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Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-1 Category: Aquatic

Statement of Question:

Provide the following information:

a. (EA Engineering 2012) EA Engineering, Science, and Technology. 2012. Byron Station 2011 Fish and Benthos Monitoring and Historical Fish and Benthos Comparisons. July 2012.

Response:

The requested information is attached.

List of Attachments Provided:

1. (EA Engineering 2012) EA Engineering, Science, and Technology. 2012. Byron Station 2011 Fish and Benthos Monitoring and Historical Fish and Benthos Comparisons. July 2012.

EA Engineering 2012
Byron - 464

BYRON STATION

2011 FISH AND BENTHOS MONITORING
AND
HISTORICAL FISH AND BENTHOS COMPARISONS

Prepared for:

Exelon Generation Company, LLC
200 Exelon Way
Kennett Square, Pennsylvania

Prepared by:

EA Engineering, Science, and Technology
444 Lake Cook Road, Suite 18
Deerfield, Illinois 60015

July 2012

BYRON STATION

2011 FISH AND BENTHOS MONITORING AND HISTORICAL FISH AND BENTHOS COMPARISONS

Prepared for:

Exelon Generation Company, LLC
200 Exelon Way
Kennett Square, Pennsylvania

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Richard Monzingo — 7/31/12

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Project Manager
Date

Joe Vondruska — 7/31/12

Joe Vondruska
Project Director
Date

July 2012 14880.01

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1. INTRODUCTION

Fish, benthos, and physicochemical monitoring was conducted during summer 2011 in the Rock River upstream and downstream of the Byron Station to collect current aquatic biological information needed to support the preparation of the Environmental Report that is part of U.S. Nuclear Regulatory Commission (NRC) license renewal application. The 2011 data were compared with historical data to determine if changes in the Rock River have occurred that could be related to station operation.

Byron Station is located near the Rock River in Ogle County about three miles south of Byron, Illinois. Makeup cooling water is withdrawn from the Rock River at river mile 115, two miles to the west of Byron Station and five miles upstream of the Oregon Dam. Byron Station has two generating units and a closed cycle cooling system that uses two natural draft-cooling towers. The cooling towers discharge through a short canal downstream of the intake.

The 2011 monitoring program was comprised of two primary elements.

- Fish sampling using electrofishing and seining gear, and associated physicochemical measurements at locations sampled during previous monitoring efforts.

- Benthos sampling using artificial substrate samplers and a grab sampler or kick net was conducted along transects that were established during pre-operational studies.

The objectives of the 2011 Byron program were to:

- Determine the current species composition, relative abundance, and distribution of fish within the study area and compare results with available historical data from pre-operational studies.

- Determine current taxa richness, density, and relative abundance of benthos within the study area and compare results with available historical data from pre-operational studies.

EA Engineering, Science, and Technology (EA) was contracted by the Exelon Generation Company, LLC to perform these tasks.

2. METHODS

Fish sampling was conducted at three transect locations in the Rock River (R2, R3, and R4) and one stream mouth location (Spring Creek S5) downstream of the blowdown area (Figure 2-1). The river transects represent sampling locations upstream of the cooling tower blowdown discharge (R2); near the discharge (R3); and 1.25 river miles downstream from the discharge point (R4). Each river transect was divided into east bank (L) and west bank (R) sampling locations. River and creek locations were the same as those sampled during previous monitoring efforts. Fish sampling was conducted during August 2011.

Benthos sampling was conducted along three of the transects that were established during the pre-operational studies conducted during the 1970s (R2, R3, and R4). Sampling was conducted along one bank upstream (R2), along both banks adjacent to the discharge (R3), and along both banks downstream (R4) for a total of five sampling locations. Each location was sampled using Hester-Dendy (HD) artificial substrate samplers and a Ponar grab sampler or kick net. Artificial substrates were set in June and retrieved in the August. Ponar grab samples were collected in August when the artificial substrates were recovered.

2.1 FISH

2.1.1 Field and Laboratory

Fish were sampled by electrofishing and seining. Electrofishing was conducted using a boat-mounted boom-type electrofishing system utilizing a 230-V, 5,000 W, 3-phase AC generator equipped with volt/amp meters and a safety cut-off switch. Sampling began no earlier than one-half hour after sunrise and did not extend beyond one-half hour before sunset. Each location was sampled in a downstream direction for 30 minutes. If the downstream boundary of a location was reached before 30 minutes had elapsed, the boat returned to the beginning of the sampling area and a second pass was initiated slightly farther off shore, continuing until the 30-min period expired. The crew consisted of a boat driver and one dipper; each equipped with long-handled, 3/16-inch mesh dip nets for retrieval of stunned fish. Shoreline seining was the second collection method used at each location. A straight seine 25 ft long by 6 ft deep with 3/16-inch ace mesh was used. Two seine hauls were made at each location in a downstream direction, each covering approximately 15 meters of shoreline. Seining and electrofishing were conducted on different days to avoid potential bias caused by each sampling effort.

All fish collected were identified to the lowest possible taxonomic level and counted. For each gear type, at each location, up to 25 randomly selected individuals of each species were measured for total length (millimeters) and weighed (grams). Any remaining individuals of a species were counted and batch weighed. Minnow species (Cyprinidae), excluding carp, goldfish, or carp/goldfish hybrids, were counted and batch weighed only. Specimens that could not be positively identified in the field were preserved in 10% formalin and returned to the laboratory for positive identification. In the laboratory, fish were processed in the same manner as in the field. Fish identifications were conducted utilizing current taxonomic keys or publications including Becker (1983), Pflieger (1975), Smith (1979), and Trautman (1981).

All fish collected were examined for external anomalies. External anomalies were classified as

DELT anomalies (deformities, erosions, lesions, and tumors; Ohio EPA 1987, 1989), external parasites, or "other" abnormalities. The following is a review of DELT anomalies and their causes in freshwater fishes (Ohio EPA 1989):

1) *Deformities* - These anomalies can affect the head, spine, fins, and have a variety of causes including toxic chemicals, viruses, bacteria (e.g., *Mycobacterium* sp.), and protozoan parasites (e.g., *Myxosoma cerebalis*) (Ohio EPA 1989).

2) *Eroded fins* - These are the result of chronic disease principally caused by flexibacteria invading the fins causing a necrosis of the tissue (Post 1983). Necrosis of the fins may also be caused by gryodactylids, a small trematode parasite (Ohio EPA 1989). For this study, fin erosion was separated into three categories: slight erosion -<1/3 of fin eroded; moderate erosion -1/3 -2/3 of fin eroded, and severe erosion ->2/3 of fin eroded.

3) *Lesions and Ulcers* - These appear as open sores or exposed tissue and can be caused by viral (e.g., *Lymphocystis* sp.) or bacterial (e.g., *Flexibacter columnaris*, *Aeromonas* spp., *Vibrio* sp.) infections (Ohio EPA 1989).

4) *Tumors* - Tumors result from the loss of carefully regulated cellular proliferative growth in tissue and are generally referred to as neoplasia. Tumors in wild fish populations can be the result of exposure to toxic chemicals. Baumann et al. (1987) identified polynuclear aromatic hydrocarbons (PAHs) as the cause of hepatic tumors in brown bullheads in the Black River (Ohio). Viral infections (e.g., Lymphocystis) can also cause tumors. Parasites (e.g., *Glugea anomala* and *Ceratomyxa shasta*; Post 1983) may cause tumor-like masses, but are not considered tumors. Parasite masses can be squeezed and broken between the thumb and forefinger whereas true tumors are firm and not easily broken (Ohio EPA 1989).

Only those anomalies visible to the naked eye were recorded. The exact counts of anomalies present (e.g., the number of tumors or lesions per fish) were not recorded. An external anomaly is defined as the presence of externally visible skin or subcutaneous disorders, and is expressed as percent of affected fish among all fish processed (Ohio EPA 1989).

2.1.2 Data Handling and Analysis

Field and laboratory data were entered on forms compatible for computer entry following serialization, diga-coding, and QA/QC checks. Data were managed in a SAS format (Release 8.2) to provide flexibility in reporting study results. Data developed from electrofishing and seining were reported as number and percent abundance for each species and kept separate by location, gear type, and sampling period. Electrofishing data were also reported as catch-per-effort (CPE, number/hr) by location and sampling period. Summarizations of length-frequency distribution were developed for five game species: channel catfish, green sunfish, bluegill, smallmouth bass, and largemouth bass. Relative weight (Wr) was calculated for all applicable species. All observed occurrences of DELT anomalies were summarized in tabular form and reported as percent occurrence by species for each sampling period.

Fish condition was evaluated using the relative weight (*Wr*) index (Wege and Anderson 1978). This index represents a refinement of the relative condition factor concept and allows for interpopulational comparisons by making the standard weight-length regression species-specific rather than population-specific. Relative weight was calculated as:

$$Wr = W/Ws \times 100$$

Where W is the measured weight, Ws is the standard weight and W*r* is the length-specific standard weight predicted by a weight-length regression constructed to represent the species as a whole. Length-specific standard weight functions are in the form:

$$\log_{10} Ws = a + (b \times \log_{10} \text{total length})$$

where *a* (intercept) and *b* (slope) account for genetically determined shape characteristics of a species and yield W*r* values of 100 at particular times of the year for fish that have been well fed (Anderson and Gutreuter 1983).

Intercept, slope, and minimum length values for the *Ws* equation have been published for 36 species and one hybrid (Bister et al. 2000; Anderson and Neumann 1996; Murphy et al. 1991) (Table 2-1). Minimum lengths are established because the accuracy in weighing fish decreases markedly for smaller individuals and minimum lengths represent the length at which the variance to mean ratio for $\log_{10}$ sharply increases (Murphy et al. 1991).

Appendix A provides the Byron Station fish data.

2.2 BENTHOS

2.2.1 Field and Laboratory

Benthos sampling was conducted along three transects that were established during the pre-operational studies conducted during the 1970s (R2, R3, and R4) (Figure 2-1). Sampling was conducted along one bank upstream (R2L), along both banks adjacent to the discharge (R3), and along both banks downstream (R4). Each location was sampled using a combination of Hester-Dendy (HD) artificial substrates and Ponar grabs or kick nets.

Each modified HD artificial substrate sampler consisted of eight 3x3-inch plates constructed from 1/8 inch tempered hardboard and twelve 1/8 plastic spacers. The plates and spacers were arranged on a 1/4 inch eyebolt so that each sampler had three 1/8 inch spaces, three 1/4 inch spaces, and one 3/8 inch space among the plates. The total surface area of a single sampler, excluding the eyebolt, was 0.093 m^2 (1.01 ft^2). A single HD sample consisted of a five HD sampler array, arranged on a single cinder block, and deployed on the stream bottom. Duplicate HD sets were deployed at each location to minimize the potential loss of samplers (e.g., from vandalism). The HD samplers were set on 7 July 2011 and retrieved approximately eight weeks later on 29 August 2011. Retrieval of the HDs was accomplished by enclosing the samplers in a fine-mesh sweep-net and then carefully lifting the sampler array and net to the surface. The HDs were placed into a single labeled container, and preserved with 10% formalin.

The Ponar and/or kick net samples were collected concurrent with the HD sample retrieval. Ponar samples from each location consisted of four composite grab samples at each location

using a full-sized 522.6 cm^2 (81 in^2) Ponar dredge sampler. For locations where the substrate was too coarse to obtain a Ponar grab sample, four 522.6 cm^2 (81 in^2) kick net samples were collected. Each sample was sieved in the field using an U.S. Standard No. 35 (500 μm) mesh sieve and preserved. The material obtained in each sample was examined to qualitatively determine substrate characteristics and percent composition.

Upon arrival at the laboratory, the samples were logged in and accounted for. Based on measured current velocity, the amount of silt/debris caught on the samplers and the numbers and types of organisms observed during retrieval, one of the duplicate HD arrays from each location was initially processed. The second HD array was kept as a backup. The five HDs from each array were disassembled in a water filled enamel pan and cleaned of organisms and debris. This mixture was then passed through a No. 60 (250 μm mesh) U.S. Standard Testing Sieve and preserved in labeled containers containing 10% formalin.

Sorting of each HD and Ponar grab or kick net sample was conducted in grided petri dishes under a dissecting stereo-scope at 10X magnification. The samples were initially pre-picked to remove any large or rare taxa (less than 20 individuals/sample) prior to subsampling. When necessary, a Folsum sample splitter was used to subsample until a manageable number of organisms was achieved. A minimum of 250 organisms in representative proportions was removed from the fractionated samples. Organisms from all sample types were sorted to higher taxonomic levels (generally Class or Order level) and preserved separately in labeled vials containing 70% ethyl alcohol. Sorted samples were routinely checked by senior EA personnel to assure a consistent level of quality and sorting efficiency.

Macroinvertebrate identifications were made to the lowest practical taxonomic level using the most current literature available. Chironomidae (midge) larvae were cleared in 10% potassium hydroxide and mounted in CMC-10 on glass slides prior to identification. For all sample types, specimens were enumerated, coded, and recorded on a standard laboratory bench sheet for data processing.

2.2.2 Data Handling and Analysis

The following data were used for spatial and temporal comparisons:

1) Density (no./m^2) – Density is the total number of individuals collected within a square meter. Extremely high or low density relative to other locations may be indicative of environmental stress.

2) Relative Abundance (%) – Relative abundance is the percent each taxon composes within a sample. Dominance by one taxon or relatively few taxa may suggest greater environmental stress.

3) Dominant Taxa – Based on relative abundance, similarities in the top five dominant taxa among stations suggests balance within the benthic community. Numerical dominance by one or a few taxa may suggest impairment.

4) Total Taxa Richness – Total number of different types of macroinvertebrates. Generally, the higher the taxa richness, the better the quality of the benthic community.

5) EPT Taxa Richness – Collectively, Ephemeroptera, Plecoptera, and Trichoptera are referred to as EPT. EPT richness is the number of taxa identified from these groups. Since EPT taxa are generally considered to be intolerant of environmental stress, a relatively higher number of EPT taxa typically represent a quality benthic community.

6) Tolerance Values – Developed by the Illinois Environmental Protection Agency (IEPA 1987) tolerance values are used to generally characterize the environmental sensitivity of the benthic community. The tolerance values were derived for individual macroinvertebrate taxa and reflect an increasing level of pollution tolerance from 0 (least tolerant) to 11 (most tolerant). A benthos community dominated by taxa with lower tolerance values is typically indicative of a healthy benthic community while a higher tolerance values suggest some degree of impairment.

Appendix B provides the Byron Station macroinvertebrate data.

2.3 PHYSICOCHEMICAL MEASUREMENTS

Water temperature, dissolved oxygen concentration, percent oxygen saturation, specific conductance, and water transparency using a Secchi disk were measured at each electrofishing location. All measurements, except Secchi depth, were made at mid-depth in the water column. Instruments used to measure temperature were checked against a calibrated thermometer. Instruments used to measure DO were calibrated before each measurement. In addition, immediately before each sampling day, they were checked against the Winkler method as specified in *Standard Methods for the Examination of Water and Wastewater* (current edition). The conductivity meter was also checked against a standard before each electrofishing sampling day. Percent oxygen saturation was determined from the relationship between dissolved oxygen in the water and water temperature.

3. RESULTS

3.1 FISH

Fish were collected with boat electrofishing and standard seining at seven locations, six in the Rock River, and one site along Spring Creek. In 2011, samples were collected on 29 and 30 August.

Twenty-eight species plus one hybrid (*Lepomis*) were collected from the study area in 2011. Diversity was highest in the carp/minnow, suckers, and sunfish families, which were represented by seven, seven, and five, respectively (Table 3-1).

A total of 2,577 fish comprised of 28 species and one hybrid weighing 80.5 kg were collected by gears combined during the program. Spotfin shiner (40.2%), bullhead minnow (25.0%), sand shiner (8.3%), gizzard shad (4.9%), bluntnose minnow (4.2%), smallmouth bass (4.0%), freshwater drum (3.8%), bluegill (1.8%), channel catfish (1.8%), and emerald shiner (1.8%) were the ten most abundant species collected in 2011. These ten species comprised 95% of the total abundance. Carp (15.8%), freshwater drum (13.8%), channel catfish (13.2%), silver redhorse (13.1%), quillback (11.6%), shorthead redhorse (6.4%), river carpsucker (6.2%), golden redhorse (5.3%), flathead catfish (2.8%), and bigmouth buffalo (2.7%), comprised 91% of the total biomass collected during the 2011 electrofishing and seining efforts (Table 3-2). No endangered or threatened species were collected (Illinois Endangered Species Protection Board 2011).

3.1.1 Electrofishing

Twenty-seven species and one hybrid were collected by electrofishing as part of the 2011 monitoring study. Spottail shiner (18.9%) was the dominant species followed by gizzard shad (13.8%), bullhead minnow (13.2%), freshwater drum (12.6%), and smallmouth bass (10.5%). Other species that comprised two percent or greater of the catch by number were bluegill (4.2%), bluntnose minnow, (3.6%), green sunfish (3.6%), channel catfish (3.6%), sand shiner (3.1%), emerald shiner (2.6%),and largemouth bass (2.3%) (Table 3-2).

Sport fish species collected during the 2011 electrofishing surveys included northern pike, channel catfish, flathead catfish, white bass, green sunfish, bluegill, largemouth bass, smallmouth bass, walleye, and freshwater drum. Individuals of these species comprised 37.7% of the total catch by number (Table 3-2). Freshwater drum (12.6%), smallmouth bass (10.5%), bluegill (4.2%), green sunfish (3.6%), channel catfish (3.6%), and largemouth bass (2.3%) were the most abundant sport fish species collected. Northern pike, flathead catfish, white bass, largemouth bass, and walleye were occasionally encountered during the 2011 collections.

The highest number (234) of fish was collected upstream of Byron Station's discharge at Location R3R, where freshwater drum (54), spotfin shiner (48), bullhead minnow (36), gizzard shad (29), sand shine, and emerald shiner (both 12) were the most abundant species collected (Table 3-3). The lowest catches occurred at Location S5 and R2L, 64 and 67 fish, respectively. Catches at Locations R2L, R3R, and R4R were similar (87-89 fish). Species composition among sampling zones ranged from 12 taxa (R2R) to 17 taxa (Location R3R, and R4L). Seven species,

gizzard shad, spotfin shiner, bullhead minnow, channel catfish, green sunfish, smallmouth bass, and freshwater drum were collected at each of the seven sampling locations (Table 3-2).

Length frequency distributions were developed for channel catfish, green sunfish, bluegill, smallmouth bass, and largemouth bass collected by electrofishing and seining (Table 3-4). Length frequency distributions were not developed for additional game fish species due to insufficient sample size.

In 2011, nine (24.3%) of the 37 channel catfish collected were young-of-year (YOY) measuring <100 mm in total length, whereas twenty-eight (75.8%) were Age 2 or older (≥210 mm). The majority of the 28 green sunfish collected in 2011 were likely Age 1, with low numbers of YOY and Age 2 also present. All of the bluegill collected from the Rock River in 2011 were relatively small fish. Twenty-two of the 47 fish collected measured less than 49 mm (YOY), and twenty-five were larger than 50 mm but less than 100 mm in total length (Age 1). The majority of the smallmouth bass collected in 2011 were YOY, with some Age 1 and a few Age 2 and older. Young-of-year fish (<70 mm) comprised 83.0% (85) of the smallmouth bass collected. Age 1 fish (90-190 mm) comprised 13 (12.7%) of the 102 smallmouth bass collected. Young-of-year and Age largemouth bass were present. The majority (66.7%) were YOY (Table 3-4).

