devices (PFD) while on the boat. A type IV Coast Guard approved throwable device must be immediately available.
18. At a minimum, the team leader and another team member (two in total), must have up-to-date First Aid/CPR/AED training. The team leader will designate where first aid kit and AED in waterproof containers are located.

19. To aid in identifying underwater hazards, all team leaders and team members must be equipped with polarized sunglasses. Glasses also protect against eye injury caused by sticks and branches. Wide-brimmed hats or caps are also beneficial in increasing the effectiveness of polarized glasses.
20. All team leaders and team members must be equipped with long-armed gloves that are non-conductive, waterproof and inspected to be free of leaks. Rubber insulating Class 1 gloves must always be worn during electrofishing operations.
21. All team leaders and team members must wear knee-high, non-slip rubber boots while on board.
22. Hearing protection will be available to all team leaders and members.
23. All team member must stay hydrated especially on hot/humid days.
24. An emergency response plan must be discussed with all team members and a statewide list of the medical facilities will be carried in the vehicle (Appendix D8).
25. Ensure all team leaders and members agree on a system of communication during electrofishing operations

Start-up Procedures:

26. Warn all team members prior to the start of electrofishing and the end of electrofishing.
27. When handling electrodes, the generator must be off, unplug the booms when handling electrodes. NEVER handle electrodes with the generator running and the electrodes connected to the control box.

Operational Procedures:

28. The team leader or member who control the power switch must be constantly aware of the netters position during the event
29. Due to the length of the dip nets, pay special attention as you swing around to transfer a fish after being netted to the livewell.
30. Do not disassemble pulsator immediately after use due to shock potential form the capacitors. Capacitors are made to self-bleed (typically 5 minutes). Electrodes may be “hot” immediately after shut-down.
31. Discontinue electrofishing if anyone outside the electrofishing team approaches with in 100 feet of the boat
32. Electrofishing operations must cease during inclement weather such as any lightning or moderate rain. Ensure that team members remain out of the water for 30 minutes after the last lightning strike before resuming electrofishing activities.

End of Day Procedures

1. Check output voltage.

2. Check to make sure wiring to the anode is in good working condition.
3. Check to make sure electrode is in good working condition.
4. Check to make sure all equipment is electrically bonded.
5. Check to make sure PPE is in good working condition.

Appendix D6.1: Boat Electrofishing Equipment and Safety Check List

☐ **Verify all packed equipment is in "safe working condition"** _____

Safety

- ☐ First aid kit
- ☐ AED
- ☐ Medical waste kit
- ☐ PFDs (1 per person)
- ☐ Rescue throw bag
- ☐ Fire extinguisher
- ☐ Throwable Type IV Device
- ☐ Signaling device (Air horn/whistle)
- ☐ Flares

Boat Electrofishing

- ☐ (2) Black 8' electrofishing poles
- ☐ (2) electrofishing net heads
- ☐ (2) electrode arrays
- ☐ Netter foot control switch
- ☐ Electrofisher control box
- ☐ (1) stand pipe
- ☐ (1) Bucket
- ☐ Boat plug
- ☐ Anchor and line
- ☐ Paddle or oar
- ☐ Depth finder
- ☐ Gloves
- ☐ Rubber boots
- ☐ Polarized sunglasses
- ☐ Boat Toolkit
- ☐ Spare Propeller

Truck

- ☐ Navigational GPS and mount
- ☐ Truck clipboard
- ☐ Spare key

Data Sheets and Site Info

- ☐ Clipboard
- ☐ Pencils
- ☐ Scientific Collection Permits
- ☐ Site recon sheet with coordinates
- ☐ Field data sheet
- ☐ Hospital list/ emergency contacts

Fish Processing

- ☐ Coolers with ice
- ☐ (1) Small yellow net
- ☐ Nitrile gloves
- ☐ Biopsy punches
- ☐ Forceps
- ☐ Scalpels
- ☐ Scintillation vials
- ☐ Bulb Syringe Aspirator
- ☐ Fish measuring board
- ☐ Weighing scales
- ☐ Labels
- ☐ Plastic bags
- ☐ Garbage bags

Miscellaneous

- ☐ Trimble GPS
- ☐ Garmin GPS
- ☐ Digital Camera
- ☐ AA batteries
- ☐ Chem Wipes
- ☐ Sunscreen
- ☐ Bug Spray
- ☐ Hand Sanitizer
- ☐ Tool bag

Appendix D6.2: Annual Electrofishing Boat Field Safety Check List

Inspected by_____ Date_____

Boat Model/Make_____ Registration # _____

Log Book: Up to date Yes_____ No_____ Manual Present Yes_____ No_____

BOAT

_____ 1. Hull integrity
_____ 2. Safety railing intact and sturdy
_____ 3. Non-skid footing
_____ 4. Wiring okay – connection secure, etc.
_____ 5. All metal equipment in boat electrically bonded/connected
_____ 6. Lighting and navigational lights working
_____ 7. Batteries fully charged, properly enclosed and vented
_____ 8. Regulation fuel containers
_____ 9. Boat clean, equipment neatly stored
_____ 10. Oars or paddles present and in good condition
_____ 11. Anchor present
_____ 12. Bailer present or bilge pump in working condition