The 2011 mean electrofishing catch-per-effort (CPE) for fish collected at all locations combined was 224.0 fish/hr (Table 3-3). Mean electrofishing CPE for locations sampled upstream (R2L and R2R) from the Byron Station discharge canal was 154 fish/hr. Mean CPE at locations downstream (R3L, R3R, R4L, R4R, and S1) of the discharge averaged 251.6 fish/hr. Eighteen and 25 taxa were collected from the combined upstream and downstream zones, respectively. CPE's from the left (plant side) shoreline were higher compared to those from the right shoreline locations, 316.7 fish/hr and 162.7 fish/hr, respectively. This was mainly due to higher catches of spotfin shiner at left bank locations and bullhead minnow at Locations R2L and R3L and freshwater drum at Location R3L.

Water quality measurements collected during the 2011 electrofishing survey are summarized by location in Table 3-5. Water temperature was highest (24.9°C) at Location R3L, which is located immediately downstream of the Byron Station discharge canal. Water temperatures at the upstream river locations R2L and R2R were 22.4 and 22.6°C, respectively and at the remaining river stations (R3R and R4) temperatures ranged from 22.7 to 23.1°C. The temperature at stream mouth location S5 was similar (23.0°C). Mean water temperature (seven locations combined) in 2011 was 23.1°C. Dissolved oxygen values in 2011 ranged from 8.8 ppm at Locations R2L to 12.7 ppm at Location R2R. The dissolved oxygen reading at R3L was 9.1 ppm. DO concentrations were consistently above the General Use minimum standards (effective 28 January 2008) of 5 ppm at any time March through July and 3.5 ppm at any time August through February. Conductivity by location in 2011 ranged from 753 µS/cm at Location R2R to 1143 µS/cm at Location R3L. Based on conductivity, the electrofishing gear was adjusted to provide output at about 220 volts at five amps or greater. Transparency (Secchi disk) readings ranged from 35 to 55 cm. at locations R3L and R2L, respectively. Water clarity was adequate for the field crew to observe and retrieve fish stunned by the electrofishing gear. All of the physicochemical measurements were within the range of values suitable to the native fish fauna of the Rock River.

3.1.2 Seining

Fourteen species were included among the 1,794 fish collected in seine samples (Table 3-2). Spotfin shiner (49.6%), bullhead minnow (30.1%), sand shiner (10.5%), bluntnose minnow (4.5%), and smallmouth bass (1.1%) dominated seine catches. These five species comprised 95.8% of all the fish collected by seine. No other species individually comprised more than 1% of the numerical catch. Cyprinids comprised 95.4% of all fish collected by seine.

Spotfin shiner, bluntnose minnow, bullhead minnow, and smallmouth bass were collected at each of the seven sampling locations, whereas, sand shiner was collected at six locations (Table 3-3). The greatest number of fish (965) was collected at location R3L, where spotfin shiner comprised 57.8%, and bullhead minnow 26.0% of all fish captured. The fewest number of fish (24) was collected at Location R3R. Total number of taxa collected by location ranged from six at Locations R2L and R4L to 10 at Locations R2R and R3L.

3.1.3 DELT Anomalies

Only eleven (0.4%) of the 2577 fish collected (combined methods), exhibited one or more forms of DELT (deformations, erosions, lesions, and tumors) anomalies in 2011 (Table 3-6). Emerald shiner (three fish), channel catfish (two fish), smallmouth bass (three fish), and freshwater drum (two fish) had more than one individual afflicted with some form of DELT anomaly. A single specimen of flathead catfish was the only other species that exhibited a DELT anomaly in 2011. In addition, external parasites were noted on 27 fish collected during the current study. Fish with the greatest number of DELT anomalies were collected at R3R (four fish), followed by R2L and R4L (three fish each) and S5 (one fish). The presence of deformations, erosions, lesions, and tumors can indicate environmental stress when a large percentage of the population is afflicted. Conversely, parasitic infestations (anchor worm, black spot, leeches, fish lice, etc.) are not generally indicative of poor water quality. The low incidence of DELT anomalies observed in the local fish community during the course of these studies does not suggest any obvious environmental stress. Fish collected from this portion of the Rock River during August 2011 were generally in good condition.

3.1.4 Relative Weight

Inherent in the development of standard weight (*Ws*) equations used to calculate relative weight (*Wr*) of fish is the objective of modeling the growth form of a species for individuals in better-than-average condition for management purposes. A mean W*r* value close to 100 for a broad range of size groups may reflect optimal health and utilization of food resources for a given population (Anderson and Gutreuter 1983). Mean *Wr* values considerably less than 100 may suggest low food availability and/or disruption of feeding relationships or the presence of various environmental stressors. However, relative weights can also be influenced by several factors including sex, fish size, and spawning condition.

A total of 152 fish (13 species) that met the minimum length criteria of the W*r* equations was collected (Table 3-7). Only three of the 13 species collected were represented by more than 10 specimens. Relative weights by species, as well as by individuals within a species, were highly

variable. Mean relative weights by species ranged from 86 for northern pike to 123 for largemouth bass. Two of the 11 species collected had mean W*r* values of less than 90. All of the species collected in 2002 had mean W*r* scores of ≥85.9. Seven species exhibited mean W*r* scores of greater than or equal to 100 (river carpsucker, shorthead redhorse, white bass, green sunfish, bluegill, largemouth bass, and freshwater drum), indicating that they were in excellent condition. The range in *Wr* values indicates that these species, with the exception of a few individuals, were in average or better than average condition, which suggests no significant health, food availability, and/or feeding relationship problems exists for these species in this portion of the Rock River.

No identifiable change in the fish community occurred in 2011 due to the operation of the Byron Station intake and discharge.

3.2 BENTHOS

During 2011, benthic macroinvertebrate sampling was conducted at five locations on the Rock River near the Byron Station: R2L, R3L, R3R, R4L, and R4R (Figure 2-1). Due to development along the east bank of the Rock River near the pre-operational location R4L, the HD samples for that location were deployed in an area downstream of the development. HD samples were retrieved from each of the five locations. In addition, Ponar or kick net samples were collected successfully at all five locations.

Overall, the benthos collections yielded 57 total taxa (Table 3-8). Chironomidae was the most taxa rich group with 20 taxa followed by Ephemeroptera with 11 taxa and Trichoptera with eight taxa.

3.2.1 Hester-Dendy

The five HD samples yielded a combined 34 total taxa (Table 3-9). Ephemeroptera and Chironomidae were the most taxa rich groups with eight taxa while Trichoptera contributed seven taxa to the total HD richness. Total taxa richness was highest among Locations R3L, R3R, and R4R (21-22 taxa) and slightly lower at Locations R2L and R4L with 17 to18 taxa (Table 3-9). As with total taxa, EPT richness was highest among Locations R3L, R3R, and R4R (10-12 taxa) and slightly lower at Locations R2L and R4L with eight taxa (Table 3-9).

Total density (no./m^2) was similar and substantially higher at Locations R3R, R4L, and R4R compared to Locations R2L and R3L (Table 3-9). The higher densities observed among Locations R3R, R4L, and R4R were due to high numbers of *Glyptotendipes*, which composed 50 percent or more of the total density at each of the five locations (Table 3-9). Overall, dominant taxa among the five locations exhibited some similarities but no longitudinal trends.

HD Dominant Taxa in Order of Percent Abundance

R2L	R3L	R3R	R4L	R4R
Glyptotendipes	*Glyptotendipes*	*Glyptotendipes*	*Glyptotendipes*	*Glyptotendipes*
M. terminatum	Turbellaria	*Thienemannimyia* grp. *Parachironomus* *P. flavum*	Turbellaria	Turbellaria

Stenacron	*D. simpsoni*	*Tricorythodes*	*Rheotanytarsus*	*Rheotanytarsus*
Tricorythodes	*Thienemannimyia* grp. *P. flavum*	*Stenacron*	*Thienemannimyia* grp.	*Stenacron*
Rheotanytarsus	*Caenis*	Turbellaria	*Tricorythodes*	*M. exiguum*

Based on the environmental tolerance values developed by the Illinois Environmental Protection Agency (IEPA 1987), the only tolerant taxon among the dominants was *Glyptotendipes*. In contrast, the remaining dominant taxa are considered facultative. The Chironomidae taxon *Glyptotendipes* was dominant at all five locations. In addition, Turbellaria was among the dominant taxa at four of the five locations while *Stenacron*, *Tricorythodes*, and *Thienemannimyia* grp. were common at three of the five locations.

3.2.2 Ponar and Kick Net Samples

Due to the abundance of coarse substrate, kick net samples were substituted for Ponar samples at Location R3R while Ponar grab samples were collected at Locations 2L, R3L, R4L, and R4R. Combined, the Ponar grab and kick net samples from the five locations yielded 41 total taxa and 10 EPT taxa (Table 3-10). Chironomidae was the most taxa rich group with 18 taxa while eight Ephemeroptera taxa were also observed. Total taxa richness was highest among Locations R2L, R3R, and R4R (21-28 taxa) and noticeably lower at Locations R3L and R4L with 10 to13 taxa (Table 3-10). As with total taxa, EPT richness was highest among Locations R2L, R3R, and R4R (five to seven taxa) and lower at Locations R3L and R4L with zero and one EPT taxon, respectively (Table 3-10).

Total density (no./m^2) was similar and noticeably higher at Locations R2L, R4L, and R4R compared to Locations R3L and R3R (Table 3-10). The higher densities observed at Location R2L was largely due to a high number of Tubificidae. In addition to Tubificidae, density was also affected by a high number of *Polypedilum halterale* grp. at Location R4L and *Glyptotendipes* at R4R. Tubificidae was among the dominant taxa at all five locations while Glyptotendipes was among the dominants at four of the five locations, and Corixidae, *Cryptochironomus*, and *Polypedilum halterale* grp. were common among three of the five locations.

Ponar and Kick Net Dominant Taxa in Order of Percent Abundance

R2L Ponar	R3L Ponar	R3R Kick Net	R4L Ponar	R4R Ponar
Tubificidae	Tubificidae	Corixidae	Tubificidae	Tubificidae
Cryptochironomus	*Cryptochironomus*	Tubificidae	*P. halterale* grp.	*Glyptotendipes*
Corixidae	*P. halterale* grp.	*Glyptotendipes*	*Chironomus*	*Cryptochironomus*
Glyptotendipes	*Procladius*	*Caenis*	*Glyptotendipes*	*P. halterale* grp.
Procladius	*Chironomus*	*Dubiraphia*	Corixidae	*Dubiraphia*

Based on IEPA environmental tolerance values (IEPA 1987), relatively tolerant taxa such as Tubificidae, *Procladius*, *Chironomus*, *Cryptochironomus*, and *Glyptotendipes* composed the majority of the benthos at all locations. Intolerant facultative taxa were generally less abundant among the locations.

Overall, the spatial differences in terms of total and EPT richness differed primarily by substrate composition. The single kick net sample was collected from Location R3R, which was dominated by coarse substrate (i.e., cobble, and gravel), whereas Ponar grabs were collected in areas dominated by fine substrate (silt and sand).

Kick Net and Ponar Percent Substrate Composition

Substrate	R2L	R3L	R3R	R4L	R4R
Cobble			40		
Gravel	20	5	40	5	40
Coarse Sand	5	15	20	10	20
Fine Sand	5	5		10	15
Silt	50	70		60	20
Detritus	20	5		15	5

The lowest total and EPT taxa richness were observed at Locations R3L and R4L (Table 3-10). As indicated by the substrate composition at each location, the higher total and EPT taxa richness at Locations R2L, R3L, and R4R generally corresponded with the higher percentage of coarse substrate such as cobble and gravel. Locations R3L and R4L were dominated by silt with relatively little gravel and no cobble. In the absence of water quality impacts, benthic community quality generally increases with habitat and substrate complexity. Coarse substrate increases complexity related to surface area, cover, and flow. Intolerant EPT taxa generally prefer areas with good exchange associated with flow as well as coarse and clean substrate while tolerant taxa will often dominate relatively poor habitat with primarily depositional sediment. As such, it appears the spatial differences observed among the Ponar and kick net samples are attributable to changes in habitat quality.

4. DISCUSSION

4.1 FISH

Baseline ecology studies were conducted in the Rock River near the Byron site in 1972-1974 (Commonwealth Edison 1973, U.S. Nuclear Regulatory Commission 1974). Construction of Byron Station began in 1975. A five year construction/pre-operational biological monitoring of the Rock River in areas upstream and downstream of the river intake screenhouse and discharge location also began in 1975 and ended in 1979. Another five-year program to monitor fish and the occurrence of *Aeromonas hydrophila* (a pathogenic bacteria) during the August time period was conducted from 1983-1987. During this time period commercial operation of Byron Unit 1 began on 16 September 1985 followed by Unit 2 on 2 August 1987. Based on the date of commercial operation, pre-operational studies were conducted from 1975-1979 and 1983-1985. Operational fish and *Aeromonas* studies were conducted in 1986-1987. Operational fish surveys were conducted in August from 1988-2002. The most recent fish study was conducted in August 2011 and the results are presented in Section 3.1 of this report. Fish were examined for external anomalies, species composition, and relative abundance were determined, and catch-per-unit-effort (CPE) and relative weights were calculated.

4.1.1 Operational Studies

Including the 2011 fish survey, 15 annual operational fish surveys have been conducted at the Byron Station. All surveys were conducted during August with similar electrofishing and seining gear. The 14 consecutive surveys (1988-2002) sampled the same locations, as did the 2011 survey, with the exception that only one creek mouth was sampled in 2011.

The number of fish species collected from 1986 through 2002 ranged from 34 in 1991and 2002 to 43 in 2001 (Table 3-1, Lawler, Matusky, and Skelly Engineers 2001 and 2003). Twenty-eight species were collected in 2011. Differences in species composition between years were typically associated with incidental catches of less common or occasional species. Exceptions to this were the increased abundance of walleye beginning in the mid-1980's due to a fingerling stocking program, the occurrence of sauger beginning in 1992 as a result of introductions to the Rock River drainage in Wisconsin, the occurrence of gizzard shad beginning in 1990 (presumably due to escapement from privately owned impoundments in the drainage), and the recent occurrence of goldfish in some years also beginning in 1990.

Electrofishing catch-per-effort (CPE) varied during the 14 consecutive annual surveys from 65.3 to 406.5 fish per hour (Table 3-3, LMS 2003). The lowest and highest CPE was obtained over a short time period: 1986 to 1989. High numbers of cyprinids (minnows) and YOY of several taxa, particularly catostomids (suckers) characterized the 1988 and 1989 catches. Electrofishing CPE from 1990 to 2002 was less variable ranging from 81.4 to 281.3 fish per hour. In 2011, the CPE for the combined locations was within this range; 224.0 fish per hour. Catches in 1991 and 1992 declined to 115.2 and 81.4 fish/hr, respectively, due to an unusually low contribution of cyprinids to the catch. Catch rates from 1993 to 1999 were similar to or slightly higher than those reported in 1990 (205.5 fish/hr). The decline in CPE observed in 2000 was likely due to the relatively high river flows that occurred during the August sampling period. The increase in

CPE in 2001 was attributed to an increase in the numbers of cyprinids, gizzard shad, and freshwater drum collected. Low cyprinid and very low gizzard shad numbers contributed to the lower CPE (157.0 fish/hour) in 2002, along with high winds which hampered sampling in shallow waters. Much of the annual variability in electrofishing CPE can be attributed to the collection of cyprinid species, and perhaps to a lesser extent, catostomids (LMS 2003).

Modifications to the river channel at Locations R2R and R2L were made in the fall of 1993. These modifications included the construction of two wing dams within the boundaries of Location R2R and the placing of several Iowa Vanes in front of the Byron Station intake (downstream extent of Location R2L). These structures were designed to divert stream flow and to prevent sediment deposition at the intake. Both structures altered flow direction, current velocity, and substrate composition while providing additional cover at those sites, alterations that could influence the biotic community. Consequently, special attention was given to those locations from 1994 to 2002 to determine if any notable changes in the fish assemblage had occurred. Catch rates at these locations since 1996 have typically been higher than those of previous years; however, the increase in CPE during the last few years of the program was attributed primarily to gizzard shad, which dominated the catch at both locations. Since 1990, gizzard shad abundance has increased substantially, particularly in the vicinity of Byron Station's intake and discharge. With the exception of gizzard shad, there has been no notable consistent change in species richness at either of these two locations through 2002 (LMS 2003).

A total of 1,352 fish was collected by seine from sampling locations near Byron Station in 2002 and 1,794 in 2011. These numbers are similar to the 1,537 and 1,644 fish that were collected at these locations in 2001 and 2000, respectively. Since 1993, the total number of fish collected by seining has ranged from 766 fish in 1999 to 4,336 fish in 1996; however, species richness has been relatively consistent during all nine survey years. The number of species collected by seine from 1993-2001 ranged from 22 to 30. The 15 species collected in 2002 and the 14 species collected in 2011 were the lowest recorded in this 11-year seining data set (1993-2002, 2011). Part of this difference could be attributed to rough water conditions due to high winds during sampling, especially in 2002.

No species listed as endangered or threatened by Illinois were observed in during the operational fish surveys (IESPB 2011).

Episodic occurrences of infections caused by *Aeromonas* had occurred in the Rock River prior to the construction and operation of Byron Station. The IDNR was concerned that the thermal discharge from Bryon Station could increase infections. Increases in bacterial infections caused by *Aeromonas* were not observed.

4.1.2 Pre-Operational Studies

The baseline ecology studies 1972-1973 (EAI 1973) and 1973-1974 (EAI 1974-75) were conducted by Environmental Analysts Inc (EAI). Seasonal fish sampling was conducted by seining and electrofishing. In 1974, hoop netting was added to the gear utilized to sample fish. Each river station was electrofished for 15 minutes on each side of the river. The electroshocking surveys utilized a 230-V, 2,000 W, 3-phase AC generator. Seine samples were

collected with either a 10-ft or a 50-ft beach seine with ¼-inch mesh. The seine catch was expressed in numbers of fish caught per square foot of net coverage. Condition factors for 10 individuals of each of the five most important species were calculated to provide indices of physical condition. All fish collected were examined for external parasites.

A total of 1,102 fish was collected by electrofishing, seining, and hoop nets from sampling locations near Byron Station during the 1973-1974 program. Thirty-one species, representing eight families of fish, were collected, compared with a total of 42 species collected during the 1972-1973 baseline study (Commonwealth Edison 1978). Carpsuckers (*Carpiodes* sp.) were the predominant species collected during the 1973-1974 program, accounting for 40.3% (river carpsucker 25.0% and quillback 15.3%) of the total number of fish collected. Channel catfish, most of which were collected by hoop nets that were only used from 1974 through the early operational studies), accounted for 19.1% of the total catch, and common carp accounted for 13.0%. The greatest differences between the 1973-1974 and the 1972-1973 baseline studies were the greater numbers and higher relative abundance of channel catfish collected during the 1973-1974 program and the greater variety of minnows (*Pimephales* sp.), catfishes, and sunfishes (*Lepomis* sp.) collected during the 1972-1973 study. Commercial/rough fish accounted for 62.7% of the total number of fish collected during the 1973-1974 monitoring program (Commonwealth Edison 1978).

Of the 31 species of fish collected during the 1973-1974 sampling program, 14 were game species. Although game fish accounted for over 30% of the total number of fish collected, 62% of the game fish (or 19% of the total number of all the species caught) were channel catfish. The composition of fish samples taken from river stations R-2, R-3, and R-4 did not differ substantially by station in terms of the number of species or fish. The percentage of forage fish in samples from river Stations R-1 through R-5 was only 7.6% during the 1973-1974 monitoring program, as compared with 47.8% forage fish reported in the 1972-1973 baseline study. The decrease in the relative abundance of forage fish was due in part to a decrease in seining effort at a variety of shallow areas and to the increase in the relative abundance of channel catfish in the 1974 river samples that resulted from the addition of hoop netting to the sampling program (Commonwealth Edison 1978).