BOAT MOTOR

_____ 1. Servicing up to date
_____ 2. Components working properly
_____ 3. Proper venting of exhaust (away from operator)
_____ 4. No gasoline leaks

GENERATOR

_____ 1. Servicing up to date
_____ 2. Generator should be grounded to frame
_____ 3. All metal components grounded to generator frame
_____ 4. Internal ground removed (check with ohm meter)
_____ 5. Check output voltage

ELECTROFISHER

_____ 1. Controls and gauges operational
_____ 2. Booms made of non-conductive material
_____ 2. Adequate mechanical protection of wiring
_____ 3. Adequate connectors and interlocking
_____ 4. Operator's safety switch and/or "KILL SWITCH" working
_____ 5. Wiring to anodes in good condition
_____ 6. Droppers in good condition

ADDITIONAL EQUIPMENT

_____ 1. Fire extinguisher fully charged, correct type and inspected
_____ 2. Stocked First Aid Kit
_____ 3. AED battery check

Appendix D7: Electrofishing Personal Floatation Device (PFD) Exemption

A U.S. Coast Guard approved personal floatation devices (Type III minimum), are required in all operations near, or over water except in those cases where a site-specific job hazard analysis defines the conditions for exemption.

Low Flow and Depth Wadable Waters Exemption

For wadable streams known to be at or below knee high and have low to no current, there is an understanding/expectation, if a crew member were to slip/fall in this shallow water, they could get themselves up again, unaided and not drown. If for some reason the falling team member needed help getting up, multiple team members are near to give assistance. Hence, exemption can be applied as, the use of PFD in this situation would be at the discretion of the Team Leader but only if the following parameters, practices are in place:

- The electrofishing event has at least three members in the water, and
- The bucket holder or barge operator will be specifically designated to watch for falling/injured crew members and act as a responder. The bucket holder or barge operator, while wearing a PFD at all times, carrying a throw bag and positioning himself/herself behind the electrofishers and netters, will assist team members in the event of a fall or other injury.

Backpack Electrofisher Exemption,

For backpack electrofishing, the electrofisher's use of PFD interferes with the safety release of the backpack and could increase human selection error of the manual inflation pull device of the PFD. The PFD over the backpack limits the electrofisher's range of motion and operation of the anode and adds to the electrofisher's heat burden. The last two conditions could make the risk for falling into wadable waters greater. Hence, an exemption will be applied to backpack electrofishers, if the following additional safety features/precautions are in place:

- the netter works in close proximity to the electrofisher, to pull electrofisher out of the water if a fall should occur and
- the electrofisher uses a wader belt, allowing air to be trapped in the chest waders in case one is submerged, acting as a pseudo flotation device; and
- the bucket holder, while wearing a PFD, carrying a throw bag and positioning himself/herself behind the electrofisher and netters, will assist backpack electrofisher in the event of a fall or other injury.

NOTE - At any time despite the above exemption, team members can request or choose to wear a PFD, which needs to be made easily and readily available for them by the team leader.

IMPORTANT: This exemption does not apply to guests. Guest of the electrofishing team must always wear a Coast Guard approved PFD (Type III minimum) while near the water's edge.

Appendix 8: List of New Jersey Hospitals by County

ATLANTIC COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Acuity Specialty Hospital of New Jersey	1925 PACIFIC AVE	ATLANTIC CITY		39.357909	-74.433648
Atlantic City Center	1301 ATLANTIC AVENUE	ATLANTIC CITY	609-572-0000	39.362611	-74.426820
AtlantiCare Health Services at Covenant House	929 ATLANTIC AVENUE	ATLANTIC CITY	609-344-5714	39.364406	-74.422384
AtlantiCare Health Services Healthcare for the Homeless-Atlantic Ave	1401 ATLANTIC AVE SUITE 2600	ATLANTIC CITY	609-572-6055	39.362107	-74.428071
AtlantiCare Health Services Healthcare for the Homeless-Bacharach Blvd	2009 BACHARACH BLVD.	ATLANTIC CITY	609-344-5714	39.361124	-74.430587
Atlanticare Regional Medical Center City Division	1925 PACIFIC AVENUE	ATLANTIC CITY	609-345-4000	39.358004	-74.433655
Women and Children's Health Pavilion	1125 ATLANTIC AVENUE	ATLANTIC CITY	609-348-0066	39.363359	-74.425004
AtlantiCare Health Services	2500 ENGLISH CREEK ROAD	EGG HARBOR TOWNSHIP	609-344-5714	39.455197	-74.593311
ARMC SED - Kessler	219 N. WHITE HORSE PIKE	HAMMONTON	609-561-1096	39.632312	-74.772663
Hammonton Center	860 S. WHITE HORSE PIKE	HAMMONTON	609-567-0200	39.620675	-74.774406
Hammonton Dental Center	310 BELLEVUE AVENUE	HAMMONTON	609-561-9150	39.637399	-74.801817
Southern Jersey Family Medical Centers	1 WHITE HORSE CENTRE	HAMMONTON	609-567-0434	39.620675	-74.774406
The Mobile Medic	1 WHITE HORSE CENTRE	HAMMONTON	800-486-0131	39.620675	-74.774406
Ancora Psychiatric Hospital	301 SPRING GARDEN ROAD	HAMMONTOWN	609-561-1700	39.682273	-74.860706
Pleasantville Center	932 SOUTH MAIN STREET	PLEASANTVILLE	609-383-0880	39.383089	-74.530233
Atlanticare Regional Medical Center Mainland Division	JIMMIE LEEDS ROAD	POMONA	609-652-1000	39.479029	-74.540426
Bacharach Institute for Rehabilitation	61 WEST JIMMIE LEEDS ROAD	POMONA	609-652-7000	39.478552	-74.539172
Shore Medical Center	ONE EAST NEW YORK AVENUE	SOMMERS POINT	609-653-3500	39.314740	-74.593612