Seasonal changes in the distribution of fish within the study area may be indicated by the sampling results; however, daily fish movements due to weather and river flow conditions also influences sample size and composition. Since all fish sampling was conducted in shoreline areas, the absence or decline in the number of a fish species may be attributable either to local movements from shallow to deep water or to movements to upstream or downstream areas of the river for purposes such as spawning or feeding. Carp and carpsuckers were generally present at the sampling stations throughout the 1973-1974 study. Game fish, other than channel catfish, were not collected in sufficient numbers to indicate seasonal changes in distribution. Channel catfish appeared to inhabit deeper mid-channel areas of the river during the cooler months and to inhabit shoreline areas or the entire river during the warmer months (Commonwealth Edison 1978).

Condition factors (K) were determined for individuals of 14 species of game fish collected from the river and creek stations from September 12, 1973 through November 1, 1974. As does the

relative weight (W*r*) calculation used in the operational studies, differences in values can be caused by a variety of environmental factors and biological factors (e.g., food availability and standing crop). Changes in condition can indicate that a factor or combination of factors have altered the growth characteristics of an individual. Condition factors were reported by season and by the total length range for each species; however, the low number of fish collected within each season and of the length range for most species made valid interpretations of condition factor data difficult. Other than channel catfish, fish species were not collected in sufficient numbers to allow for a discussion of the condition of the fish. During the spawning season (March and April), more variability in condition factors would be expected within each length group because of probable groupings of gravid males, gravid females, and spent fish. In most length groups, channel catfish collected in March and April 1974 had the greatest range in K values for all months represented. In the Rock River, mean K values for channel catfish were higher in October and November 1974 than in September and October 1973. Seasonal trends in mean K values were not indicated for channel catfish collected in this study. The mean of K factors for collections where 10 or more individuals were collected ranged from 0.70 to 0.90 (Commonwealth Edison 1978). The values are in the range reported in the literature (Carlander 1969).

Information on external parasites on fish prior to plant operation was obtained from the construction/ pre-operational studies. Espey Huston &Associates, Inc annually conducted construction/pre-operational sampling near Byron Station from 1975-1979. Fish sampling was conducted in May, August, and November, using a variety of collection techniques (electrofishing, seining, and hoop nets) at a number of locations including river locations R2, R3, and R4 and creek mouth location S5. Of the fish collected during the 1977 study, 2.7% (229) were infested. The parasites included *Neascus* (black spot disease), unidentified leeches, and the parasitic copepod, *Lernaea*. Six species represented 71.6% of the infested specimens: spotfin shiner (76), silver chub (25), emerald shiner (24), spottail shiner (15), bullhead minnow (14), and channel catfish (10) (Espey, Huston, and Associates 1978).

4.1.3 Summary

The fish community in the Rock River is comprised of forage, game/sport, and commercial/ rough fish as would be expected in a midwestern stream. Fish species richness was similar for the pre-operational sampling periods 1972-1974, 1975-1979, and 1983-1985 and the operational sampling period 1986-2002 and 2011. During the 1972-73 and 1973-74 baseline studies, 42 species, and 31 species were collected, respectively. During the 1975-1979, and 1983-1985 pre-operational studies the number of species collected ranged from 25 to 38 and during the operational studies the range was 28 to 43 species (Table 3-1, LMS 2003). The number of species was slightly higher during the operational studies partly due to the planned or accidental introductions into the Rock River sauger, goldfish, and gizzard shad, which were not present during the early study years.

The pre-operational and operational fish assemblages were similar. They included forage fish such as emerald shiner, spottail shiner, spotfin shiner, sand shiner, and bluntnose minnow. and gizzard shad; game species such as channel catfish, bluegill, smallmouth bass, largemouth bass, and walleye; and rough/commercial species such as common carp, river carpsucker, quillback,

and other sucker species (buffalo and redhorse). There were differences in abundance for some species, some likely the result of the use of baited hoop nets in the pre-operational studies beginning in 1974. This gear is efficient for collecting catfish and sucker species like redhorse and buffalo. Gizzard shad, which has been collected since 1990, has become one of the dominant species. During the 1973-74 survey, a number of crappie and white crappie were collected, which was not the usual case during the other pre-operational or operational surveys as low numbers were collected most years (LMS 2003).

The mean electrofishing CPEs for the operational studies were within the historical pre-operational ranges, although the operational annual rates were often higher. Mean electrofishing CPE for fish collected at all locations combined for the pre-operational sampling periods 1975-1979 and 1983-1985 periods was 75.48 fish/hr (Table 3-3, LMS 2003). The mean CPE value varied from 18.8 fish/hour in 1976 to 145.3 fish/hour in 1978. The mean electrofishing CPE for the operational sampling period 1986-2002 and 2011 was higher at 200.5 fish/hour (varied from 65.3 in1986 to 406.5 fish per hour in 1988).

Fish with external DELT anomalies and external parasites in 2011 remained low, 1.4%, whereas in 1977, 2.7% had external parasites, of which black spot disease was the most prevalent. Black spot disease was observed on five individuals in 2011. Low numbers of channel catfish and smallmouth bass had external parasites in both pre-operational and operational studies.

No species on the Illinois list of endangered and threatened species have been recorded throughout the monitoring history for Byron Station.

The NPDES permit for Byron Station was renewed in January 2011 by the IEPA. After agency review of the renewal application and other data available to agency staff, it was determined that Byron Station as operated was in compliance with environmental regulations, in particular thermal and intake issues. Special Condition 3 states, "Byron meets the allowed mixing criteria for thermal discharges pursuant to 35 IAC 302.102. No reasonable potential exists for the discharge to exceed thermal water quality standards". Special Condition 20 states, "Exelon Generation Company's demonstration for the Byron Nuclear Power Station in accordance with Section 316(b) of the Clean Water Act was approved by IEPA by a letter dated May 15, 1989. It is determined that no additional intake monitoring or modification is being required for reissuance of this NPDES Permit". Followed by Special Condition 21 that states "Exelon Generation Company's Byron Nuclear Power Station has been deemed to have met the applicable national performance standards and will not be required to demonstrate further that the Rock River Intake Structure meets the specified impingement mortality and entrainment performance standards pursuant to 40 CFR 125.94(a)(1)(l). This determination was made because of the use and operation of the cooling towers".

It is reasonable to expect that if the operation of Byron Station was adversely affecting fish populations, then it would be manifested in consistently lower catches and/or reduced species diversity during the operational studies conducted near Byron Station and that has not been observed.

4.2 BENTHOS

4.2.1 Pre-Operational Studies

As with the fisheries studies, benthic sampling was a component of the pre-operational aquatic monitoring program that was conducted by EAI from 1973 to 1974 (Commonwealth Edison 1978) and Espey, Huston, & Associates, Inc. from 1977 to 1978 (Espey, Huston, & Associates 1978). Although the pre-operational monitoring programs were more extensive, the sampling methods (i.e., Ponar dredge and HD artificial substrates) and locations were similar to the 2011 survey.

In the 1973-1974 sampling year, HD samples were collected monthly compared to six Ponar sampling events between September 1973 and October 1974 (Commonwealth Edison 1978). For the year, 115 taxa were collected in the HD samples while 101 taxa were observed in the Ponar samples. Ponar taxa richness was highest among samples dominated by coarse gravel while samples dominated by silt yielded nearly 50 percent fewer taxa. Among the HD samples, Chironomidae and Ephemeroptera were the most taxa rich groups whereas Chironomidae, Coleoptera, Ephemeroptera, and non-Chironomidae Diptera were the most taxa rich groups among the Ponars. Combined, Chironomidae, Ephemeroptera, and Tubificidae dominated the 1973-1974 benthos collections in terms of abundance; however, Tubificidae was the dominant group in six of the 12 sampling months.

In the 1977-1978 sampling year, HD samples were collected bi-monthly between April and September while Ponar sampling was conducted quarterly (Espey, Huston, & Associates 1978). Although taxa richness was characterized as being high at all locations, data were not available to quantify that assessment. September HD mean total density ranged from 3,329 to 11,004 organisms/m^2 whereas mean Ponar total density from August was much lower ranging from 397 to 1,512 organisms/m^2. In terms of abundance, Chironomidae dominated the HD collections throughout the year while Chironomidae, Ephemeroptera, and Trichoptera were the most abundant groups in September. *Tanytarsus* and *Glyptotendipes* were the two most abundant taxa collected in the HD samples during 1977-1978. In the Ponar samples, Tubificidae and Chironomidae dominated the collections overall while Tubificidae, Chironomidae, and Ephemeroptera were most abundant groups in August and November. Tubificidae and *Chironomus* were the most abundant taxa collected in the Ponars throughout the year. Overall, no effects related to pre-operational activities were observed among the HD and Ponar samples results in the 1977-1978 sampling year.

4.2.2 Summary

Comparisons between the pre-operational and 2011 benthos surveys are challenging due largely to variations in sampling methods such as different types of modified HDs (four round plates 0.061 m^2 [rarely used now] versus five square plates 0.093 m^2), number of sampling events, and differences in taxonomic resolution among studies. In addition, although the general locations are known, the exact locality of where the HDs were deployed and the benthic grabs were collected during pre-operational studies compared to 2011 is unknown. Although the 2011 samples were treated separately by bank, some of the pre-operational data combined these

results. Finally, the effects of inherent changes that have occurred in the Rock River and watershed over the past 30+ years are not completely understood. Despite these differences and challenges, the pre-operational and 2011 results exhibited some similarities.

For the HD results, Chironomidae was the dominant group in terms of richness and abundance in both the pre-operational studies as well as the 2011 survey (Espey, Huston, & Associates 1978). In addition, *Glyptotendipes* was among the most dominant taxa identified from HD samples collected during the 1977-1978 pre-operational surveys and was also the most dominant taxon among each of the five HD locations in 2011.

Among the Ponar results, Tubificidae and Chironomidae were among the two most abundant groups during both pre-operational studies (Commonwealth Edison 1978; Espey, Huston, & Associates 1978). Specifically, Tubificidae and *Chironomus* were the two dominant taxa in the 1977-1978 Ponars. In 2011, Tubificidae was the dominant taxon among four of the five locations and Chironomus was among the dominant taxa at two of the five locations. In addition, some trends were consistent among years. In both the 1973-1974 and the 2011 Ponars, samples with abundant coarse substrate (cobble and gravel) tended to exhibit the highest taxa richness while samples with fine substrate (silt) as the primary component had lower richness.

Although some differences in the benthic community were evident between years, overall, the 2011 benthic community in the Rock River near the Byron Station was rather similar to the pre-operational benthic community observed. Community structure remained generally consistent as evidenced by the dominant taxa among studies. In addition, trends observed 30+ years ago were evident in the 2011 collections. In both surveys, longitudinal changes appeared to be due to differences in substrate quality rather than construction or operation of the Byron Station. Just as the 1977-1978 benthic surveys showed no effects related to pre-operational activities, the 2011 survey suggests that there are also no operational effects.

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FIGURES

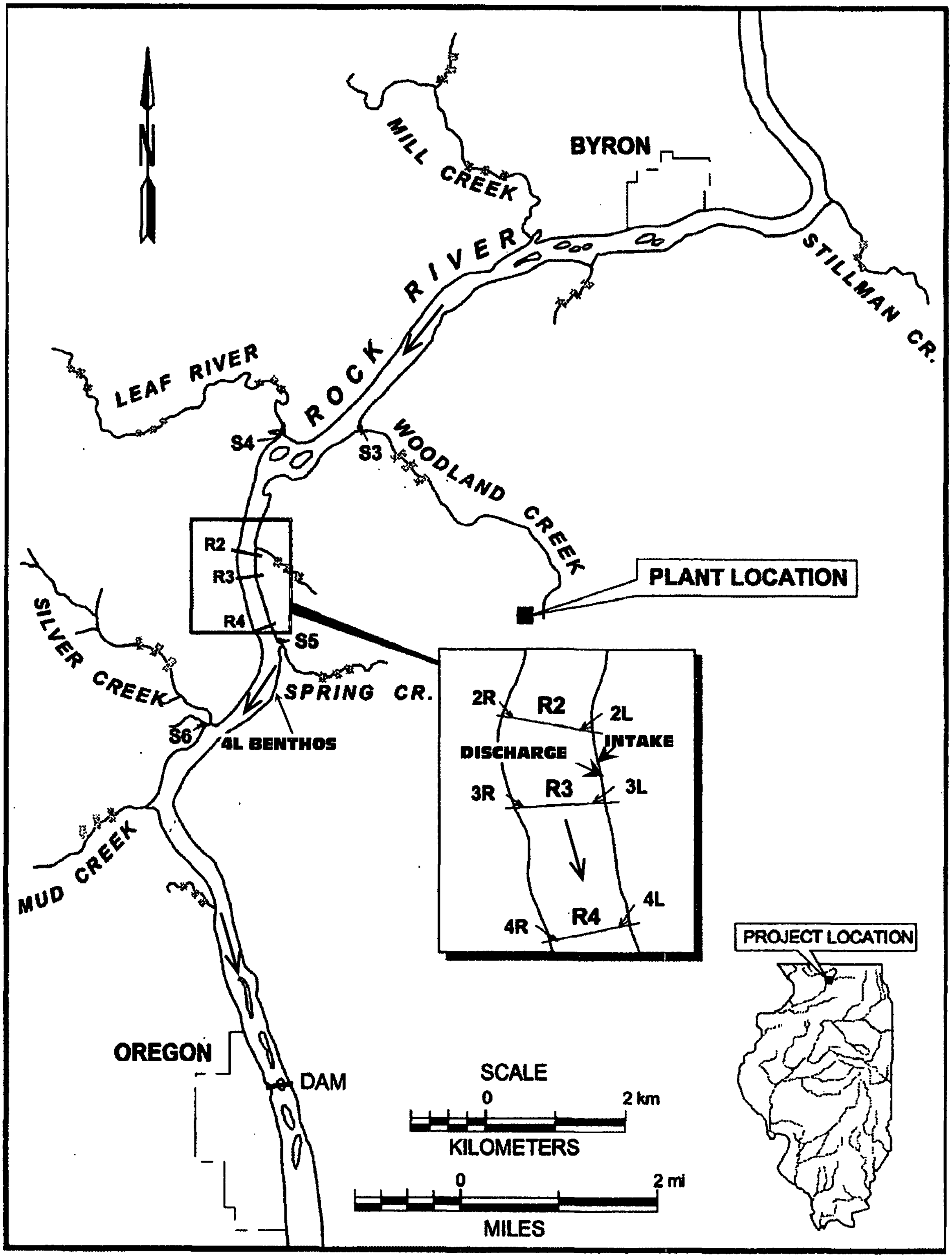

Figure 2-1 Sampling locations in the Rock River near Byron Station

TABLES

Table 2-1. Intercept (a) and Slope (b) Parameters for Standard Weight (Ws) Equations with Minimum Total Lengths (mm) Recommended for Application[(a)].

Species	Intercept (a)	Slope (b)	Minimum Length	Reference or developer
Longnose gar	-6.811	3.449	200	Bister et al. (2000)
Gizzard shad	-5.376	3.170	180	Anderson and Gutreuter (1983)
Rainbow trout (lentic)	-4.898	2.990	120	Simpkins and Hubert (unpublished)
Brook trout	-5.085	3.043	130	Whelan and Taylor (1984)
Chinook salmon	-4.661	2.901	200	Halseth et al. (1990)
Northern pike	-5.437	3.096	100	Willis (unpublished)
Common carp	-4.639	2.920	200	Bister et al. (2000)
Golden shiner	-5.593	3.302	50	Liao et al. (1995)
Bigmouth buffalo	-5.069	3.118	150	Bister et al. (2000)
Smallmouth buffalo	-5.298	3.208	200	Bister et al. (2000)
River carpsucker	-4.839	2.992	130	Bister et al. (2000)
White sucker	-4.755	2.940	100	Bister et al. (2000)
Shorthead redhorse	-4.841	2.962	100	Bister et al. (2000)
Black bullhead	-4.974	3.085	130	Bister et al. (2000)
Yellow bullhead	-5.374	3.232	60	Bister et al. (2000)
Brown bullhead	-5.076	3.105	130	Bister et al. (2000)
Channel catfish	-5.800	3.294	70	Brown et al. (1995)
Flathead catfish	-5.542	3.230	130	Bister et al. (2000)
White perch	-5.122	3.136	80	Bister et al. (2000)
White bass	-5.066	3.081	115	Brown and Murphy (1991)
Yellow bass	-5.142	3.133	70	Bister et al. (2000)
Striped bass	-4.924	3.007	150	Brown and Murphy (1991)
Hybrid Morone	-5.201	3.139	115	Brown and Murphy (1991)
Rock bass	-4.827	3.074	80	Bister et al. (2000)
Green sunfish	-4.915	3.101	60	Bister et al. (2000)
Pumpkinseed	-5.179	3.237	50	Liao et al. (1995)
Warmouth	-5.180	3.241	80	Bister et al. (2000)
Bluegill	-5.374	3.316	80	Hillman (1982)
Largemouth bass	-5.316	3.191	150	Wege and Angerson (1978)
Smallmouth bass	-5.329	3.200	150	Kolander et al. (1993)
Black crappie	-5.618	3.345	100	Neumann and Murphy (1991)
White crappie	-5.642	3.332	100	Neumann and Murphy (1991)
Sauger	-5.492	3.187	70	C.S. Guy (unpublished)
Walleye	-5.453	3.180	150	Murphy et al. (1990)
Yellow perch	-5.386	3.230	100	Willis et al. (1991)
Freshwater drum	-5.419	3.204	100	Blackwell et al. (1995)

(a) Sources: Bister et al. 2000, Anderson and Neumann 1996, and Murphy et al. 1991.

TABLE 3-1. LIST OF COMMON AND SCIENTIFIC NAMES OF FISH TAXA COLLECTED NEAR BYRON STATION, AUGUST 2011.

COMMON FAMILY NAME	COMMON NAME	SCIENTIFIC NAME
HERRINGS	GIZZARD SHAD	Dorosoma cepedianum
CARPS AND MINNOWS	SPOTFIN SHINER	Cyprinella spiloptera
	COMMON CARP	Cyprinus carpio
	COMMON SHINER	Luxilus cornutus
	EMERALD SHINER	Notropis atherinoides
	SAND SHINER	Notropis stramineus
	Notropis sp.	Notropis sp.
	BLUNTNOSE MINNOW	Pimephales notatus
	BULLHEAD MINNOW	Pimephales vigilax
SUCKERS	RIVER CARPSUCKER	Carpiodes carpio
	QUILLBACK	Carpiodes cyprinus
	ICTIOBINAE sp.	Carpiodes sp. &/or Ictiobus sp.
	BIGMOUTH BUFFALO	Ictiobus cyprinellus
	SILVER REDHORSE	Moxostoma anisurum
	BLACK REDHORSE	Moxostoma duquesnei
	GOLDEN REDHORSE	Moxostoma erythrurum
	SHORTHEAD REDHORSE	Moxostoma macrolepidotum
NORTH AMERICAN CATFISHES	CHANNEL CATFISH	Ictalurus punctatus
	FLATHEAD CATFISH	Pylodictis olivaris
PIKES	NORTHERN PIKE	Esox lucius
NEW WORLD SILVERSIDES	BROOK SILVERSIDE	Labidesthes sicculus
TEMPERATE BASSES	WHITE BASS	Morone chrysops
SUNFISHES	GREEN SUNFISH	Lepomis cyanellus
	ORANGESPOTTED SUNFISH	Lepomis humilis
	BLUEGILL	Lepomis macrochirus
	Lepomis sp.	Lepomis sp.
	Lepomis HYBRID	Lepomis HYBRID
	SMALLMOUTH BASS	Micropterus dolomieu
	LARGEMOUTH BASS	Micropterus salmoides
PERCHES	JOHNNY DARTER	Etheostoma nigrum
	WALLEYE	Sander vitreus
DRUMS AND CROAKERS	FRESHWATER DRUM	Aplodinotus grunniens

Table 3-2. Summary of Fish Collected by Electrofishing and Seining in the Rock River near Byron Station, August 2011.

	Electrofishing				Seining				Gears Combined					
Species	No.	%	Kg	%	No.	%	Kg	%	No.	%	Kg	%	Minimum Length (mm)	Maximum Length (mm)
GIZZARD SHAD	108	13.8	0.862	1.1	17	0.9	0.079	8.6	125	4.9	0.941	1.2	43	165
NORTHERN PIKE	1	0.1	2.050	2.6	--	--	--	--	1	0.0	2.050	2.5	704	704
COMMON CARP	10	1.3	12.737	16.0	1	0.1	0.002	0.2	11	0.4	12.739	15.8	43	576
EMERALD SHINER	20	2.6	0.032	0.0	17	0.9	0.003	0.3	37	1.4	0.035	0.0	--	--
COMMON SHINER	1	0.1	0.001	0.0	--	--	--	--	1	0.0	0.001	0.0	--	--
SPOTFIN SHINER	148	18.9	0.083	0.1	889	49.6	0.299	32.7	1,037	40.2	0.382	0.5	--	--
SAND SHINER	24	3.1	0.007	0.0	189	10.5	0.051	5.6	213	8.3	0.058	0.1	--	--
Notropis sp.	1	0.1	0.001	0.0	1	0.1	0.001	0.1	2	0.1	0.002	0.0	--	--
BLUNTNOSE MINNOW	28	3.6	0.029	0.0	81	4.5	0.038	4.2	109	4.2	0.067	0.1	--	--
BULLHEAD MINNOW	103	13.2	0.077	0.1	540	30.1	0.213	23.3	643	25.0	0.290	0.4	--	--
RIVER CARPSUCKER	5	0.6	4.980	6.3	--	--	--	--	5	0.2	4.980	6.2	374	498
QUILLBACK	12	1.5	9.377	11.8	--	--	--	--	12	0.5	9.377	11.6	96	452
BIGMOUTH BUFFALO	1	0.1	2.150	2.7	--	--	--	--	1	0.0	2.150	2.7	504	504
SILVER REDHORSE	12	1.5	10.545	13.2	--	--	--	--	12	0.5	10.545	13.1	228	543
BLACK REDHORSE	1	0.1	0.420	0.5	--	--	--	--	1	0.0	0.420	0.5	336	336
GOLDEN REDHORSE	4	0.5	4.252	5.3	--	--	--	--	4	0.2	4.252	5.3	139	543
SHORTHEAD REDHORSE	6	0.8	5.170	6.5	--	--	--	--	6	0.2	5.170	6.4	293	463
ICTIOBINAE sp.	--	--	--	--	7	0.4	0.008	0.9	7	0.3	0.008	0.0	39	52
CHANNEL CATFISH	28	3.6	10.588	13.3	9	0.5	0.010	1.1	37	1.4	10.598	13.2	42	543
FLATHEAD CATFISH	2	0.3	2.220	2.8	--	--	--	--	2	0.1	2.220	2.8	403	512
BROOK SILVERSIDE	2	0.3	0.002	0.0	--	--	--	--	2	0.1	0.002	0.0	--	--
WHITE BASS	3	0.4	0.311	0.4	--	--	--	--	3	0.1	0.311	0.4	110	224
GREEN SUNFISH	28	3.6	0.516	0.6	--	--	--	--	28	1.1	0.516	0.6	46	121
ORANGESPOTTED SUNFISH	--	--	--	--	2	0.1	0.002	0.2	2	0.1	0.002	0.0	29	37
BLUEGILL	33	4.2	0.123	0.2	14	0.8	0.019	2.1	47	1.8	0.142	0.2	25	89
Lepomis HYBRID	1	0.1	0.022	0.0	--	--	--	--	1	0.0	0.022	0.0	--	--
Lepomis sp.	--	--	--	--	2	0.1	0.002	0.2	2	0.1	0.002	0.0	14	19
SMALLMOUTH BASS	82	10.5	1.653	2.1	20	1.1	0.116	12.7	102	4.0	1.769	2.2	49	395
LARGEMOUTH BASS	18	2.3	0.269	0.3	3	0.2	0.067	7.3	21	0.8	0.336	0.4	63	173
JOHNNY DARTER	1	0.1	0.002	0.0	2	0.1	0.005	0.5	3	0.1	0.007	0.0	--	--
WALLEYE	1	0.1	0.024	0.0	--	--	--	--	1	0.0	0.024	0.0	148	148
FRESHWATER DRUM	99	12.6	11.095	13.9	--	--	--	--	99	3.8	11.095	13.8	98	406
TOTAL FISH	783	100.0	79.598	100.0	1,794	100.0	0.915	100.0	2,577	100.0	80.513	100.0		
TOTAL SPECIES	27				14				28					

Note: 0.0 denotes values less than 0.05.

TABLE 3-3. FISH CAPTURED AT EACH ELECTROFISHING AND SEINING LOCATION IN THE ROCK RIVER NEAR BYRON STATION, AUGUST 2011.

ELECTROFISHING

SPECIES	R2L	R2R	R3L	R3R	R4L	R4R	S5	LOCATIONS COMBINED	
	No.	No.	No.	No.	No.	No.	No.	No.	%
GIZZARD SHAD	8	26	29	13	18	9	5	108	13.79
NORTHERN PIKE	--	--	--	--	--	--	1	1	0.13
COMMON CARP	--	2	4	2	--	2	--	10	1.28
EMERALD SHINER	4	--	12	1	2	--	1	20	2.55
COMMON SHINER	1	--	--	--	--	--	--	1	0.13
SPOTFIN SHINER	37	1	48	3	42	11	6	148	18.90
SAND SHINER	3	--	12	--	9	--	--	24	3.07
Notropis sp.	--	--	--	--	1	--	--	1	0.13
BLUNTNOSE MINNOW	8	--	3	1	12	4	--	28	3.58
BULLHEAD MINNOW	16	2	36	5	15	17	12	103	13.15
RIVER CARPSUCKER	--	--	1	3	--	1	--	5	0.64
QUILLBACK	--	--	2	1	3	--	6	12	1.53
BIGMOUTH BUFFALO	--	--	--	--	--	--	1	1	0.13
SILVER REDHORSE	1	1	--	1	2	2	5	12	1.53
BLACK REDHORSE	--	--	--	1	--	--	--	1	0.13
GOLDEN REDHORSE	--	--	--	--	--	--	4	4	0.51
SHORTHEAD REDHORSE	--	1	--	3	1	1	--	6	0.77
CHANNEL CATFISH	2	5	2	11	4	3	1	28	3.58
FLATHEAD CATFISH	--	1	--	--	1	--	--	2	0.26
BROOK SILVERSIDE	1	--	--	--	--	1	--	2	0.26
WHITE BASS	--	--	2	--	--	1	--	3	0.38
GREEN SUNFISH	1	5	3	13	3	1	2	28	3.58
BLUEGILL	--	1	11	6	13	2	--	33	4.21
Lepomis HYBRID	--	--	--	--	1	--	--	1	0.13
SMALLMOUTH BASS	2	18	7	21	10	17	7	82	10.47
LARGEMOUTH BASS	--	--	8	1	6	1	2	18	2.30
JOHNNY DARTER	1	--	--	--	--	--	--	1	0.13
WALLEYE	--	--	--	--	1	--	--	1	0.13
FRESHWATER DRUM	2	4	54	3	10	15	11	99	12.64
TOTAL FISH	87	67	234	89	154	88	64	783	100.00
TOTAL SPECIES	14	12	16	17	17	16	14	27	
CPE (FISH/HOUR)	174	134	468	178	308	176	128	224	

SEINING

SPECIES	R2L	R2R	R3L	R3R	R4L	R4R	S5	LOCATIONS COMBINED	
	No.	No.	No.	No.	No.	No.	No.	No.	%
GIZZARD SHAD	--	3	1	2	--	1	10	17	0.95
COMMON CARP	--	1	--	--	--	--	--	1	0.06
EMERALD SHINER	--	1	16	--	--	--	--	17	0.95
SPOTFIN SHINER	62	139	557	7	94	5	25	889	49.55
SAND SHINER	--	33	98	2	25	6	25	189	10.54
Notropis sp.	--	--	--	--	--	--	1	1	0.06
BLUNTNOSE MINNOW	7	10	27	3	7	13	14	81	4.52
BULLHEAD MINNOW	22	60	251	4	57	52	94	540	30.10
ICTIOBINAE sp.	--	--	2	--	2	--	3	7	0.39
CHANNEL CATFISH	--	--	9	--	--	--	--	9	0.50
ORANGESPOTTED SUNFISH	--	--	1	1	--	--	--	2	0.11
BLUEGILL	2	--	--	4	--	1	7	14	0.78
Lepomis sp.	--	--	--	--	--	--	2	2	0.11
SMALLMOUTH BASS	1	1	3	1	4	6	4	20	1.11
LARGEMOUTH BASS	--	1	--	--	--	--	2	3	0.17
JOHNNY DARTER	1	1	--	--	--	--	--	2	0.11
TOTAL FISH	95	250	965	24	189	84	187	1,794	100.00
TOTAL SPECIES	6	10	10	8	6	7	9	14	

TABLE 3-4. LENGTH FREQUENCY DISTRIBUTIONS OF CHANNEL CATFISH, GREEN SUNFISH, BLUEGILL, SMALLMOUTH BASS, AND LARGEMOUTH BASS COLLECTED FROM THE ROCK RIVER NEAR BYRON STATION, AUGUST 2011.

LENGTH (mm)	CHANNEL CATFISH	GREEN SUNFISH	BLUEGILL	SMALLMOUTH BASS	LARGEMOUTH BASS
20-29	--	--	2	--	--
30-39	--	--	9	--	--
40-49	5	3	11	1	--
50-59	4	--	19	27	--
60-69	--	--	4	33	1
70-79	--	5	--	24	2
80-89	--	5	2	6	5
90-99	--	5	--	4	6
100-109	--	7	--	1	4
110-119	--	2	--	--	1
120-129	--	1	--	1	1
130-139	--	--	--	--	--
140-149	--	--	--	--	--
150-159	--	--	--	1	--
160-169	--	--	--	--	--
170-179	--	--	--	--	1
180-189	--	--	--	--	--
190-199	--	--	--	--	--
200-209	--	--	--	--	--
210-219	1	--	--	2	--
220-229	--	--	--	1	--
230-239	--	--	--	--	--
240-249	--	--	--	--	--
250-259	--	--	--	--	--
260-269	--	--	--	--	--
270-279	--	--	--	--	--
280-289	1	--	--	--	--
290-299	--	--	--	--	--
300-309	1	--	--	--	--
310-319	2	--	--	--	--
320-329	1	--	--	--	--
330-339	6	--	--	--	--
340-349	3	--	--	--	--
350-359	5	--	--	--	--
360-369	1	--	--	--	--
370-379	2	--	--	--	--
380-389	2	--	--	--	--
390-399	--	--	--	1	--
400-409	--	--	--	--	--
410-419	2	--	--	--	--
420-429	--	--	--	--	--
430-439	--	--	--	--	--
440-449	--	--	--	--	--
450-459	--	--	--	--	--
460-469	--	--	--	--	--
470-479	--	--	--	--	--
480-489	--	--	--	--	--
490-499	--	--	--	--	--
500-509	--	--	--	--	--
510-519	--	--	--	--	--
520-529	--	--	--	--	--
530-539	--	--	--	--	--
540-549	1	--	--	--	--
TOTAL	37	28	47	102	21

TABLE 3-5. SUMMARY OF PHYSICOCHEMICAL DATA COLLECTED IN CONJUNCTION WITH ELECTROFISHING IN THE ROCK RIVER NEAR BYRON STATION, AUGUST 2011.

LOCATION	TEMPERATURE (C)	DISSOLVED OXYGEN (ppm)	DISSOLVED OXYGEN Percent Saturation	SPECIFIC CONDUCTANCE (μS/cm)	SECCHI (cm)
R2L	22.4	8.8	102	787	55
R2R	22.6	12.7	148	758	49
R3L	24.9	9.1	108	1143	51
R3R	22.7	10.6	130	760	35
R4L	22.9	10.1	118	849	50
R4R	23.1	11.7	136	753	40
S5	23.0	11.6	140	853	47

TABLE 3-6. SUMMARY OF DELT (Deformity, Erosion, Lesion, and Tumor) ANOMALIES ON FISH CAPTURED BY ELECTROFISHING AND SEINING IN THE ROCK RIVER NEAR BYRON STATION, AUGUST 2011.

	LOCATION							LOCATIONS COMBINED		
SPECIES	R2L DELT #	R2R DELT #	R3L DELT #	R3R DELT #	R4L DELT #	R4R DELT #	S5 DELT #	DELT #	EXAM #	DELT %
GIZZARD SHAD	--	--	--	--	--	--	--	--	125	--
NORTHERN PIKE	--	--	--	--	--	--	--	--	1	--
COMMON CARP	--	2	--	1	--	--	--	3	11	27.3
EMERALD SHINER	--	--	--	--	--	--	--	--	37	--
COMMON SHINER	--	--	--	--	--	--	--	--	1	--
SPOTFIN SHINER	--	--	--	--	--	--	--	--	1037	--
SAND SHINER	--	--	--	--	--	--	--	--	213	--
Notropis sp.	--	--	--	--	--	--	--	--	2	--
BLUNTNOSE MINNOW	--	--	--	--	--	--	--	--	109	--
BULLHEAD MINNOW	--	--	--	--	--	--	--	--	643	--
RIVER CARPSUCKER	--	--	--	--	--	--	--	--	5	--
QUILLBACK	--	--	--	--	--	--	--	--	12	--
BIGMOUTH BUFFALO	--	--	--	--	--	--	--	--	1	--
SILVER REDHORSE	--	--	--	--	--	--	--	--	12	--
BLACK REDHORSE	--	--	--	--	--	--	--	--	1	--
GOLDEN REDHORSE	--	--	--	--	--	--	--	--	4	--
SHORTHEAD REDHORSE	--	--	--	--	--	--	--	--	6	--
ICTIOBINAE sp.	--	--	--	--	--	--	--	--	7	--
CHANNEL CATFISH	--	--	--	2	--	--	--	2	37	5.4
FLATHEAD CATFISH	--	--	--	--	1	--	--	1	2	50.0
BROOK SILVERSIDE	--	--	--	--	--	--	--	--	2	--
WHITE BASS	--	--	--	--	--	--	--	--	3	--
GREEN SUNFISH	--	--	--	--	--	--	--	--	28	--
ORANGESPOTTED SUNFISH	--	--	--	--	--	--	--	--	2	--
BLUEGILL	--	--	--	--	--	--	--	--	47	--
Lepomis HYBRID	--	--	--	--	--	--	--	--	1	--
Lepomis sp.	--	--	--	--	--	--	--	--	2	--
SMALLMOUTH BASS	--	1	--	1	1	--	--	3	102	2.9
LARGEMOUTH BASS	--	--	--	--	--	--	--	--	21	--
JOHNNY DARTER	--	--	--	--	--	--	--	--	3	--
WALLEYE	--	--	--	--	--	--	--	--	1	--
FRESHWATER DRUM	--	--	--	--	1	--	1	2	99	2.0
TOTAL FISH	--	3	--	4	3	--	1	11	2577	0.4
PERCENT DELT ANOMALIES	0.0	0.9	0.0	3.5	0.9	0.0	0.4			

TABLE 3-7. MEAN RELATIVE WEIGHTS OF FISH COLLECTED FROM THE ROCK RIVER NEAR BYRON STATION, AUGUST 2011.

SPECIES	N	(Wr)	MINIMUM	MAXIMUM
NORTHERN PIKE	1	86	--	--
COMMON CARP	7	89	79	97
RIVER CARPSUCKER	5	101	78	121
BIGMOUTH BUFFALO	1	94	--	--
SHORTHEAD REDHORSE	6	103	94	113
CHANNEL CATFISH	28	91	73	115
FLATHEAD CATFISH	2	93	91	95
WHITE BASS	2	108	107	110
GREEN SUNFISH	25	117	101	132
BLUEGILL	2	119	106	133
SMALLMOUTH BASS	5	93	84	100
LARGEMOUTH BASS	1	123	--	--
FRESHWATER DRUM	67	121	94	148
SPECIES COMBINED	152	110	73	148

Table 3-8. Benthic macroinvertebrate taxa collected from the Rock River in the vicinity of Byron Station, August 2011.

TURBELLARIA (flatworms)

ANNELIDA

- **Oligochaeta (aquatic worms)**
  - Tubificidae
- **Hirudinea (leeches)**
  - Helobdella stagnalis

CRUSTACEA

- **Amphipoda (sideswimmers)**
  - Gammarus

INSECTA

- **Ephemeroptera (mayflies)**
  - Isonychia
  - Baetis intercalaris
  - Maccaffertium exiguum
  - Maccaffertium integrum
  - Maccaffertium terminatum
  - Stenacron
  - Tricorythodes
  - Brachycercus
  - Caenis
  - Hexagenia limbata
  - Anthopotamus myops
- **Odonata (damselflies and dragonflies)**
  - Argia
  - Stylurus
- **Plecoptera (stoneflies)**
  - Pteronarcys
- **Hemiptera (true bugs)**
  - Corixidae
- **Trichoptera (caddisflies)**
  - Brachycentrus
  - Cheumatopsyche
  - Potamyia flava
  - Hydroptila
  - Nectopsyche
  - Oecetis
  - Cyrnellus fraternus
  - Polycentropus
- **Coleoptera (beetles)**
  - Dineutus
  - Ancyronyx variegata
- **Coleoptera (cont.)**
  - Dubiraphia
  - Macronychus glabratus
  - Stenelmis
- **Diptera (true flies)**
  - Ceratopogonidae
  - **Chironomidae (midges)**
  - Procladius
  - Ablabesmyia mallochi
  - Thienemannimyia grp.
  - Nanocladius crassicornus/rectinervis
  - Chironomus
  - Cryptochironomus
  - Dicrotendipes simpsoni
  - Glyptotendipes
  - Harnischia
  - Microchironomus
  - Parachironomus
  - Phaenopsectra obediens grp.
  - Polypedilum aviceps
  - Polypedilum flavum
  - Polypedilum halterale grp.
  - Polypedilum illinoense
  - Polypedilum scalaenum grp.
  - Stenochironomus
  - Cladotanytarsus vanderwulpi grp.
  - Rheotanytarsus

MOLLUSCA

- **Gastropoda (snails)**
  - Pleurocera
- **Bivalvia (mussels & clams)**
  - Pisidium
  - Leptodea fragilis
  - Quadrula pustulosa

Table 3-9. Density (#/m^2) and relative abundance (%) for benthic macroinvertebrate taxa collected in Hester-Dendy samples from the Rock River near Byron Station - August 2011.