BERGEN COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Englewood Hospital and Medical Center	350 ENGLE STREET	ENGLEWOOD	201-894-3000	40.904463	-73.968441
NHCAC Health Center at Englewood	197 SOUTH VAN BRUNT ST	ENGLEWOOD	201-537-4442	40.888708	-73.981061
NHCAC Garfield	535 MIDLAND AVENUE	GARFIELD	973-340-1182	40.881230	-74.100952
Hackensack University Medical Center	30 PROSPECT AVENUE	HACKENSACK	551-996-2000	40.883704	-74.056323
NHCAC Hackensack	25 EAST SALEM STREET	HACKENSACK	201-996-2121	40.885651	-74.041524
Bergen Regional Medical Center L.P.	230 EAST RIDGEWOOD AVENUE	PARAMUS	201-967-4000	40.956363	-74.062517
Valley Hospital	223 NORTH VAN DIEN AVENUE	RIDGEWOOD	201-447-8000	40.983992	-74.100577
Select Specialty Hospital Northeast New Jersey	96 PARKWAY	ROCHELLE PARK		40.899105	-74.076535
Kessler Institute for Rehabilitation - North Facility	300 MARKET STREET	SADDLE BROOK	201-587-8500	40.896093	-74.092671
Holy Name Medical Center	718 TEANECK ROAD	TEANECK	201-833-3000	40.882886	-74.010473
Hackensack UMC at Pascack Valley	250 OLD HOOK ROAD	WESTWOOD		40.985499	-74.014845
Christian Healthcare Center - Ramapo Ridge Psychiatric Hospital	301 SICOMAC AVENUE	WYCKOFF	201-848-5200	40.981360	-74.171760
Ramapo Ridge Psychiatric Hospital	301 CEDAR HILL AVE	WYCKOFF		40.997054	-74.155661

BURLINGTON COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Deborah Heart and Lung Center	200 TRENTON ROAD	BROWNS MILLS	609-893-6611	39.977428	-74.585381
Lourdes-Deborah SED	200 TRENTON ROAD	BROWNS MILLS		39.974893	-74.584696
Burlington City Center	665 HIGH STREET	BURLINGTON CITY	609-386-0775	40.073592	-74.856305
Marlton Rehabilitation Hospital	92 BRICK ROAD	MARLTON	856-988-8778	39.882422	-74.918201
Virtua West Jersey Hospital - Marlton	90 BRICK ROAD	MARLTON	856-355-6200	39.881499	-74.918512
Weisman Children's Rehabilitation Hospital	92 BRICK ROAD	MARLTON	609-489-4520	39.882678	-74.918123
Buttonwood Hospital of Burlington County	600 PEMBERTON-BROWNS MILLS ROAD	MOUNT HOLLY	609-726-7000	39.967734	-74.637807
Virtua Memorial Hospital of Burlington County	175 MADISON AVENUE	MT. HOLLY	609-267-0700	39.985987	-74.795244
Southern Jersey Family Medical Center - Buttonwood	600 PEMBERTON-BROWNS MILLS ROAD	PEMBERTON	609-894-1100	39.969488	-74.670326
Hampton Behavioral Health Center	650 RANCOCAS ROAD	WESTAMPTON TOWNSHIP	800-603-6767	40.008226	-74.846559
Lourdes Medical Center of Burlington County	218 SUNSET ROAD	WILLINGBORO	609-835-2900	40.046544	-74.880849
Lourdes Specialty Hospital of Southern New Jersey	218 SUNSET RD	WILLINGBORO		40.048227	-74.886092