TAXA	R2L #/m^2	R2L %	R3L #/m^2	R3L %	R3R #/m^2	R3R %	R4L #/m^2	R4L %	R4R #/m^2	R4R %
Turbellaria	682.1	6.44	1967.4	18.54	70.3	0.25	1076.4	3.57	2131.5	7.06
Tubificidae	--[a]	--	--	--	25.6	0.09	--	--	--	--
Gammarus	34.1	0.32	17.1	0.16	2.1	0.01	--	--	--	--
Isonychia	--	--	--	--	4.3	0.02	--	--	--	--
Baetis intercalaris	--	--	--	--	--	--	--	--	2.1	0.01
Stenacron	835.6	7.89	110.8	1.04	83.1	0.30	110.8	0.37	920.8	3.05
Maccaffertium integrum	34.1	0.32	57.6	0.54	27.7	0.10	223.8	0.74	49.0	0.16
Maccaffertium terminatum	1091.3	10.31	294.2	2.77	32.0	0.12	91.7	0.30	29.8	0.10
Maccaffertium exiguum	38.4	0.36	2.1	0.02	4.3	0.02	--	--	292.0	0.97
Tricorythodes	790.8	7.47	283.5	2.67	85.3	0.31	407.1	1.35	168.4	0.56
Caenis	--	--	343.2	3.23	6.4	0.02	136.4	0.45	2.1	0.01
Argia	106.6	1.01	144.9	1.37	--	--	74.6	0.25	42.6	0.14
Stylurus	--	--	4.3	0.04	--	--	--	--	--	--
Pteronarcys	--	--	2.1	0.02	--	--	--	--	--	--
Cyrnellus fraternus	--	--	70.3	0.66	55.4	0.20	181.2	0.60	14.9	0.05
Polycentropus	--	--	--	--	--	--	--	--	2.1	0.01
Cheumatopsyche	2.1	0.02	--	--	2.1	0.01	6.4	0.02	6.4	0.02
Potamyia flava	74.6	0.70	29.8	0.28	21.3	0.08	27.7	0.09	51.2	0.17
Brachycentrus	--	--	53.3	0.50	--	--	--	--	--	--
Nectopsyche	38.4	0.36	--	--	2.1	0.01	--	--	--	--
Oecetis	--	--	--	--	--	--	--	--	272.8	0.90
Dineutus	--	--	--	--	2.1	0.01	--	--	--	--
Ancyronyx variegata	--	--	--	--	2.1	0.01	--	--	--	--
Dubiraphia	--	--	34.1	0.32	--	--	--	--	2.1	0.01
Macronychus glabratus	4.3	0.04	36.2	0.34	51.2	0.18	14.9	0.05	14.9	0.05
Stenelmis	34.1	0.32	--	--	17.1	0.06	2.1	0.01	17.1	0.06
Thienemannimyia grp.	68.2	0.64	409.3	3.86	272.8	0.98	545.7	1.81	272.8	0.90
Nanocladius crassicornus/rectinervis	--	--	272.8	2.57	--	--	--	--	272.8	0.90
Dicrotendipes simpsoni	--	--	477.5	4.50	--	--	--	--	--	--
Glyptotendipes	5866.0	55.41	5388.5	50.77	26465.2	95.27	25919.5	85.88	24282.5	80.37
Parachironomus	--	--	--	--	272.8	0.98	--	--	--	--
Polypedilum flavum	68.2	0.64	409.3	3.86	272.8	0.98	272.8	0.90	--	--
Polypedilum halterale grp.	136.4	1.29	--	--	--	--	272.8	0.90	--	--
Rheotanytarsus	682.1	6.44	204.6	1.93	--	--	818.5	2.71	1364.2	4.52
TOTAL BENTHOS (no./m^2)	10587.3	100	10612.9	100	27778.2	100	30182.6	100	30212.4	100
TOTAL TAXA RICHNESS	18		22		22		17		21	
EPT TAXA RICHNESS	8		10		11		8		12	

[a] Taxon absent.

Table 3-10. Density (#/m^2) and relative abundance (%) for benthic macroinvertebrate taxa collected in Ponar and kick net samples from the Rock River near Byron Station - August 2011.

	R2L		R3L		R3R		R4L		R4R	
	PONAR		PONAR		KICK		PONAR		PONAR	
TAXA	#/m^2	%	#/m^2	%	#/m^2	%	#/m^2	%	#/m^2	%
Turbellaria	12.8	0.28	--[a]	--	19.1	0.96	--	--	--	--
Tubificidae	3195.6	69.58	280.6	50.57	376.3	18.97	3240.2	54.04	1856.1	33.37
Helobdella stagnalis	--	--	--	--	6.4	0.32	--	--	--	--
Stenacron	6.4	0.14	--	--	--	--	--	--	--	--
Maccaffertium terminatum	--	--	--	--	38.3	1.93	--	--	--	--
Tricorythodes	--	--	--	--	70.2	3.54	--	--	19.1	0.34
Brachycercus	6.4	0.14	6.4	1.15	6.4	0.32	--	--	6.4	0.11
Caenis	6.4	0.14	--	--	108.4	5.47	--	--	6.4	0.11
Anthopotamus myops	--	--	--	--	19.1	0.96	--	--	--	--
Hexagenia limbata	6.4	0.14	--	--	25.5	1.29	--	--	19.1	0.34
Argia	--	--	--	--	12.8	0.64	--	--	--	--
Stylurus	31.9	0.69	19.1	3.45	--	--	25.5	0.43	--	--
Corixidae	401.8	8.75	6.4	1.15	465.6	23.47	108.4	1.81	38.3	0.69
Polycentropus	--	--	--	--	6.4	0.32	--	--	--	--
Hydroptila	--	--	--	--	--	--	--	--	6.4	0.11
Nectopsyche	6.4	0.14	--	--	--	--	--	--	--	--
Dubiraphia	12.8	0.28	--	--	102.1	5.14	82.9	1.38	159.5	2.87
Stenelmis	--	--	--	--	82.9	4.18	--	--	6.4	0.11
Ceratopogonidae	--	--	--	--	--	--	25.5	0.43	--	--
Procladius	102.1	2.22	44.6	8.05	--	--	25.5	0.43	51.0	0.92
Ablabesmyia mallochi	12.8	0.28	--	--	6.4	0.32	--	--	102.1	1.83
Thienemannimyia grp.	12.8	0.28	--	--	38.3	1.93	--	--	--	--
Chironomus	12.8	0.28	19.1	3.45	44.6	2.25	433.7	7.23	153.1	2.75
Cryptochironomus	421.0	9.17	82.9	14.94	51.0	2.57	102.1	1.70	1020.5	18.35
Glyptotendipes	114.8	2.50	12.8	2.30	242.4	12.22	153.1	2.55	1173.6	21.10
Harnischia	--	--	--	--	--	--	76.5	1.28	51.0	0.92
Microchironomus	--	--	--	--	--	--	25.5	0.43	--	--
Parachironomus	--	--	--	--	25.5	1.29	--	--	51.0	0.92
Phaenopsectra obediens grp.	12.8	0.28	--	--	--	--	--	--	--	--
Polypedilum aviceps	25.5	0.56	--	--	19.1	0.96	--	--	--	--
Polypedilum flavum	--	--	--	--	44.6	2.25	--	--	102.1	1.83
Polypedilum halterale grp.	63.8	1.39	76.5	13.79	19.1	0.96	1683.9	28.09	561.3	10.09
Polypedilum illinoense	25.5	0.56	--	--	38.3	1.93	--	--	--	--
Polypedilum scalaenum grp.	89.3	1.94	--	--	19.1	0.96	--	--	--	--
Stenochironomus	12.8	0.28	--	--	--	--	--	--	--	--
Cladotanytarsus vanderwulpi grp.	--	--	--	--	6.4	0.32	--	--	--	--

Table 3-10 (cont)

TAXA	R2L PONAR #/m²	R2L PONAR %	R3L PONAR #/m²	R3L PONAR %	R3R KICK #/m²	R3R KICK %	R4L PONAR #/m²	R4L PONAR %	R4R PONAR #/m²	R4R PONAR %
Rheotanytarsus	--	--	--	--	82.9	4.18	--	--	153.1	2.75
Pleurocera	--	--	--	--	6.4	0.32	--	--	--	--
Pisidium	--	--	6.4	1.15	--	--	--	--	19.1	0.34
Quadrula pustulosa	--	--	--	--	--	--	--	--	6.4	0.11
Leptodea fragilis	--	--	--	--	--	--	12.8	0.21	--	--
TOTAL BENTHOS (no./m^2)	4592.4	100	554.9	100	1983.7	100	5995.7	100	5561.9	100
TOTAL TAXA RICHNESS	22		10		28		13		21	
EPT TAXA RICHNESS	5		1		7		0		5	

[a] Taxon absent.

APPENDIX A

BYRON STATION FISH DATA

APPENDIX A – Byron Station Fish Data

SITE: ROCK RIVER   GEAR: ELECTRO   LOCATION: R2R   SAMPLING DISTANCE (m): 510   SAMPLING DURATION (min): 30
START DATETIME: 30AUG11:09:40   END DATETIME: 30AUG11:10:10

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	165	53	.	.	.	.	.
GIZZARD SHAD	.	100	12	.	.	.	.	.
GIZZARD SHAD	.	92	9	.	.	.	.	.
GIZZARD SHAD	.	76	5	.	.	.	.	.
GIZZARD SHAD	.	119	19	.	.	.	.	.
GIZZARD SHAD	.	97	10	.	.	.	.	.
GIZZARD SHAD	.	83	7	.	.	.	.	.
GIZZARD SHAD	.	74	5	.	.	.	.	.
GIZZARD SHAD	.	90	9	.	.	.	.	.
GIZZARD SHAD	.	76	5	.	.	.	.	.
GIZZARD SHAD	.	100	13	.	.	.	.	.
GIZZARD SHAD	.	71	4	.	.	.	.	.
GIZZARD SHAD	.	71	4	.	.	.	.	.
GIZZARD SHAD	.	97	11	.	.	.	.	.
GIZZARD SHAD	.	76	5	.	.	.	.	.
GIZZARD SHAD	.	91	8	.	.	.	.	.
GIZZARD SHAD	.	96	9	.	.	.	.	.
GIZZARD SHAD	.	96	10	.	.	.	.	.
GIZZARD SHAD	.	99	10	.	.	.	.	.
GIZZARD SHAD	.	106	13	.	.	.	.	.
GIZZARD SHAD	.	111	15	.	.	.	.	.
GIZZARD SHAD	.	69	4	.	.	.	.	.
GIZZARD SHAD	.	75	5	.	.	.	.	.
GIZZARD SHAD	.	68	3	.	.	.	.	.
GIZZARD SHAD	.	73	5	.	.	.	.	.
GIZZARD SHAD	.	79	6	.	.	.	.	.
COMMON CARP	97	491	1610	.	.	Slight Erosion	.	.
COMMON CARP	87	519	1690	.	.	Slight Erosion	Deformed Fin Rays	.
SPOTFIN SHINER	.	.	.	1	1	.	.	.
BULLHEAD MINNOW	.	.	.	2	1	.	.	.
SILVER REDHORSE	.	504	1180	.	.	.	.	.
SHORTHEAD REDHORSE	112	462	1260	.	.	.	.	.
CHANNEL CATFISH	91	335	300	.	.	Parasite	.	.
CHANNEL CATFISH	81	352	315	.	.	.	.	.
CHANNEL CATFISH	88	382	445	.	.	.	.	.
CHANNEL CATFISH	80	412	520	.	.	.	.	.
CHANNEL CATFISH	81	376	390	.	.	.	.	.
FLATHEAD CATFISH	95	512	1540	.	.	.	.	.
GREEN SUNFISH	132	121	46	.	.	.	.	.
GREEN SUNFISH	118	79	11	.	.	.	.	.
GREEN SUNFISH	114	72	8	.	.	.	.	.
GREEN SUNFISH	115	82	12	.	.	.	.	.
GREEN SUNFISH	129	83	14	.	.	.	.	.
BLUEGILL	.	50	3	.	.	.	.	.
SMALLMOUTH BASS	86	395	820	.	.	Parasite	Slight Erosion	Regen. Scales
SMALLMOUTH BASS	.	52	2	.	.	.	.	.
SMALLMOUTH BASS	.	56	2	.	.	.	.	.
SMALLMOUTH BASS	.	55	2	.	.	.	.	.
SMALLMOUTH BASS	.	52	2	.	.	.	.	.
SMALLMOUTH BASS	.	63	3	.	.	.	.	.
SMALLMOUTH BASS	.	75	5	.	.	.	.	.
SMALLMOUTH BASS	.	76	6	.	.	Parasite	.	.
SMALLMOUTH BASS	.	93	10	.	.	.	.	.
SMALLMOUTH BASS	.	55	2	.	.	.	.	.
SMALLMOUTH BASS	.	77	7	.	.	.	.	.
SMALLMOUTH BASS	.	80	8	.	.	.	.	.
SMALLMOUTH BASS	.	84	8	.	.	.	.	.
SMALLMOUTH BASS	.	77	7	.	.	.	.	.
SMALLMOUTH BASS	.	65	4	.	.	.	.	.
SMALLMOUTH BASS	.	56	3	.	.	.	.	.
SMALLMOUTH BASS	.	66	4	.	.	.	.	.
SMALLMOUTH BASS	.	69	5	.	.	.	.	.
FRESHWATER DRUM	106	403	900	.	.	.	.	.
FRESHWATER DRUM	104	314	395	.	.	.	.	.
FRESHWATER DRUM	119	335	560	.	.	.	.	.
FRESHWATER DRUM	106	110	14	.	.	.	.	.

SITE: ROCK RIVER   GEAR: ELECTRO   LOCATION: R2L   SAMPLING DISTANCE (m): 543   SAMPLING DURATION (min): 30
START DATETIME: 30AUG11:10:45   END DATETIME: 30AUG11:11:15

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	76	5	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	77	5	.	.	.	.	.
GIZZARD SHAD	.	84	7	.	.	.	.	.
GIZZARD SHAD	.	68	4	.	.	.	.	.
GIZZARD SHAD	.	89	9	.	.	.	.	.

GIZZARD SHAD	.	73	5	.	.	.	.	.
GIZZARD SHAD	.	72	5	.	.	.	.	.
EMERALD SHINER	.	.	.	2	8	.	.	.
EMERALD SHINER	.	.	.	2	1	.	.	.
COMMON SHINER	.	.	.	1	1	.	.	.
SPOTFIN SHINER	.	.	.	4	11	.	.	.
SPOTFIN SHINER	.	.	.	27	9	.	.	.
SPOTFIN SHINER	.	.	.	5	2	.	.	.
SPOTFIN SHINER	.	.	.	1	1	.	.	.
SAND SHINER	.	.	.	3	1	.	.	.
BLUNTNOSE MINNOW	.	.	.	8	5	.	.	.
BULLHEAD MINNOW	.	.	.	12	9	.	.	.
BULLHEAD MINNOW	.	.	.	4	1	.	.	.
SILVER REDHORSE	.	378	630	.	.	.	.	.
CHANNEL CATFISH	73	331	230	.	.	.	.	.
CHANNEL CATFISH	112	213	83	.	.	.	.	.
BROOK SILVERSIDE	.	.	.	1	1	.	.	.
GREEN SUNFISH	.	47	2	.	.	.	.	.
SMALLMOUTH BASS	.	63	4	.	.	.	.	.
SMALLMOUTH BASS	.	54	2	.	.	.	.	.
JOHNNY DARTER	.	.	.	1	2	.	.	.
FRESHWATER DRUM	118	312	440	.	.	.	.	.
FRESHWATER DRUM	118	117	19	.	.	.	.	.

SITE: ROCK RIVER GEAR: ELECTRO LOCATION: R3R SAMPLING DISTANCE (m): 470 SAMPLING DURATION (min): 30
START DATETIME: 30AUG11:13:20 END DATETIME: 30AUG11:13:50

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	149	40	.	.	.	.	.
GIZZARD SHAD	.	102	11	.	.	.	.	.
GIZZARD SHAD	.	103	12	.	.	.	.	.
GIZZARD SHAD	.	87	8	.	.	.	.	.
GIZZARD SHAD	.	87	8	.	.	.	.	.
GIZZARD SHAD	.	104	11	.	.	.	.	.
GIZZARD SHAD	.	97	10	.	.	.	.	.
GIZZARD SHAD	.	95	10	.	.	.	.	.
GIZZARD SHAD	.	85	7	.	.	.	.	.
GIZZARD SHAD	.	82	7	.	.	.	.	.
GIZZARD SHAD	.	88	7	.	.	.	.	.
GIZZARD SHAD	.	98	12	.	.	.	.	.
GIZZARD SHAD	.	99	11	.	.	.	.	.
COMMON CARP	79	564	1960	.	.	Slight Erosion	.	.
COMMON CARP	90	493	1510	.	.	.	.	.
EMERALD SHINER	.	.	.	1	1	.	.	.
SPOTFIN SHINER	.	.	.	2	5	.	.	.
SPOTFIN SHINER	.	.	.	1	2	Blackspot	.	.
BLUNTNOSE MINNOW	.	.	.	1	2	.	.	.
BULLHEAD MINNOW	.	.	.	3	4	.	.	.
BULLHEAD MINNOW	.	.	.	2	1	.	.	.
RIVER CARPSUCKER	110	395	940	.	.	.	.	.
RIVER CARPSUCKER	78	498	1330	.	.	.	.	.
RIVER CARPSUCKER	103	394	870	.	.	.	.	.
QUILLBACK	.	384	790	.	.	.	.	.
SILVER REDHORSE	.	425	890	.	.	Regen. Scales	.	.
BLACK REDHORSE	.	336	420	.	.	.	.	.
SHORTHEAD REDHORSE	101	424	880	.	.	.	.	.
SHORTHEAD REDHORSE	96	421	820	.	.	.	.	.
SHORTHEAD REDHORSE	100	414	810	.	.	.	.	.
CHANNEL CATFISH	77	412	500	.	.	Parasite	Eroded barbels	.
CHANNEL CATFISH	80	334	260	.	.	Parasite	.	.
CHANNEL CATFISH	79	346	290	.	.	.	.	.
CHANNEL CATFISH	102	387	540	.	.	Parasite	.	.
CHANNEL CATFISH	88	306	215	.	.	Parasite	.	.
CHANNEL CATFISH	101	543	1640	.	.	Slight Erosion	Parasite	Eroded barbels
CHANNEL CATFISH	96	336	320	.	.	Parasite	.	.
CHANNEL CATFISH	91	345	330	.	.	Parasite	.	.
CHANNEL CATFISH	94	354	370	.	.	Parasite	.	.
CHANNEL CATFISH	85	335	280	.	.	.	.	.
CHANNEL CATFISH	97	347	360	.	.	.	.	.
GREEN SUNFISH	120	92	18	.	.	.	.	.
GREEN SUNFISH	118	74	9	.	.	.	.	.
GREEN SUNFISH	124	86	15	.	.	.	.	.
GREEN SUNFISH	101	104	22	.	.	.	.	.
GREEN SUNFISH	124	117	39	.	.	.	.	.
GREEN SUNFISH	122	108	30	.	.	.	.	.
GREEN SUNFISH	110	115	33	.	.	.	.	.
GREEN SUNFISH	119	109	30	.	.	.	.	.
GREEN SUNFISH	114	92	17	.	.	.	.	.
GREEN SUNFISH	112	78	10	.	.	.	.	.
GREEN SUNFISH	123	99	23	.	.	.	.	.
GREEN SUNFISH	124	84	14	.	.	.	.	.
GREEN SUNFISH	109	76	9	.	.	.	.	.
BLUEGILL	.	62	5	.	.	.	.	.

BLUEGILL	.	46	1	.	.	.	.	.
BLUEGILL	.	54	4	.	.	.	.	.
BLUEGILL	.	58	4	.	.	.	.	.
BLUEGILL	.	48	3	.	.	.	.	.
BLUEGILL	.	42	1	.	.	.	.	.
SMALLMOUTH BASS	99	212	129	.	.	Moderate Erosion	Deformed Fin Rays	.
SMALLMOUTH BASS	98	229	164	.	.	Parasite	.	.
SMALLMOUTH BASS	.	76	6	.	.	.	.	.
SMALLMOUTH BASS	.	64	4	.	.	.	.	.
SMALLMOUTH BASS	.	103	16	.	.	.	.	.
SMALLMOUTH BASS	.	62	3	.	.	.	.	.
SMALLMOUTH BASS	.	74	6	.	.	.	.	.
SMALLMOUTH BASS	.	74	6	.	.	.	.	.
SMALLMOUTH BASS	.	63	3	.	.	.	.	.
SMALLMOUTH BASS	.	91	9	.	.	.	.	.
SMALLMOUTH BASS	.	69	5	.	.	.	.	.
SMALLMOUTH BASS	.	80	8	.	.	.	.	.
SMALLMOUTH BASS	.	56	3	.	.	.	.	.
SMALLMOUTH BASS	.	67	4	.	.	.	.	.
SMALLMOUTH BASS	.	54	3	.	.	.	.	.
SMALLMOUTH BASS	.	56	3	.	.	.	.	.
SMALLMOUTH BASS	.	58	4	.	.	.	.	.
SMALLMOUTH BASS	.	66	4	.	.	.	.	.
SMALLMOUTH BASS	.	65	4	.	.	.	.	.
SMALLMOUTH BASS	.	54	3	.	.	.	.	.
SMALLMOUTH BASS	.	64	4	.	.	.	.	.
LARGEMOUTH BASS	.	63	4	.	.	.	.	.
FRESHWATER DRUM	103	387	770	.	.	.	.	.
FRESHWATER DRUM	102	374	680	.	.	.	.	.
FRESHWATER DRUM	123	133	30	.	.	.	.	.