CAMDEN COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Virtua-Berlin SED	100 TOWNSEND AVENUE	BERLIN	856-322-3000	39.781749	-74.920334
Northbrook Behavioral Health Hospital	425 WOODBURY-TURNERSVILLE ROAD	BLACKWOOD	856-374-6600	39.789406	-75.073850
Antioch Manor	1860 VAN BUREN STREET	CAMDEN	856-964-8028	39.921247	-75.114776
CAMcare - East	2610 FEDERAL STREET	CAMDEN	856-635-0203	39.946143	-75.088655
CAMcare - North	6TH ST AND ERIE STREETS	CAMDEN	856-757-9180	39.954515	-75.116517
CAMcare - South	S 8TH ST AND CARL MILLER BLVD.	CAMDEN	856-541-4926	39.931380	-75.112909
CAMCare Gateway Health Center	817 FEDERAL STREET	CAMDEN	856-541-3270	39.944037	-75.115740
CAMcare Odessa Paulk-Jones	813 FERRY AVENUE	CAMDEN	856-541-3270	39.920940	-75.114621
Cooper Hospital/University Medical Center	ONE COOPER PLAZA	CAMDEN	856-342-2000	39.941599	-75.116434
Our Lady of Lourdes Medical Center	1600 HADDON AVENUE	CAMDEN	856-757-3500	39.927891	-75.095040
Project H.O.P.E Inc at Bergen Lanning Health Center	439 CLINTON ST	CAMDEN	856-968-2320	39.938579	-75.121770
Project H.O.P.E. Inc	622 COOPER ST	CAMDEN	856-541-6092	39.926901	-75.095506
Project H.O.P.E. Mobile Unit	439 CLINTON STREET	CAMDEN	856-968-2320	39.938737	-75.122340
Virtua-Camden SED	1000 ATLANTIC AVENUE	CAMDEN		39.929110	-75.108205
Kennedy Memorial Hospitals UMC Cherry Hill	2201 CHAPEL AVENUE WEST	CHERRY HILL	856-488-6500	39.928058	-75.016114
CAMcare Clementon	121 WHITEHORSE PIKE	CLEMENTON	856-627-7701	39.811664	-74.983714
Kennedy Memorial Hospitals UMC Stratford	18 EAST LAUREL ROAD	STRATFORD	856-346-6000	39.828183	-75.008501
Virtua West Jersey Hospital - Voorhees	101 CARNIE BOULEVARD	VOORHEES	856-325-3000	39.864191	-74.958890

CAPE MAY COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Cape Community Health Center	410 N. ROUTE 9	CAPE MAY COURT HOUSE	609-465-0258	39.089245	-74.816674
Cape Regional Medical Center	2 STONE HARBOR BOULEVARD	CAPE MAY COURT HOUSE	609-463-2000	39.087614	-74.816829

CUMBERLAND COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Bridgeton RiteCare	1000 PEARL STREET	BRIDGETON	856-451-4700	39.456201	-75.211540
CompleteCare Adult & Women's Medical Professionals	70 COHANSEY ST	BRIDGETON		39.430465	-75.234350
CompleteCare Bridgeton - Medical and Dental Health Professionals	105 MANHEIM AVENUE	BRIDGETON	856-451-4700 X2320	39.429367	-75.218158
CompleteCare Health Network	53 SOUTH LAUREL ST	BRIDGETON	856-451-4700	39.427832	-75.235190
Inspira-Bridgeton SED	333 IRVING AVENUE	BRIDGETON	856-575-4500	39.436139	-75.220492
Millville Community Health Center	1200 N. HIGH STREET	MILLVILLE	856-451-4700	39.409763	-75.039704
CompleteCare Vineland RiteCare	215 STHY 47	VINELAND		39.490489	-75.042801
HealthSouth Rehabilitation Hospital of Vineland	1237 W SHERMAN AVE	VINELAND		39.447169	-75.052191
Inspira Medical Center Vineland	1505 W. SHERMAN AVENUE	VINELAND	856-641-8000	39.445359	-75.058832
Rehabilitation Hospital of South Jersey	1237 WEST SHERMAN AVENUE	VINELAND	856-696-7100	39.445114	-75.052597
Vineland Medical and Dental Center	319 LANDIS AVENUE	VINELAND	856-451-4700	39.486378	-75.030450
Vineland Women's Health Center	484 S. BREWSTER RD	VINELAND	856-451-4700	39.515520	-74.972124