SITE: ROCK RIVER GEAR: ELECTRO LOCATION: R3L SAMPLING DISTANCE (m): 505 SAMPLING DURATION (min): 30
START DATETIME: 30AUG11:12:05 END DATETIME: 30AUG11:12:35

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	69	4	.	.	.	.	.
GIZZARD SHAD	.	76	5	.	.	.	.	.
GIZZARD SHAD	.	71	4	.	.	.	.	.
GIZZARD SHAD	.	74	5	.	.	.	.	.
GIZZARD SHAD	.	70	4	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	74	5	.	.	.	.	.
GIZZARD SHAD	.	75	5	.	.	.	.	.
GIZZARD SHAD	.	67	3	.	.	.	.	.
GIZZARD SHAD	.	75	5	.	.	.	.	.
GIZZARD SHAD	.	70	4	.	.	.	.	.
GIZZARD SHAD	.	72	5	.	.	.	.	.
GIZZARD SHAD	.	78	6	.	.	.	.	.
GIZZARD SHAD	.	74	5	.	.	.	.	.
GIZZARD SHAD	.	70	4	.	.	.	.	.
GIZZARD SHAD	.	65	3	.	.	.	.	.
GIZZARD SHAD	.	73	5	.	.	.	.	.
GIZZARD SHAD	.	73	4	.	.	.	.	.
GIZZARD SHAD	.	70	4	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	76	5	.	.	.	.	.
GIZZARD SHAD	.	66	4	.	.	.	.	.
GIZZARD SHAD	.	64	3	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	68	4	.	.	.	.	.
GIZZARD SHAD	.	71	4	.	.	.	.	.
GIZZARD SHAD	.	69	4	.	.	.	.	.
GIZZARD SHAD	.	78	5	.	.	.	.	.
COMMON CARP	91	503	1620	.	.	.	.	.
COMMON CARP	.	89	12	.	.	.	.	.
COMMON CARP	.	78	8	.	.	.	.	.
COMMON CARP	.	73	7	.	.	.	.	.
EMERALD SHINER	.	.	.	3	9	.	.	.
EMERALD SHINER	.	.	.	9	2	.	.	.
SPOTFIN SHINER	.	.	.	1	5	.	.	.
SPOTFIN SHINER	.	.	.	47	21	.	.	.
SAND SHINER	.	.	.	12	4	.	.	.
BLUNTNOSE MINNOW	.	.	.	3	1	.	.	.
BULLHEAD MINNOW	.	.	.	36	21	.	.	.
RIVER CARPSUCKER	93	374	670	.	.	Regen. Scales	.	.
QUILLBACK	.	96	13	.	.	.	.	.
QUILLBACK	.	96	14	.	.	.	.	.
CHANNEL CATFISH	80	372	370	.	.	.	.	.
CHANNEL CATFISH	115	354	455	.	.	.	.	.
WHITE BASS	110	224	165	.	.	.	.	.
WHITE BASS	.	110	21	.	.	.	.	.
GREEN SUNFISH	125	106	29	.	.	.	.	.

GREEN SUNFISH	110	101	22	.	.	.	.	.
GREEN SUNFISH	.	46	2	.	.	.	.	.
BLUEGILL	106	89	13	.	.	.	.	.
BLUEGILL	.	58	4	.	.	.	.	.
BLUEGILL	.	57	4	.	.	.	.	.
BLUEGILL	.	51	3	.	.	.	.	.
BLUEGILL	.	63	5	.	.	.	.	.
BLUEGILL	.	58	4	.	.	.	.	.
BLUEGILL	.	57	4	.	.	.	.	.
BLUEGILL	.	60	5	.	.	.	.	.
BLUEGILL	.	54	3	.	.	.	.	.
BLUEGILL	.	55	4	.	.	.	.	.
BLUEGILL	.	35	1	.	.	.	.	.
SMALLMOUTH BASS	.	63	4	.	.	.	.	.
SMALLMOUTH BASS	.	66	4	.	.	.	.	.
SMALLMOUTH BASS	.	65	4	.	.	.	.	.
SMALLMOUTH BASS	.	73	6	.	.	.	.	.
SMALLMOUTH BASS	.	75	6	.	.	.	.	.
SMALLMOUTH BASS	.	51	2	.	.	.	.	.
SMALLMOUTH BASS	.	58	3	.	.	.	.	.
LARGEMOUTH BASS	.	104	15	.	.	.	.	.
LARGEMOUTH BASS	.	87	8	.	.	.	.	.
LARGEMOUTH BASS	.	99	11	.	.	.	.	.
LARGEMOUTH BASS	.	87	9	.	.	.	.	.
LARGEMOUTH BASS	.	93	10	.	.	.	.	.
LARGEMOUTH BASS	.	92	8	.	.	.	.	.
LARGEMOUTH BASS	.	93	12	.	.	.	.	.
LARGEMOUTH BASS	.	85	9	.	.	.	.	.
FRESHWATER DRUM	125	214	140	.	.	.	.	.
FRESHWATER DRUM	122	216	140	.	.	.	.	.
FRESHWATER DRUM	.	.	.	19	480	.	.	.
FRESHWATER DRUM	137	120	24	.	.	.	.	.
FRESHWATER DRUM	137	130	31	.	.	.	.	.
FRESHWATER DRUM	.	98	10	.	.	.	.	.
FRESHWATER DRUM	132	111	18	.	.	.	.	.
FRESHWATER DRUM	124	138	34	.	.	.	.	.
FRESHWATER DRUM	118	129	26	.	.	.	.	.
FRESHWATER DRUM	120	125	24	.	.	.	.	.
FRESHWATER DRUM	111	121	20	.	.	.	.	.
FRESHWATER DRUM	137	135	35	.	.	.	.	.
FRESHWATER DRUM	133	130	30	.	.	.	.	.
FRESHWATER DRUM	141	119	24	.	.	.	.	.
FRESHWATER DRUM	131	132	31	.	.	.	.	.
FRESHWATER DRUM	125	135	32	.	.	.	.	.
FRESHWATER DRUM	134	127	28	.	.	.	.	.
FRESHWATER DRUM	136	122	25	.	.	.	.	.
FRESHWATER DRUM	134	124	26	.	.	.	.	.
FRESHWATER DRUM	143	117	23	.	.	.	.	.
FRESHWATER DRUM	127	142	38	.	.	.	.	.
FRESHWATER DRUM	118	117	19	.	.	.	.	.
FRESHWATER DRUM	137	123	26	.	.	.	.	.
FRESHWATER DRUM	125	135	32	.	.	.	.	.
FRESHWATER DRUM	131	137	35	.	.	.	.	.
FRESHWATER DRUM	.	.	.	11	202	.	.	.

SITE: ROCK RIVER GEAR: ELECTRO LOCATION: R4R SAMPLING DISTANCE (m): 650 SAMPLING DURATION (min): 30
START DATETIME: 30AUG11:14:20 END DATETIME: 30AUG11:14:50

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	74	5	.	.	.	.	.
GIZZARD SHAD	.	64	3	.	.	.	.	.
GIZZARD SHAD	.	98	12	.	.	.	.	.
GIZZARD SHAD	.	99	11	.	.	.	.	.
GIZZARD SHAD	.	98	11	.	.	.	.	.
GIZZARD SHAD	.	116	18	.	.	.	.	.
GIZZARD SHAD	.	93	9	.	.	.	.	.
GIZZARD SHAD	.	101	12	.	.	.	.	.
GIZZARD SHAD	.	93	9	.	.	.	.	.
COMMON CARP	93	576	2450	.	.	.	.	.
COMMON CARP	85	541	1870	.	.	Deformed Fin Rays	.	.
SPOTFIN SHINER	.	.	.	1	3	.	.	.
SPOTFIN SHINER	.	.	.	9	4	.	.	.
SPOTFIN SHINER	.	.	.	1	1	.	.	.
BLUNTNOSE MINNOW	.	.	.	4	1	.	.	.
BULLHEAD MINNOW	.	.	.	17	13	.	.	.
RIVER CARPSUCKER	121	412	1170	.	.	.	.	.
SILVER REDHORSE	.	228	145	.	.	.	.	.
SILVER REDHORSE	.	386	620	.	.	Regen. Scales	.	.
SHORTHEAD REDHORSE	94	463	1070	.	.	.	.	.
CHANNEL CATFISH	106	283	200	.	.	.	.	.
CHANNEL CATFISH	93	324	275	.	.	.	.	.
CHANNEL CATFISH	94	314	250	.	.	.	.	.
BROOK SILVERSIDE	.	.	.	1	1	.	.	.

WHITE BASS	107	207	125	.	.	.	.	.
GREEN SUNFISH	111	105	25	.	.	.	.	.
BLUEGILL	.	60	4	.	.	.	.	.
BLUEGILL	.	42	1	.	.	.	.	.
SMALLMOUTH BASS	.	98	15	.	.	.	.	.
SMALLMOUTH BASS	.	85	9	.	.	.	.	.
SMALLMOUTH BASS	.	72	6	.	.	.	.	.
SMALLMOUTH BASS	.	73	6	.	.	.	.	.
SMALLMOUTH BASS	.	76	6	.	.	.	.	.
SMALLMOUTH BASS	.	72	5	.	.	.	.	.
SMALLMOUTH BASS	.	59	3	.	.	.	.	.
SMALLMOUTH BASS	.	62	3	.	.	.	.	.
SMALLMOUTH BASS	.	71	5	.	.	.	.	.
SMALLMOUTH BASS	.	60	4	.	.	.	.	.
SMALLMOUTH BASS	.	53	2	.	.	.	.	.
SMALLMOUTH BASS	.	49	2	.	.	.	.	.
SMALLMOUTH BASS	.	61	3	.	.	.	.	.
SMALLMOUTH BASS	.	72	6	.	.	.	.	.
SMALLMOUTH BASS	.	54	3	.	.	.	.	.
SMALLMOUTH BASS	.	54	3	.	.	Parasite	.	.
SMALLMOUTH BASS	.	60	3	.	.	.	.	.
LARGEMOUTH BASS	.	87	10	.	.	.	.	.
FRESHWATER DRUM	125	306	440	.	.	.	.	.
FRESHWATER DRUM	112	312	420	.	.	.	.	.
FRESHWATER DRUM	99	326	425	.	.	.	.	.
FRESHWATER DRUM	112	312	420	.	.	.	.	.
FRESHWATER DRUM	100	387	745	.	.	.	.	.
FRESHWATER DRUM	95	364	580	.	.	.	.	.
FRESHWATER DRUM	108	219	130	.	.	.	.	.
FRESHWATER DRUM	118	117	19	.	.	.	.	.
FRESHWATER DRUM	127	126	26	.	.	.	.	.
FRESHWATER DRUM	129	134	32	.	.	Parasite	.	.
FRESHWATER DRUM	130	131	30	.	.	.	.	.
FRESHWATER DRUM	124	130	28	.	.	.	.	.
FRESHWATER DRUM	117	119	20	.	.	.	.	.
FRESHWATER DRUM	148	133	36	.	.	.	.	.
FRESHWATER DRUM	127	137	34	.	.	Parasite	.	.

SITE: ROCK RIVER GEAR: ELECTRO LOCATION: R4L SAMPLING DISTANCE (m): 500 SAMPLING DURATION (min): 30
START DATETIME: 30AUG11:15:35 END DATETIME: 30AUG11:16:05

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	87	8	.	.	.	.	.
GIZZARD SHAD	.	86	7	.	.	.	.	.
GIZZARD SHAD	.	96	10	.	.	.	.	.
GIZZARD SHAD	.	82	6	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	99	12	.	.	.	.	.
GIZZARD SHAD	.	73	5	.	.	.	.	.
GIZZARD SHAD	.	93	9	.	.	.	.	.
GIZZARD SHAD	.	95	9	.	.	.	.	.
GIZZARD SHAD	.	78	5	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	77	5	.	.	.	.	.
GIZZARD SHAD	.	84	7	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	73	5	.	.	.	.	.
GIZZARD SHAD	.	76	5	.	.	.	.	.
GIZZARD SHAD	.	77	5	.	.	.	.	.
GIZZARD SHAD	.	68	4	.	.	.	.	.
EMERALD SHINER	.	.	.	2	10	.	.	.
SPOTFIN SHINER	.	.	.	16	6	.	.	.
SPOTFIN SHINER	.	.	.	23	8	.	.	.
SPOTFIN SHINER	.	.	.	3	1	.	.	.
SAND SHINER	.	.	.	9	2	.	.	.
Notropis sp.	.	.	.	1	1	.	.	.
BLUNTNOSE MINNOW	.	.	.	12	20	.	.	.
BULLHEAD MINNOW	.	.	.	15	15	.	.	.
QUILLBACK	.	371	680	.	.	.	.	.
QUILLBACK	.	374	780	.	.	Regen. Scales	.	.
QUILLBACK	.	436	1080	.	.	.	.	.
SILVER REDHORSE	.	472	1140	.	.	Regen. Scales	.	.
SILVER REDHORSE	.	424	880	.	.	.	.	.
SHORTHEAD REDHORSE	113	293	330	.	.	.	.	.
CHANNEL CATFISH	96	316	260	.	.	Parasite	.	.
CHANNEL CATFISH	81	357	330	.	.	.	.	.
CHANNEL CATFISH	79	364	340	.	.	Parasite	.	.
CHANNEL CATFISH	101	354	400	.	.	Parasite	.	.
FLATHEAD CATFISH	91	403	680	.	.	Slight Erosion	.	.
GREEN SUNFISH	110	104	24	.	.	.	.	.
GREEN SUNFISH	.	46	2	.	.	.	.	.
GREEN SUNFISH	113	94	18	.	.	.	.	.
BLUEGILL	133	83	13	.	.	.	.	.

BLUEGILL	.	54	3	.	.	.	.	.
BLUEGILL	.	52	3	.	.	.	.	.
BLUEGILL	.	48	3	.	.	.	.	.
BLUEGILL	.	50	3	.	.	.	.	.
BLUEGILL	.	51	3	.	.	.	.	.
BLUEGILL	.	48	2	.	.	.	.	.
BLUEGILL	.	57	4	.	.	.	.	.
BLUEGILL	.	49	3	.	.	.	.	.
BLUEGILL	.	46	2	.	.	.	.	.
BLUEGILL	.	42	2	.	.	.	.	.
BLUEGILL	.	54	3	.	.	.	.	.
BLUEGILL	.	53	3	.	.	.	.	.
Lepomis HYBRID	.	.	.	1	22	.	.	.
SMALLMOUTH BASS	84	216	116	.	.	Body Deformity	.	.
SMALLMOUTH BASS	.	77	7	.	.	.	.	.
SMALLMOUTH BASS	.	63	3	.	.	.	.	.
SMALLMOUTH BASS	.	54	3	.	.	.	.	.
SMALLMOUTH BASS	.	66	4	.	.	.	.	.
SMALLMOUTH BASS	.	95	12	.	.	.	.	.
SMALLMOUTH BASS	.	77	7	.	.	.	.	.
SMALLMOUTH BASS	.	75	7	.	.	.	.	.
SMALLMOUTH BASS	.	72	5	.	.	.	.	.
SMALLMOUTH BASS	.	83	7	.	.	.	.	.
LARGEMOUTH BASS	123	173	82	.	.	.	.	.
LARGEMOUTH BASS	.	116	22	.	.	.	.	.
LARGEMOUTH BASS	.	107	19	.	.	.	.	.
LARGEMOUTH BASS	.	78	7	.	.	.	.	.
LARGEMOUTH BASS	.	81	8	.	.	.	.	.
LARGEMOUTH BASS	.	72	6	.	.	Parasite	.	.
WALLEYE	.	148	24	.	.	.	.	.
FRESHWATER DRUM	97	406	840	.	.	Slight Erosion	.	.
FRESHWATER DRUM	125	214	140	.	.	.	.	.
FRESHWATER DRUM	107	107	13	.	.	.	.	.
FRESHWATER DRUM	135	125	27	.	.	.	.	.
FRESHWATER DRUM	124	127	26	.	.	.	.	.
FRESHWATER DRUM	121	116	19	.	.	.	.	.
FRESHWATER DRUM	139	101	14	.	.	.	.	.
FRESHWATER DRUM	112	117	18	.	.	.	.	.
FRESHWATER DRUM	124	134	31	.	.	.	.	.
FRESHWATER DRUM	116	128	25	.	.	.	.	.

SITE: ROCK RIVER GEAR: ELECTRO LOCATION: S5 SAMPLING DISTANCE (m): 448 SAMPLING DURATION (min): 30
START DATETIME: 30AUG11:16:25 END DATETIME: 30AUG11:16:55

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	97	11	.	.	.	.	.
GIZZARD SHAD	.	73	5	.	.	.	.	.
GIZZARD SHAD	.	98	10	.	.	.	.	.
GIZZARD SHAD	.	95	10	.	.	.	.	.
GIZZARD SHAD	.	145	40	.	.	.	.	.
NORTHERN PIKE	86	704	2050	.	.	.	.	.
EMERALD SHINER	.	.	.	1	1	.	.	.
SPOTFIN SHINER	.	.	.	5	2	.	.	.
SPOTFIN SHINER	.	.	.	1	1	.	.	.
BULLHEAD MINNOW	.	.	.	3	6	.	.	.
BULLHEAD MINNOW	.	.	.	9	6	.	.	.
QUILLBACK	.	378	720	.	.	.	.	.
QUILLBACK	.	436	1090	.	.	.	.	.
QUILLBACK	.	387	920	.	.	.	.	.
QUILLBACK	.	442	1030	.	.	Regen. Scales	.	.
QUILLBACK	.	436	1120	.	.	.	.	.
QUILLBACK	.	452	1140	.	.	Regen. Scales	.	.
BIGMOUTH BUFFALO	94	504	2150	.	.	.	.	.
SILVER REDHORSE	.	543	1740	.	.	Regen. Scales	.	.
SILVER REDHORSE	.	474	1130	.	.	.	.	.
SILVER REDHORSE	.	482	1120	.	.	.	.	.
SILVER REDHORSE	.	346	440	.	.	.	.	.
SILVER REDHORSE	.	377	630	.	.	Regen. Scales	.	.
GOLDEN REDHORSE	.	543	1520	.	.	.	.	.
GOLDEN REDHORSE	.	506	1440	.	.	Regen. Scales	.	.
GOLDEN REDHORSE	.	506	1260	.	.	Parasite	.	.
GOLDEN REDHORSE	.	139	32	.	.	.	.	.
CHANNEL CATFISH	98	334	320	.	.	Parasite	.	.
GREEN SUNFISH	119	97	21	.	.	.	.	.
GREEN SUNFISH	113	80	11	.	.	.	.	.
SMALLMOUTH BASS	100	152	45	.	.	.	.	.
SMALLMOUTH BASS	.	65	4	.	.	.	.	.
SMALLMOUTH BASS	.	70	5	.	.	.	.	.
SMALLMOUTH BASS	.	66	4	.	.	.	.	.
SMALLMOUTH BASS	.	63	4	.	.	.	.	.
SMALLMOUTH BASS	.	71	5	.	.	.	.	.
SMALLMOUTH BASS	.	69	5	.	.	.	.	.
LARGEMOUTH BASS	.	106	15	.	.	.	.	.

LARGEMOUTH BASS	.	97	14	.	.	Blackspot	.	.
FRESHWATER DRUM	118	314	450	.	.	Lesion	Fungus	.
FRESHWATER DRUM	117	296	370	.	.	Regen. Scales	.	.
FRESHWATER DRUM	94	234	140	.	.	.	.	.
FRESHWATER DRUM	113	196	95	.	.	.	.	.
FRESHWATER DRUM	124	127	26	.	.	.	.	.
FRESHWATER DRUM	.	98	11	.	.	.	.	.
FRESHWATER DRUM	124	117	20	.	.	.	.	.
FRESHWATER DRUM	125	111	17	.	.	.	.	.
FRESHWATER DRUM	128	108	16	.	.	.	.	.
FRESHWATER DRUM	115	136	30	.	.	.	.	.
FRESHWATER DRUM	117	121	21	.	.	.	.	.

SITE: ROCK RIVER GEAR: SEINE LOCATION: R2R SAMPLING DISTANCE (m): . SAMPLING DURATION (min): 13
START DATETIME: 29AUG11:16:20 END DATETIME: 29AUG11:16:33

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	91	10	.	.	.	.	.
GIZZARD SHAD	.	73	5	.	.	.	.	.
GIZZARD SHAD	.	71	4	.	.	.	.	.
COMMON CARP	.	43	2	.	.	.	.	.
EMERALD SHINER	.	.	.	1	1	.	.	.
SPOTFIN SHINER	.	.	.	100	26	.	.	.
SPOTFIN SHINER	.	.	.	27	7	.	.	.
SPOTFIN SHINER	.	.	.	12	1	.	.	.
SAND SHINER	.	.	.	29	7	.	.	.
SAND SHINER	.	.	.	4	1	.	.	.
BLUNTNOSE MINNOW	.	.	.	10	4	.	.	.
BULLHEAD MINNOW	.	.	.	59	10	.	.	.
BULLHEAD MINNOW	.	.	.	1	1	.	.	.
SMALLMOUTH BASS	.	69	5	.	.	.	.	.
LARGEMOUTH BASS	.	102	16	.	.	.	.	.
JOHNNY DARTER	.	.	.	1	4	.	.	.

SITE: ROCK RIVER GEAR: SEINE LOCATION: R2L SAMPLING DISTANCE (m): . SAMPLING DURATION (min): 13
START DATETIME: 29AUG11:15:53 END DATETIME: 29AUG11:16:06

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
SPOTFIN SHINER	.	.	.	62	20	.	.	.
BLUNTNOSE MINNOW	.	.	.	7	3	.	.	.
BULLHEAD MINNOW	.	.	.	22	10	.	.	.
BLUEGILL	.	45	2	.	.	.	.	.
BLUEGILL	.	32	1	.	.	.	.	.
SMALLMOUTH BASS	.	57	3	.	.	.	.	.
JOHNNY DARTER	.	.	.	1	1	.	.	.

SITE: ROCK RIVER GEAR: SEINE LOCATION: R3R SAMPLING DISTANCE (m): . SAMPLING DURATION (min): 12
START DATETIME: 29AUG11:17:45 END DATETIME: 29AUG11:17:57

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	49	1	.	.	.	.	.
GIZZARD SHAD	.	43	1	.	.	.	.	.
SPOTFIN SHINER	.	.	.	5	4	.	.	.
SPOTFIN SHINER	.	.	.	2	1	.	.	.
SAND SHINER	.	.	.	2	1	.	.	.
BLUNTNOSE MINNOW	.	.	.	3	1	.	.	.
BULLHEAD MINNOW	.	.	.	4	1	.	.	.
ORANGESPOTTED SUNFISH	.	37	1	.	.	.	.	.
BLUEGILL	.	51	3	.	.	.	.	.
BLUEGILL	.	36	1	.	.	.	.	.
BLUEGILL	.	34	1	.	.	.	.	.
BLUEGILL	.	31	1	.	.	.	.	.
SMALLMOUTH BASS	.	56	3	.	.	.	.	.

SITE: ROCK RIVER GEAR: SEINE LOCATION: R3L SAMPLING DISTANCE (m): . SAMPLING DURATION (min): 15
START DATETIME: 29AUG11:17:21 END DATETIME: 29AUG11:17:36

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	74	5	.	.	.	.	.
EMERALD SHINER	.	.	.	16	2	.	.	.
SPOTFIN SHINER	.	.	.	100	33	.	.	.
SPOTFIN SHINER	.	.	.	430	142	.	.	.
SPOTFIN SHINER	.	.	.	22	4	.	.	.
SPOTFIN SHINER	.	.	.	5	1	.	.	.
SAND SHINER	.	.	.	80	23	.	.	.
SAND SHINER	.	.	.	18	3	.	.	.
BLUNTNOSE MINNOW	.	.	.	26	11	.	.	.

BLUNTNOSE MINNOW	.	.	.	1	1	.	.	.
BULLHEAD MINNOW	.	.	.	100	45	.	.	.
BULLHEAD MINNOW	.	.	.	147	66	.	.	.
BULLHEAD MINNOW	.	.	.	3	1	.	.	.
BULLHEAD MINNOW	.	.	.	1	1	.	.	.
ICTIOBINAE sp.	.	40	1	.	.	.	.	.
ICTIOBINAE sp.	.	52	2	.	.	.	.	.
CHANNEL CATFISH	.	57	2	.	.	.	.	.
CHANNEL CATFISH	.	49	1	.	.	.	.	.
CHANNEL CATFISH	.	42	1	.	.	.	.	.
CHANNEL CATFISH	.	47	1	.	.	.	.	.
CHANNEL CATFISH	.	53	1	.	.	.	.	.
CHANNEL CATFISH	.	52	1	.	.	.	.	.
CHANNEL CATFISH	.	46	1	.	.	.	.	.
CHANNEL CATFISH	.	48	1	.	.	.	.	.
CHANNEL CATFISH	.	50	1	.	.	.	.	.
ORANGESPOTTED SUNFISH	.	29	1	.	.	.	.	.
SMALLMOUTH BASS	.	77	6	.	.	.	.	.
SMALLMOUTH BASS	.	79	7	.	.	.	.	.
SMALLMOUTH BASS	.	68	4	.	.	.	.	.

SITE: ROCK RIVER GEAR: SEINE LOCATION: R4R SAMPLING DISTANCE (m): . SAMPLING DURATION (min): 8
START DATETIME: 29AUG11:18:48 END DATETIME: 29AUG11:18:56

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	73	5	.	.	.	.	.
SPOTFIN SHINER	.	.	.	1	4	.	.	.
SPOTFIN SHINER	.	.	.	4	2	.	.	.
SAND SHINER	.	.	.	6	2	.	.	.
BLUNTNOSE MINNOW	.	.	.	13	6	.	.	.
BULLHEAD MINNOW	.	.	.	52	26	.	.	.
BLUEGILL	.	54	3	.	.	.	.	.
SMALLMOUTH BASS	.	53	3	.	.	.	.	.
SMALLMOUTH BASS	.	68	5	.	.	.	.	.
SMALLMOUTH BASS	.	57	3	.	.	.	.	.
SMALLMOUTH BASS	.	56	3	.	.	.	.	.
SMALLMOUTH BASS	.	52	2	.	.	.	.	.
SMALLMOUTH BASS	.	54	2	.	.	.	.	.

SITE: ROCK RIVER GEAR: SEINE LOCATION: R4L SAMPLING DISTANCE (m): . SAMPLING DURATION (min): 12
START DATETIME: 29AUG11:18:15 END DATETIME: 29AUG11:18:27

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
SPOTFIN SHINER	.	.	.	78	23	.	.	.
SPOTFIN SHINER	.	.	.	9	1	.	.	.
SPOTFIN SHINER	.	.	.	7	1	.	.	.
SAND SHINER	.	.	.	24	7	.	.	.
SAND SHINER	.	.	.	1	1	.	.	.
BLUNTNOSE MINNOW	.	.	.	7	3	.	.	.
BULLHEAD MINNOW	.	.	.	2	2	.	.	.
BULLHEAD MINNOW	.	.	.	41	14	.	.	.
BULLHEAD MINNOW	.	.	.	13	2	.	.	.
BULLHEAD MINNOW	.	.	.	1	1	.	.	.
ICTIOBINAE sp.	.	40	1	.	.	.	.	.
ICTIOBINAE sp.	.	39	1	.	.	.	.	.
SMALLMOUTH BASS	.	79	7	.	.	.	.	.
SMALLMOUTH BASS	.	67	4	.	.	.	.	.
SMALLMOUTH BASS	.	89	9	.	.	.	.	.
SMALLMOUTH BASS	.	58	3	.	.	.	.	.

SITE: ROCK RIVER GEAR: SEINE LOCATION: S5 SAMPLING DISTANCE (m): . SAMPLING DURATION (min): 12
START DATETIME: 29AUG11:19:08 END DATETIME: 29AUG11:19:20

SPECIES	Wr	LENGTH (mm)	WEIGHT (g)	PLUS COUNT	BATCH WEIGHT	ANOMALY 1	ANOMALY 2	ANOMALY 3
GIZZARD SHAD	.	93	8	.	.	.	.	.
GIZZARD SHAD	.	73	5	.	.	.	.	.
GIZZARD SHAD	.	72	4	.	.	.	.	.
GIZZARD SHAD	.	66	4	.	.	.	.	.
GIZZARD SHAD	.	68	4	.	.	.	.	.
GIZZARD SHAD	.	78	6	.	.	.	.	.
GIZZARD SHAD	.	68	4	.	.	.	.	.
GIZZARD SHAD	.	69	4	.	.	.	.	.
GIZZARD SHAD	.	69	4	.	.	.	.	.
GIZZARD SHAD	.	72	5	.	.	.	.	.
SPOTFIN SHINER	.	.	.	12	26	.	.	.
SPOTFIN SHINER	.	.	.	11	2	.	.	.
SPOTFIN SHINER	.	.	.	2	1	.	.	.
SAND SHINER	.	.	.	19	5	.	.	.
SAND SHINER	.	.	.	6	1	.	.	.

Notropis sp.	.	.	.	1	1	.	.	.
BLUNTNOSE MINNOW	.	.	.	1	1	.	.	.
BLUNTNOSE MINNOW	.	.	.	1	4	Parasite	.	.
BLUNTNOSE MINNOW	.	.	.	12	4	.	.	.
BULLHEAD MINNOW	.	.	.	93	32	.	.	.
BULLHEAD MINNOW	.	.	.	1	1	Blackspot	.	.
ICTIOBINAE sp.	.	42	1	.	.	.	.	.
ICTIOBINAE sp.	.	41	1	.	.	.	.	.
ICTIOBINAE sp.	.	41	1	.	.	.	.	.
BLUEGILL	.	42	1	.	.	.	.	.
BLUEGILL	.	32	1	.	.	.	.	.
BLUEGILL	.	34	1	.	.	.	.	.
BLUEGILL	.	33	1	.	.	.	.	.
BLUEGILL	.	33	1	.	.	.	.	.
BLUEGILL	.	29	1	.	.	.	.	.
BLUEGILL	.	25	1	.	.	.	.	.
Lepomis sp.	.	19	1	.	.	.	.	.
Lepomis sp.	.	14	1	.	.	.	.	.
SMALLMOUTH BASS	.	129	33	.	.	Blackspot	.	.
SMALLMOUTH BASS	.	67	5	.	.	.	.	.
SMALLMOUTH BASS	.	65	5	.	.	.	.	.
SMALLMOUTH BASS	.	64	4	.	.	.	.	.
LARGEMOUTH BASS	.	93	13	.	.	Blackspot	.	.
LARGEMOUTH BASS	.	129	38	.	.	.	.	.

APPENDIX B

BYRON STATION MACROINVERTEBRATE DATA

APPENDIX B – Byron Station Macroinvertebrate Data

GEAR=HESTER-DENDY, DATE=AUG 2011, and LOCATION=R2L

TAXA	#	#/m2	%
Turbellaria	320	682.1	6.44
Gammarus	16	34.1	0.32
Stenacron	392	835.6	7.89
Maccaffertium integrum	16	34.1	0.32
Maccaffertium terminatum	512	1,091.3	10.31
Maccaffertium exiguum	18	38.4	0.36
Tricorythodes	371	790.8	7.47
Argia	50	106.6	1.01
Cheumatopsyche	1	2.1	0.02
Potamyia flava	35	74.6	0.70
Nectopsyche	18	38.4	0.36
Macronychus glabratus	2	4.3	0.04
Stenelmis	16	34.1	0.32
Thienemannimyia grp.	32	68.2	0.64
Glyptotendipes	2,752	5,866.0	55.41
Polypedilum flavum	32	68.2	0.64
Polypedilum halterale grp.	64	136.4	1.29
Rheotanytarsus	320	682.1	6.44
TOTAL BENTHOS	4,967	10,587.3	100.00

GEAR=HESTER-DENDY, DATE=AUG 2011, and LOCATION=R3L

TAXA	#	#/m2	%
Turbellaria	923	1,967.4	18.54
Gammarus	8	17.1	0.16
Stenacron	52	110.8	1.04
Maccaffertium integrum	27	57.6	0.54
Maccaffertium terminatum	138	294.2	2.77
Maccaffertium exiguum	1	2.1	0.02
Tricorythodes	133	283.5	2.67
Caenis	161	343.2	3.23
Argia	68	144.9	1.37
Stylurus	2	4.3	0.04
Pteronarcys	1	2.1	0.02
Cyrnellus fraternus	33	70.3	0.66
Potamyia flava	14	29.8	0.28
Brachycentrus	25	53.3	0.50
Dubiraphia	16	34.1	0.32
Macronychus glabratus	17	36.2	0.34
Thienemannimyia grp.	192	409.3	3.86
Nanocladius crassicornus/rectinervis	128	272.8	2.57
Dicrotendipes simpsoni	224	477.5	4.50
Glyptotendipes	2,528	5,388.5	50.77
Polypedilum flavum	192	409.3	3.86
Rheotanytarsus	96	204.6	1.93
TOTAL BENTHOS	4,979	10,612.9	100.00

GEAR=HESTER-DENDY, DATE=AUG 2011, and LOCATION=R3R

TAXA	#	#/m2	%
Turbellaria	33	70.3	0.25
Tubificidae	12	25.6	0.09
Gammarus	1	2.1	0.01
Isonychia	2	4.3	0.02
Stenacron	39	83.1	0.30
Maccaffertium integrum	13	27.7	0.10
Maccaffertium terminatum	15	32.0	0.12
Maccaffertium exiguum	2	4.3	0.02
Tricorythodes	40	85.3	0.31
Caenis	3	6.4	0.02
Cyrnellus fraternus	26	55.4	0.20
Cheumatopsyche	1	2.1	0.01
Potamyia flava	10	21.3	0.08
Nectopsyche	1	2.1	0.01
Dineutus	1	2.1	0.01
Ancyronyx variegata	1	2.1	0.01
Macronychus glabratus	24	51.2	0.18
Stenelmis	8	17.1	0.06
Thienemannimyia grp.	128	272.8	0.98
Glyptotendipes	12,416	26,465.2	95.27
Parachironomus	128	272.8	0.98
Polypedilum flavum	128	272.8	0.98
TOTAL BENTHOS	13,032	27,778.2	100.00

APPENDIX B (cont.)

GEAR=HESTER-DENDY, DATE=AUG 2011, and LOCATION=R4L

TAXA	#	#/m2	%
Turbellaria	505	1,076.4	3.57
Stenacron	52	110.8	0.37
Maccaffertium integrum	105	223.8	0.74
Maccaffertium terminatum	43	91.7	0.30
Tricorythodes	191	407.1	1.35
Caenis	64	136.4	0.45
Argia	35	74.6	0.25
Cyrnellus fraternus	85	181.2	0.60
Cheumatopsyche	3	6.4	0.02
Potamyia flava	13	27.7	0.09
Macronychus glabratus	7	14.9	0.05
Stenelmis	1	2.1	0.01
Thienemannimyia grp.	256	545.7	1.81
Glyptotendipes	12,160	25,919.5	85.88
Polypedilum flavum	128	272.8	0.90
Polypedilum halterale grp.	128	272.8	0.90
Rheotanytarsus	384	818.5	2.71
TOTAL BENTHOS	14,160	30,182.6	100.00

GEAR=HESTER-DENDY, DATE=AUG 2011, and LOCATION=R4R

TAXA	#	#/m2	%
Turbellaria	1,000	2,131.5	7.06
Baetis intercalaris	1	2.1	0.01
Stenacron	432	920.8	3.05
Maccaffertium integrum	23	49.0	0.16
Maccaffertium terminatum	14	29.8	0.10
Maccaffertium exiguum	137	292.0	0.97
Tricorythodes	79	168.4	0.56
Caenis	1	2.1	0.01
Argia	20	42.6	0.14
Cyrnellus fraternus	7	14.9	0.05
Polycentropus	1	2.1	0.01
Cheumatopsyche	3	6.4	0.02
Potamyia flava	24	51.2	0.17
Oecetis	128	272.8	0.90
Dubiraphia	1	2.1	0.01
Macronychus glabratus	7	14.9	0.05
Stenelmis	8	17.1	0.06
Thienemannimyia grp.	128	272.8	0.90
Nanocladius crassicornus/rectinervis	128	272.8	0.90
Glyptotendipes	11,392	24,282.5	80.37
Rheotanytarsus	640	1,364.2	4.52
TOTAL BENTHOS	14,174	30,212.4	100.00

GEAR=KICK NET, DATE=AUG 2011, and LOCATION=R3R

TAXA	#	#/m2	%
Turbellaria	3	19.1	0.96
Tubificidae	59	376.3	18.97
Helobdella stagnalis	1	6.4	0.32
Maccaffertium terminatum	6	38.3	1.93
Tricorythodes	11	70.2	3.54
Brachycercus	1	6.4	0.32
Caenis	17	108.4	5.47
Anthopotamus myops	3	19.1	0.96
Hexagenia limbata	4	25.5	1.29
Argia	2	12.8	0.64
Corixidae	73	465.6	23.47
Polycentropus	1	6.4	0.32
Dubiraphia	16	102.1	5.14
Stenelmis	13	82.9	4.18
Ablabesmyia mallochi	1	6.4	0.32
Thienemannimyia grp.	6	38.3	1.93
Chironomus	7	44.6	2.25
Cryptochironomus	8	51.0	2.57
Glyptotendipes	38	242.4	12.22
Parachironomus	4	25.5	1.29
Polypedilum aviceps	3	19.1	0.96
Polypedilum flavum	7	44.6	2.25
Polypedilum halterale grp.	3	19.1	0.96
Polypedilum illinoense	6	38.3	1.93
Polypedilum scalaenum grp.	3	19.1	0.96
Cladotanytarsus vanderwulpi grp.	1	6.4	0.32
Rheotanytarsus	13	82.9	4.18
Pleurocera	1	6.4	0.32
TOTAL BENTHOS	311	1,983.7	100.00

GEAR=PONAR, DATE=AUG 2011, and LOCATION=R2L

TAXA	#	#/m2	%
Turbellaria	2	12.8	0.28
Tubificidae	501	3,195.6	69.58
Stenacron	1	6.4	0.14
Brachycercus	1	6.4	0.14
Caenis	1	6.4	0.14
Hexagenia limbata	1	6.4	0.14
Stylurus	5	31.9	0.69
Corixidae	63	401.8	8.75
Nectopsyche	1	6.4	0.14
Dubiraphia	2	12.8	0.28
Procladius	16	102.1	2.22
Ablabesmyia mallochi	2	12.8	0.28
Thienemannimyia grp.	2	12.8	0.28
Chironomus	2	12.8	0.28
Cryptochironomus	66	421.0	9.17
Glyptotendipes	18	114.8	2.50
Phaenopsectra obediens grp.	2	12.8	0.28
Polypedilum aviceps	4	25.5	0.56
Polypedilum halterale grp.	10	63.8	1.39
Polypedilum illinoense	4	25.5	0.56
Polypedilum scalaenum grp.	14	89.3	1.94
Stenochironomus	2	12.8	0.28
TOTAL BENTHOS	720	4,592.4	100.00

GEAR=PONAR, DATE=AUG 2011, and LOCATION=R3L

TAXA	#	#/m2	%
Tubificidae	44	280.6	50.57
Brachycercus	1	6.4	1.15
Stylurus	3	19.1	3.45
Corixidae	1	6.4	1.15
Procladius	7	44.6	8.05
Chironomus	3	19.1	3.45
Cryptochironomus	13	82.9	14.94
Glyptotendipes	2	12.8	2.30
Polypedilum halterale grp.	12	76.5	13.79
Pisidium	1	6.4	1.15
TOTAL BENTHOS	87	554.9	100.00

APPENDIX B (cont.)