ESSEX COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Clara Maass Medical Center	ONE CLARA MAASS DRIVE	BELLEVILLE	973-450-2000	40.785624	-74.175997
Essex County Hospital Center	204 GROVE AVENUE	CEDAR GROVE	973-571-2801	40.849443	-74.237308
East Orange General Hospital	300 CENTRAL AVENUE	EAST ORANGE	973-674-8400	40.754489	-74.213671
East Orange Primary Care Center	444 WILLIAM STREET	EAST ORANGE	973-675-1900X1003	40.765682	-74.213327
Kessler Institute for Rehabilitation - East Facility	240 CENTRAL AVENUE	EAST ORANGE	973-414-4700	40.753556	-74.211878
VA New Jersey Health Care System (East Orange)	385 TREMONT AVENUE	EAST ORANGE	973-676-1000	40.752503	-74.236029
Irvington Community Health Center	1150 SPRINGFIELD AVENUE	IRVINGTON	973-399-6292	40.725317	-74.236111
Saint Barnabas Medical Center	94 OLD SHORT HILLS ROAD	LIVINGSTON	973-322-5000	40.763548	-74.304816
Hackensack UMC Mountainside	1 BAY AVENUE	MONTCLAIR	973-429-6000	40.811727	-74.203574
Catholic Community Services - Mount Carmel Guild	58 FREEMAN STREET	NEWARK	973-596-4190	40.736876	-74.169595
Columbus Hospital	495 N 13TH ST	NEWARK	973-268-1400	40.772925	-74.187000
George Washington Carver	333 CLINTON PLACE	NEWARK	973-705-3880	40.712389	-74.215183
Newark Beth Israel Medical Center	201 LYONS AVENUE AT OSBORNE	NEWARK	973-926-7000	40.709961	-74.212857
Newark Community Health Center	101 LUDLOW STREET	NEWARK	973-565-0355	40.689924	-74.205242
Newark Community Health Center St. James Hospital	155 JEFFERSON ST	NEWARK	973-483-1399	40.727806	-74.163182
Newark Community Health Centers, Inc	741 BROADWAY	NEWARK	973-483-1300	40.775202	-74.159067
Newark Homeless Health Care Project	110 WILLIAM STREET	NEWARK	973-733-5300	40.734622	-74.178851
Rutgers Community Health Center	65 BERGEN ST	NEWARK	973-972-9620	40.743246	-74.190951
Saint James Health	228 LAFAYETTE ST	NEWARK	973-789-8111	40.729070	-74.162699
Saint Michael's Medical Center	111 CENTRAL AVENUE	NEWARK	973-877-5000	40.743088	-74.174331
University Hospital	150 BERGEN ST.	NEWARK	973-972-1000	40.740639	-74.190872
Orange Community Health Center	37 NORTH DAY STREET	ORANGE	973-395-2611	40.773287	-74.228895
Kessler Institute for Rehabilitation - West Facility	1199 PLEASANT VALLEY WAY	WEST ORANGE	973-731-3600	40.785710	-74.276524

GLOUCESTER COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Glassboro Community Health Center	335 DELSEA DRIVE N	GLASSBORO	856-863-5720	39.708643	-75.109495
CAMcare Paulsboro	1315 NORTH DELAWARE STREET	PAULSBORO	856-687-2200	39.831110	-75.241071
Kennedy Memorial Hospitals UMC Washington Township	435 HURFFVILLE-CROSS KEYS ROAD	TURNERSVILLE	856-582-2500	39.735261	-75.065535
Inspira Medical Center Woodbury	509 NORTH BROAD STREET	WOODBURY	856-845-0100	39.843807	-75.149459

HUDSON COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Bayonne Family Medical Center by HAC, Inc	29 EAST 29TH STREET	BAYONNE	201-683-2000	40.668442	-74.114106
Bayonne Medical Center	29 E 29TH ST	BAYONNE	201-858-5000	40.668075	-74.112644
Hoboken University Medical Center	308 WILLOW AVENUE	HOBOKEN	201-418-1000	40.741130	-74.033971
NHCAC CHC at Hoboken	124 GRAND STREET	HOBOKEN	201-795-9521	40.738730	-74.036284
Alliance Community Healthcare - Bergen	714 BERGEN AVE	JERSEY CITY	201-451-6300	40.724287	-74.069835
Alliance Community Healthcare - Christopher Columbus Drive	115 CHRISTOPHER COLUMBUS DR	JERSEY CITY	201-451-6300	40.719651	-74.043954
Christ Hospital	176 PALISADE AVENUE	JERSEY CITY	201-795-8200	40.734266	-74.049834
Jersey City Medical Center	355 GRAND STREET	JERSEY CITY	201-915-2000	40.716137	-74.050951
Metropolitan Family Health Network	935 GARFIELD AVENUE	JERSEY CITY	201-478-5800	40.710451	-74.070526
Metropolitan Family Health Network at Bergen Ave	857 BERGEN AVE	JERSEY CITY	201-478-5800	40.728750	-74.066730
NHCAC Jersey City	324 PALISADE AVENUE	JERSEY CITY	201-459-8888	40.739722	-74.047048
Snyder High School	239 BERGEN AVENUE	JERSEY CITY	201-915-6220	40.710155	-74.084149
NHCAC North Bergen	1116 43RD STREET	NORTH BERGEN	201-330-2632	40.779708	-74.026831
Palisades Medical Center	7600 RIVER ROAD	NORTH BERGEN	201-854-5000	40.793780	-73.996447
Meadowlands Hospital Medical Center	55 MEADOWLANDS PARKWAY	SECAUCUS	201-392-3200	40.791776	-74.073153
Meadowview Psychiatric Hospital	595 COUNTY AVENUE	SECAUCUS	201-207-3695	40.784111	-74.058563
NHCAC Union City	714 31ST STREET	UNION CITY	201-863-7077	40.772595	-74.031575
North Hudson Community Action Corp Health Center	800 31ST STREET	UNION CITY	201-210-0100	40.773222	-74.032870
Metropolitan Family Health Center	5300 BERGENLINE AVE	WEST NEW YORK	201-478-5851	40.784619	-74.019576
NHCAC Health Center	5301 BROADWAY	WEST NEW YORK	201-866-9320	40.782278	-74.014447
NHCAC Mobile Unit	5301 BROADWAY	WEST NEW YORK	201-866-9320	40.782278	-74.014447

HUNTERDON COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Hunterdon Medical Center	2100 WESCOTT DRIVE	FLEMINGTON	908-788-6100	40.531429	-74.860798

MERCER COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Robert Wood Johnson University Hospital at Hamilton	1 HAMILTON HEALTH PLACE	HAMILTON	609-586-7900	40.216334	-74.672016
Capital Health System - Hopewell	1 CAPITAL WAY	HOPEWELL	609-394-4000	40.292226	-74.805493
St. Lawrence Rehabilitation Center	2381 LAWRENCEVILLE ROAD	LAWRENCEVILLE	609-896-9500	40.288425	-74.734427
Greystone Park Psychiatric Hospital	59 KOCH AVENUE	MORRISTOWN	973-538-1800	40.835903	-74.508873
Princeton House Behavioral Health	905 HERRONTOWN ROAD	PRINCETON	609-497-3300	40.388567	-74.653458
Capital Health Regional Medical Center	750 BRUNSWICK AVENUE	TRENTON	609-394-6000	40.236134	-74.751982
Chambers Manor Family Practice	317 CHAMBERS STREET	TRENTON	609-278-5900	40.219195	-74.744567
Ewing Health Center	112 EWING ST	TRENTON	609-278-5900	40.222834	-74.756363
Henry J. Austin Health Center, Inc (Warren St)	321 N WARREN ST	TRENTON	609-278-5900	40.225281	-74.765212
St. Francis Medical Center	601 HAMILTON AVENUE	TRENTON	609-599-5000	40.216408	-74.741320
Trenton Psychiatric Hospital	101 SULLIVAN WAY	TRENTON	609-633-1500	40.243570	-74.805436

MIDDLESEX COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
JFK Medical Center	65 JAMES ST.	EDISON	732-321-7000	40.556738	-74.350252
Robert Wood Johnson, Jr. Rehabilitation Institute	65 JAMES STREET	EDISON	732-321-7051	40.556738	-74.350252
Children's Specialized Hospital - New Brunswick	146 SOMERSET ST	NEW BRUNSWICK		40.496312	-74.449671
Eric B. Chandler Health Center	277 GEORGE STREET	NEW BRUNSWICK	732-235-6700	40.488536	-74.440793
Eric B. Chandler Health Center Church Street Annex	123 CHURCH STREET	NEW BRUNSWICK	732-235-2052	40.495786	-74.445298
Robert Wood Johnson University Hospital	ONE ROBERT WOOD JOHNSON PLACE	NEW BRUNSWICK	732-828-3000	40.495700	-74.449974
Saint Peter's University Hospital	254 EASTON AVENUE	NEW BRUNSWICK	732-745-8600	40.501287	-74.459559
Raritan Bay Medical Center - Old Bridge	1 HOSPITAL PLAZA	OLD BRIDGE	732-360-1000	40.383163	-74.323381
Care One at Raritan Bay Medical Center	530 NEW BRUNSWICK AVE	PERTH AMBOY		40.521249	-74.285958
Jewish Renaissance Foundation-Community Action Agency	149 KEARNY AVE	PERTH AMBOY	732-324-2114X124	40.503686	-74.268839
Jewish Renaissance Medical Center	275A HOBART STREET	PERTH AMBOY	732-376-9333	40.508504	-74.269362
Jewish Renaissance Medical Center Dental/Medical Mobile Van	275 HOBART STREET	PERTH AMBOY	732-376-6632	40.508513	-74.269356
Raritan Bay Medical Center - Perth Amboy	530 NEW BRUNSWICK AVE	PERTH AMBOY	732-442-3700	40.519174	-74.280924
University Behavioral Healthcare	671 HOES LANE	PISCATAWAY	609-969-5300	40.524858	-74.469387
University Medical Center of Princeton at Plainsboro	1 PLAINSBORO RD	PLAINSBORO	609-853-6500	40.339813	-74.624268

MONMOUTH COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Visiting Nurse Association of Central Jersey Community Health Center	1301 MAIN STREET	ASBURY PARK	732-774-6333	40.225708	-74.009852
CentraState Medical Center	901 WEST MAIN STREET	FREEHOLD	732-431-2000	40.237573	-74.309279
Bayshore Community Hospital	727 NORTH BEERS STREET	HOLMDEL	732-739-5900	40.405447	-74.191716
Keansburg Community Health Center	100 MAIN STREET	KEANSBURG	732-787-1250	40.448076	-74.129530
Keyport Primary Care Center	35 BROAD STREET	KEYPORT	732-888-4149	40.438248	-74.202216
AcuteCare Specialty Hospital of Monmouth	300 2ND AVE	LONG BRANCH		40.295231	-73.983679
Monmouth Family Health Center - Broadway	270 BROADWAY	LONG BRANCH	732-923-7100	40.304250	-73.988867
Monmouth Family Health Center - Dental Clinic	300 SECOND AVE	LONG BRANCH	732-923-6585	40.295421	-73.983642
Monmouth Medical Center	300 SECOND AVENUE	LONG BRANCH	732-222-5200	40.295242	-73.983670
Women's Wellness Center of Monmouth Family Health Center	80 PAVILLION AVENUE	LONG BRANCH	732-963-0114	40.296977	-73.982598
Jersey Shore University Medical Center	1945 ROUTE 33	NEPTUNE	732-775-5500	40.208535	-74.040708
Red Bank Community Health Center	176 RIVERSIDE AVENUE	RED BANK	732-219-6620	40.353753	-74.075618
Riverview Medical Center	1 RIVERVIEW PLAZA	RED BANK	732-741-2700	40.353833	-74.063453
HealthSouth Rehabilitation Hospital of Tinton Falls	2 CENTER PLZ	TINTON FALLS	732-460-5320	40.283319	-74.078054
The Rehabilitation Hospital of Tinton Falls	2 CENTRE ST	TINTON FALLS	732-460-5320	40.282805	-74.079667

MORRIS COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Saint Clare's Hospital/Boonton	130 POWERVILLE ROAD	BOONTON TOWNSHIP	973-316-1800	40.909948	-74.425843
Kessler Institute for Rehabilitation - Welkind Facility	201 PLEASANT HILL ROAD	CHESTER	973-252-6300	40.819418	-74.685602
Saint Clare's Hospital/Denville	25 POCONO ROAD	DENVILLE	973-625-6000	40.894982	-74.465320
Highlands Health Van of Zufall Health Center	17 S WARREN ST	DOVER	908-968-0898	40.883866	-74.559388
Kindred Hospital New Jersey - Morris County	400 USHY 46	DOVER		40.886410	-74.572688
Saint Clare's Hospital/Dover	400 WEST BLACKWELL ST	DOVER	973-989-3000	40.885181	-74.576407
Zufall Health Center	18 W. BLACKWELL STREET	DOVER	973-328-9100	40.884043	-74.559285
Atlantic Rehabilitation Institute	95 USHY 202	MORRISTOWN		40.799957	-74.481560
Morristown Medical Center	100 MADISON AVENUE	MORRISTOWN	973-971-5000	40.789496	-74.465487
Morristown Memorial Hospital - Mt. Kemble Division	95 MOUNT KIMBLE AVENUE	MORRISTOWN	973-971-5450	40.789693	-74.489473
Zufall Health Center at Morristown	2-4 ATNO AVENUE	MORRISTOWN	973-267-0002	40.798745	-74.485130
Chilton Medical Center	97 WEST PARKWAY	POMPTON PLAINS	973-831-5000	40.958697	-74.310209

OCEAN COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Ocean Medical Center	425 JACK MARTIN BOULEVARD	BRICK	732-840-2200	40.077328	-74.131395
Shore Rehabilitation Institute	425 JACK MARTIN BLVD	BRICK	732-295-6500	40.077236	-74.131134
Ocean Health Initiatives - Manchester	686 STHY 70	LAKEHURST		40.012427	-74.325212
CHEMED (Center for Health, Education, Medicine and Dentistry)	1771 MADISON AVENUE	LAKEWOOD	732-364-2144	40.108122	-74.219255
Monmouth Medical Center - Southern Campus	600 RIVER AVENUE	LAKEWOOD	732-363-1900	40.073225	-74.218517
Ocean Health Initiatives - Lakewood	101 SECOND STREET	LAKEWOOD	732-363-6655	40.093164	-74.208104
Ocean Health Initiatives at Clifton Avenue Grade School - SBHC	625 CLIFTON AVENUE	LAKEWOOD	732-719-1505	40.095528	-74.215284
Ocean Health Initiatives Mobile Unit	101 SECOND STREET	LAKEWOOD	732-363-6655	40.093164	-74.208104
Specialty Hospital of Central Jersey	600 USHY 9	LAKEWOOD		40.095810	-74.217480
Ocean Health Initiatives- Stafford	333 HAYWOOD RD	MANAHAWKIN	609-489-0110	39.713068	-74.289506
Southern Ocean Medical Center	1140 ROUTE 72 WEST	MANAHAWKIN	609-597-6011	39.721066	-74.284661
Ocean Care SED	1517 RICHMOND AVE	POINT PLEASANT		40.082056	-74.049664
Children's Specialized Hospital at Toms River	94 STEVENS ROAD	TOMS RIVER	732-914-1100	40.009721	-74.222052
Community Medical Center	99 HIGHWAY 37 WEST	TOMS RIVER	732-557-8000	39.964024	-74.215988
Healthsouth Rehabilitation Hospital of Toms River	14 HOSPITAL DRIVE	TOMS RIVER	732-244-3100	39.962292	-74.217511
Ocean Health Initiatives - Toms River	301 LAKEHURST ROAD	TOMS RIVER	732-552-0377	39.957376	-74.211492
Saint Barnabas Behavioral Health Center, Inc.	1691 US HIGHWAY 9	TOMS RIVER	732-914-1688	40.011961	-74.214611

PASSAIC COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
NHCAC CHC at 8th Street Passaic	148 8TH STREET	PASSAIC	973-470-3033	40.858550	-74.110028
NHCAC CHC at Passaic	110 MAIN AVENUE	PASSAIC	973-777-0256	40.843465	-74.129609
St. Mary's Hospital	350 BOULEVARD	PASSAIC	973-365-4300	40.859172	-74.137781
Paterson Community Health Center	227 BROADWAY	PATERSON	973-278-2600	40.918761	-74.165263
Paterson Community Health Center	32 CLINTON STREET	PATERSON	973-790-6594	40.924118	-74.172165
St. Joseph's Regional Medical Center	703 MAIN STREET	PATERSON	973-754-2000	40.902598	-74.165595
Kindred Hospital New Jersey - Wayne	224 HAMBURG TPKE	WAYNE		40.948946	-74.207844
St. Joseph's Wayne Hospital	224 HAMBURG TPKE	WAYNE	973-942-6900	40.946882	-74.203132

SALEM COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Inspira Medical Center Elmer	501 W FRONT STREET	ELMER	856-363-1000	39.587796	-75.180757
Memorial Hospital of Salem County	310 WOODSTOWN RD	SALEM	856-935-1000	39.593590	-75.444524
Salem Center	238 EAST BROADWAY	SALEM	856-935-7711	39.567383	-75.462579

SOMERSET COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Carrier Clinic	252 ROUTE 601	BELLE MEAD	908-281-1000	40.465676	-74.682568
East Mountain Hospital	40 EAST MOUNTAIN ROAD	BELLE MEAD	908-281-1500	40.467331	-74.683646
The Matheny School and Hospital	HIGHLAND AVE ST	PEAPACK	908-234-0011	40.712623	-74.640679
Robert Wood Johnson University Hospital Somerset	110 REHILL AVE	SOMERVILLE	908-685-2200	40.567827	-74.595053

SUSSEX COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Neighborhood Health Center - Newton	238 SPRING STREET	NEWTON	973-383-7001	41.055996	-74.749556
Newton Medical Center	175 HIGH STREET	NEWTON	973-383-2121	41.057554	-74.768321
Saint Clare's Sussex SED	20 WALNUT ST.	SUSSEX	973-702-2600	41.207017	-74.603487

UNION COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Runnells Specialized Hospital of Union County	40 WATCHUNG WAY	BERKELEY HEIGHTS	908-771-5700	40.665170	-74.421626
Care One at Trinitas	225 WILLIAMSON ST	ELIZABETH		40.659112	-74.214369
Neighborhood Health Center - Elizabeth	184 FIRST STREET, 2ND FLOOR	ELIZABETH	908-355-4459	40.649992	-74.184213
Trinitas Regional Medical Center	225 WILLIAMSON STREET	ELIZABETH	908-994-5000	40.658962	-74.214889
Children's Specialized Hospital at Mountainside	150 NEW PROVIDENCE ROAD	MOUNTAINSIDE	908-301-5534	40.669729	-74.353933
JFK-Muhlenberg SED	1200 RANDOLPH ROAD	PLAINFIELD	908-668-2000	40.606869	-74.403721
Neighborhood Health Center - Cardinal	950 PARK AVENUE	PLAINFIELD	908-754-5840	40.611956	-74.412231
Neighborhood Health Center - The Healthy Place	427 DARROW AVENUE	PLAINFIELD	908-731-4288	40.607090	-74.431427
Neighborhood Health Services - Plainfield	1700-58 MYRTLE AVENUE	PLAINFIELD	908-753-6401	40.599509	-74.455255
Kindred Hospital New Jersey - Rahway	865 STONE ST	RAHWAY		40.612050	-74.290669
Robert Wood Johnson University Hospital at Rahway	865 STONE STREET	RAHWAY	732-381-4200	40.613136	-74.291272
Overlook Medical Center	99 BEAUVOIR AVENUE	SUMMIT	908-522-5529	40.712348	-74.353963
Summit Oaks Hospital	19 PROSPECT STREET	SUMMIT	908-522-7000	40.713849	-74.362900
Overlook-Union SED	1000 GALLOPING HILL ROAD	UNION		40.674755	-74.265523

WARREN COUNTY

NAME	ADDRESS	CITY	TELEPHONE	LATITUDE	LONGITUDE
Hackettstown Regional Medical Center	651 WILLOW GROVE STREET	HACKETTSTOWN	908-852-5100	40.861750	-74.815926
Zufall Health Center at Hackettstown	653 WILLOW GROVE STREET	HACKETTSTOWN	908-452-5366	40.862032	-74.813354
Neighborhood Health Center - Phillipsburg	427 N MAIN ST	PHILLIPSBURG	908-454-4600	40.700540	-75.195491
St Luke's Warren Hospital	185 ROSEBERRY ST.	PHILLIPSBURG	908-859-6800	40.702045	-75.178457