GEAR=PONAR, DATE=AUG 2011, and LOCATION=R4L

TAXA	#	#/m2	%
Tubificidae	508	3,240.2	54.04
Stylurus	4	25.5	0.43
Corixidae	17	108.4	1.81
Dubiraphia	13	82.9	1.38
Ceratopogonidae	4	25.5	0.43
Procladius	4	25.5	0.43
Chironomus	68	433.7	7.23
Cryptochironomus	16	102.1	1.70
Glyptotendipes	24	153.1	2.55
Harnischia	12	76.5	1.28
Microchironomus	4	25.5	0.43
Polypedilum halterale grp.	264	1,683.9	28.09
Leptodea fragilis	2	12.8	0.21
TOTAL BENTHOS	940	5,995.7	100.00

GEAR=PONAR, DATE=AUG 2011, and LOCATION=R4R

TAXA	#	#/m2	%
Tubificidae	291	1,856.1	33.37
Tricorythodes	3	19.1	0.34
Brachycercus	1	6.4	0.11
Caenis	1	6.4	0.11
Hexagenia limbata	3	19.1	0.34
Corixidae	6	38.3	0.69
Hydroptila	1	6.4	0.11
Dubiraphia	25	159.5	2.87
Stenelmis	1	6.4	0.11
Procladius	8	51.0	0.92
Ablabesmyia mallochi	16	102.1	1.83
Chironomus	24	153.1	2.75
Cryptochironomus	160	1,020.5	18.35
Glyptotendipes	184	1,173.6	21.10
Harnischia	8	51.0	0.92
Parachironomus	8	51.0	0.92
Polypedilum flavum	16	102.1	1.83
Polypedilum halterale grp.	88	561.3	10.09
Rheotanytarsus	24	153.1	2.75
Pisidium	3	19.1	0.34
Quadrula pustulosa	1	6.4	0.11
TOTAL BENTHOS	872	5,561.9	100.00

Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-1 Category: Aquatic

Statement of Question:

Provide the following information:

b. (ESI 2011) Ecological Specialist, Inc. 2011. Unionid Communities near Byron Station, Rock River. ESI Project No. 11-003a. O'Fallon, Missouri. November 2011.

Response:

The requested information is attached.

List Attachments Provided:

1. (ESI 2011) Ecological Specialist, Inc. 2011. Unionid Communities near Byron Station, Rock River. ESI Project No. 11-003a. O'Fallon, Missouri. November 2011.

ESI 2011
Byron-160

Unionid Communities near Byron Station, Rock River

Prepared for:

Exelon Generation Company, LLC
Warrenville, IL

Prepared by:

Ecological Specialists, Inc.
O'Fallon, Missouri

November 2011

(ESI Project no. 11-003a)

Acknowledgments

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1.0 Introduction

Exelon Generation, LLC (Exelon) operates the Byron Nuclear Station (Byron Station) on the Rock River near Byron, IL (Figure 1-1). The two units at Byron Station have a generation capacity of 2336 megawatts and began operation in 1985 and 1987, respectively. Cooling is primarily provided by two natural draft cooling towers. Byron's intake is approximately 3.2km (2mi) east of the station on the Rock River at approximately river mile 115. The discharge flume enters the river approximately 195m (640ft) downstream of the intake. The Oregon Dam (built in early 1990's), approximately 6.4km (4mi) downstream of Byron Station, controls the water level at the intake. In 1993, Bryon Station installed two wing dikes upstream and across from the intake and Iowa Vanes in front of the intake to prevent accumulation of sediment.

The Rock River historically supported a species rich unionid community. Baker (1927) recorded 35 species in the Rock River (listed 48 in his paper, but 13 have since been synonomized [Parmalee and Bogan, 1998]) from the headwaters in Wisconsin to its confluence with the Mississippi River near Moline, IL. Within Illinois, 37 species have been recorded (Table 1-1). Of these 37, *Lampsilis higginsii* is federally endangered, *Plethobasus cyphyus* is proposed for federal endangered status, *Alasmidonta viridis* and *Ptychobranchus fasciolaris* are listed as endangered in Illinois, and *Cyclonaias tuberculata*, *Elliptio dilatata*, *Fusconaia ebena*, *Ellipsaria lineolata*, and *Ligumia recta* are listed as threatened in Illinois.

Unionid mussel species records in Ogle County include Baker (1927), OSU (1969), Illinois Department of Conservation (ILDC, W. Fritz, per. comm., 1993), ESI (1993), and INHS (2009). A total of 28 species have been reported in this reach, however 10 of these (over one third) were last reported by Baker (1927) or collected as weathered shells in 1993 (ESI, 1993) or 2009 (INHS, 2009). The only survey near the Byron Station intake/discharge was conducted by ESI (1993). This survey was conducted to determine if unionids would be affected by construction of sediment control structures. Substrate throughout the study area was a mixture of sand and gravel, with silt accumulation near the intakes. Unionids were found primarily in sand and gravel substrate, with scattered unionids in loose sand throughout the study area. Weathered shells were abundant, and 10 of the 21 species were collected only as shell material (Table 1-2), suggesting this area once supported a more species rich unionid community.

Since almost 20 years have passed since the last unionid survey in this area, Exelon contracted ESI to characterize the current unionid mussel communities upstream and downstream of Byron station in 2011. The survey was conducted June 29 and 30, and July 1, 2011.

2.0 Methods

A combination of semi-quantitative, qualitative, and quantitative sampling was used to determine the status of unionid communities near Byron Station in 2011 (Table 2-1). Twenty-five (25) 100m semi-quantitative transects were established perpendicular to the bank at approximately100m intervals between 800m (0.5miles) upstream and 1600m (1 mile) downstream of the Byron Plant discharge (Figure 2-1). Transects were staggered between banks. Upstream of the discharge flume T1, T3, T5, T7, T9, T10, and T11 were along the right descending bank, and T2, T4, T6, and T8 were along the left descending bank. Downstream of the discharge flume T12, T14, T16, T18, T20, T22, T24, and T25 were along the left descending bank and T13, T15, T17, T19, T21, and T23 were along the right descending bank. GPS coordinates were recorded at the shoreward and riverward end of each transect. A diver traversed each transect line, collecting all encountered unionids within one meter (arms reach) of the line. Each 10m interval was considered a separate sample and was searched for a minimum of three minutes. Samples were retrieved, and depth, substrate constituents, water temperature, and dissolved oxygen were recorded at each 10m interval. Live unionids were identified, counted, and classified as adults or young (≤5 years old). A representative sample (up to 25 individuals) of each species was also be measured (length in mm) and aged (external annuli count). Shells were designated as freshly dead (FD; nacre shiny, shells attached, hinge line flexible; probably died within the past few months), weathered (WD; nacre chalky, valves attached or separated, hinge line brittle; died more than a few months ago to several years ago) or subfossil (SF; nacre chalky, periostracum missing or severely worn, valves separate; died several years to decades ago), and as adults or young and counted.

Once the distribution of unionids was established, a series of quantitative and qualitative samples were collected within areas of unionid concentrations to estimate density and species richness. Ten points were selected for sampling; seven upstream (Q1 to Q7), and three downstream (Q8 to Q10; see Figure 2-1). Depth, substrate, water temperature, and dissolved oxygen, as well as GPS coordinates were recorded at each point, and one quantitative and one qualitative sample was collected. For each quantitative sample, a diver excavated all substrate within a $0.25m^2$ quadrat down to 10cm into an attached mesh bag with mesh size of 6mm. The sampler was retrieved, and unionids separated from substrate and debris. All unionids in quantitative samples were classified as live, FD, WD or SF, and live unionids were identified, measured (length in mm) and aged (external annuli count). For each qualitative sample, a diver collected as many unionids as possible within a 5min interval. Unionids were identified, classified as live, FD, WD, or SF, and live and FD unionids were counted and recorded as adults or young.

All live unionids were returned to the substrate near their collection location.

Systat v10.0 was used for statistical analysis. Student's t-test was used to test for differences in density, and a non-parametric Mann-Whitney U test was used to test for differences in abundance in semi-quantitative samples. *EstimateS* v8.2.0 (Colwell, 2009) was used to calculate species accumulation curves.

3.0 Results

Water quality and substrate characteristics

The discharge flume did not appear to affect water temperature within the study area. Water temperature (measured at the river bottom) during sampling averaged 23.5°C and ranged from 21.5° to 26.3° (Table 3-1). Temperature was warmest near the bank on all transects, where water was shallowest (Figure 3-1). The coolest temperatures were recorded at the upstream three transects, T1, T2, and T3. Although maximum water temperature near the bank downstream of the discharge flume (T12, 25.3°C) was greater than upstream (T8, 24.2°C), this difference was only 1.1°C. Additionally, water temperature seemed to increase with distance from the flume along both banks between T12 and T20. The highest water temperature was recorded near the bank at T20 (26.3°C), which was approximately 700m downstream of the discharge flume. With the exception of the water temperature within 10m of the bank, temperature was warmer upstream of the intake along T8 and across the river along T9 and T10, than downstream of the discharge T12 (see Figure 1-1 and Table 3-1).

Dissolved oxygen (DO) also did not appear to be affected by the discharge flume. DO averaged 8.0mg/L (94.4% saturation), ranged from 7.0 to 9.6mg/L, and was greater than 85% saturation throughout the study area (see Table 3-1). DO seemed to steadily decline between the discharge flume and the downstream most transect. DO averaged 8.0mg/L (93.1% saturation) at T12 and decreased to 7.2mg/L (86.8% saturation) at T22 (see Table 3-1).

Substrate throughout the study area consisted of either consolidated substrate (outside bend areas) or depositional silt (inside bend areas) near the bank, and transitioned to 100% sand with pockets of silt and clay mid-river (Figure 3-2). In general, substrate along the right descending bank contained more cobble and gravel, and substrate along the left descending bank contained more silt and clay (Table 3-2). Depth ranged from 0.3 to 3.0m mid-river (Appendix A), and averaged between 1.9 and 2.7m (see Table 3-2). Outside bends were deeper and inside bends were more sloping. The river became more of a straight reach downstream of Byron Station, and depth increased. Although not measured, current velocity appeared to be slower in the downstream portion of the study area.

Unionid distribution and abundance

Unionids were most abundant in thin strips within the transition zone between the consolidated cobble, gravel, sand and sand substrates throughout the study area along the right descending bank. Fewer unionids were found along the left descending bank where current velocity was slower and substrate contained more silt and clay. Average number of unionids per 10m transect section was significantly higher along the right (1.5 unionids/10 x 1m section) than along the left bank (0.6 unionids/10 x 1m section; $p \leq 0.10$) (Table 3-3). Unionids were also more abundant upstream of the Byron Station intake/discharge (1.8 unionids/10 x 1m section) than downstream (0.5 unionids/10 x 1m section; $p \leq 0.05$). However, this did not appear to be temperature related. The discharge plume was limited to the area near the left bank, and abundance in semi-quantitative samples did not differ significantly between upstream (0.9 unionids/10 x 1m section) and downstream (0.4 unionids/10 x 1m section, $p > 0.10$) along the left bank. Abundance did vary significantly between upstream (2.3 unionids/10 x 1m section) and downstream (0.6 unionids/10 x 1m; $p < 0.05$) along the right bank, which

was not affected by the discharge plume (see Table 3-3).

Unionid abundance was related to local hydraulic and substrate conditions. Along T1, T2, T3 unionids were abundant toward mid channel (see Table 3-2 and Figure 3-3). Only a few unionids were collected along T4, T6 and T8 upstream of the intake along the left descending bank. In the middle of the study area, unionids occurred between 40 and 60m along the right bank (T7, T9, T11, T13, T15). Only a few scattered unionids (≤2 unionids /10 x 1m of transect) were collected along T10, most likely due to the higher current velocity and more consolidated cobble substrate. Downstream of T15, the river was more of a straight reach and unionids appeared to be less abundant, although a few unionids were found along most transects (see Table 3-2 and Figure 3-3).

Within the thin strip of unionids that occurred along the right bank, unionids were abundant, although many were buried under sand. Unionids were most abundant in sand and gravel substrate, at 2.1 to 3.0m deep (Table 3-4). Unionid density within this strip averaged 12.0 unionids/m^2 (see Table 3-4).

Species composition and community characteristics

A total of 21 species were found in the study area in 2011, however only eight species were collected live (Table 3-5). The abundance of weathered and subfossil shells and the number of species, including threatened and endangered species, represented as shells indicates the area once supported a more species rich unionid community. Most of the species that are still alive within the study area were likely collected, as all eight species were collected within 215 unionids; 174 unionids were collected with no new species (Figure 3-4). *Quadrula p. pustulosa* (93.1%) overwhelmingly dominated the unionid community. *Lampsilis cardium* (4.1%) was the second most abundant (see Table 3-5). *Quadrula p. pustulosa*, *Fusconaia flava*, and *L. cardium* were found upstream and downstream of Byron Station. *Pleurobema sintoxia*, *Leptodea fragilis*, and *Potamilus ohiensis* were also collected upstream but not downstream. *Lasmigona c. complanata* and *Lampsilis siliquoidea* were also collected downstream but not upstream. No Illinois or Federal threatened and endangered species were collected alive, although *C. tuberculata*, *E. dilatata*, *P. cyphyus*, *E. lineolata*, and *L. recta* were all collected as shells.

Even though the unionid community lacks species richness, density was high, mortality was low, recruitment was good, and both young and old individuals were present. Density averaged 12.0 unionids/m^2. Recent mortality was very low, as only 3.2% of the unionids collected in quantitative samples were freshly dead shells. Half (50%) of the individuals collected in quantitative samples were ≤5 years old, and at least one individual of 50% of the species was ≤5 years old (see Table 3-5). Age ranged from two to 21 years old based on external annuli counts (Table 3-6).

4.0 Discussion

Species composition near Byron Station was historically similar to other sites within the reach of the Rock River from Byron, IL to Oregon, IL (Table 4-1). Twenty-six (26) species have been reported in Ogle County between 8km upstream of Byron, IL to Oregon Dam. Baker (1927) reported 19 species near Oregon, IL. Ohio State University mollusk museum database reported only three species from sites 8km upstream of Byron and upstream of the Oregon Dam (OSU, 1969). Illinois Natural History Survey (2009) sampled one site 1.6km downstream of Byron and found eight species either live or as freshly dead shells. Illinois Department of Conservation sampled downstream of Byron Station in 1986, but found only five species (W. Fritz, ILDC, pers. comm., 1993). However, all of these studies were either conducted while wading in shallow water or brailling.

Sampling in 1993 and 2011 was more intensive than other studies and was conducted primarily while diving. Twenty-four (24) species were recovered in either the 1993 or 2011 surveys near Byron Station (see Table 4-1). Species not found near Byron that were previously reported between Byron and Oregon, IL include *F. ebena* (Baker, 1927) and *Toxolasma parva* (Baker, 1927; INHS, 2009). Species found near Byron Station but not recovered in other areas include *Pyganodon grandis* (live in 1993, WD in 2011), *E. lineolata* (SF in 2011), *L. siliquoidea* (live in both 1993 and 2011), *Ptychobranchus fasciolaris* (WD in 1993), and *Truncilla donaciformis* (live in 1993). Since most unionids occurred within a narrow band in 2 to 3m of water near Byron Station, few if any live unionids would have been recovered if only wading or brailling was used as the collection method.

The study area likely supported a more species rich community than currently exists, however other areas of the Rock River also seem to have lost many of the species that historically occurred in the river. INHS (2009) found only eight species either live or as fresh shells near Byron, IL. Similar results of few live species, but numerous relic shells was recorded for eight other sites in Ogle County (INHS, 2009).

A comparison of the 1993 and 2011 studies near Byron Station suggests that species richness has declined, but unionid abundance has increased. In 1993, 14 species were found either live or as freshly dead shells, compared to nine in 2011 even though total number of unionids was 235 compared to 389 in 1993 and 2011, respectively (see Table 4-1). A comparison of the species accumulation curves indicates fewer species would be collected with the same level of effort in 2011 compared to 1993 (Figure 4-1). With the collection of 200 individuals, 9.9 to 11.6 species would have been found in 1993, compared to 2.7 to 8.8 species in 2011 (see Table 4-1). Species collected live in 1993 but only found as shells in 2011 include *Alasmidonta marginata*, *P. grandis*, *Strophitus undulatus*, *Actinonaias ligamentina*, and *L. recta*. However, *P. sintoxia* and *P. ohiensis* were collected live in 2011 but not in 1993.

Even though nine species were collected either live or a freshly dead shells in 2011, many of these species (except *Q. p. pustulosa*) appear to be declining in abundance. In 1993, *Q. p. pustulosa* comprised 35.7% of the collected individuals, whereas it comprised 93.1% in 2011. A similar pattern of persistence, but decline in population size of all but the most abundant species has also been observed in the Little South Fork Cumberland River (Warren and Haag, 2005), and was

also cited as a common pattern in declining unionid mussel communities by Strayer (2008). This pattern of declining unionid species richness was observed both upstream and downstream of Byron Station (see Table 3-5) and is also likely occurring in other parts of the Rock River based on the number of relic species compared to live/freshly dead species found by INHS (2009). However, despite the decline in species, recruitment was similar between studies with 46.3% and 50% of unionids ≤5 years old in 1993 and 2011, respectively (see Table 4-1).

Although species richness is declining near Byron Station, unionids were similarly distributed in 1993 and 2011, and unionid abundance appears to have increased since 1993. In both studies, most unionids were collected within a thin strip along the right descending bank in sand/gravel substrate, and unionids were scattered throughout the remainder of the area in loose sand substrate. In both years, most of the quantitative and qualitative samples were collected in areas of unionid abundance (Figures 4-2 and 4-3). Quantitative and qualitative samples collected in close proximity in both years yielded a higher abundance of unionids in 2011 than in 1993 (see Figures 4-2 and 4-3). Catch per hour averaged 26.3 unionids in 1993 compared to 110.4 in 2011, and density averaged 1.0/m^2 in 1993 compared to 12.0/m^2 in 2011 (see Table 4-1). The only difference in distribution may be along the right descending bank in front of the intake structure. Before construction 11 to 60 unionids/hour were found in this area (see Figure 4-3). No quantitative or qualitative samples were collected in front of the intakes in 2011 due to the presence of the sediment control structures that were constructed in 1993. Recolonization of this area could not be assessed due to dangerous diving conditions.

The Rock River unionid community near the Byron Station seems to be declining with respect to species composition, but may be increasing in abundance. Most unionids currently occur in a thin strip within the transition zone between consolidated and loose substrate along the right descending bank. Unionids seem to be less abundant downstream of Byron Station than upstream, but this appears to be due to differences in habitat rather than discharge from Byron Station. The declines in species composition seem to be occurring river wide, as surveys by INHS (2009) in Ogle County also yielded primarily weathered shells and few live unionids.

5.0 Literature cited

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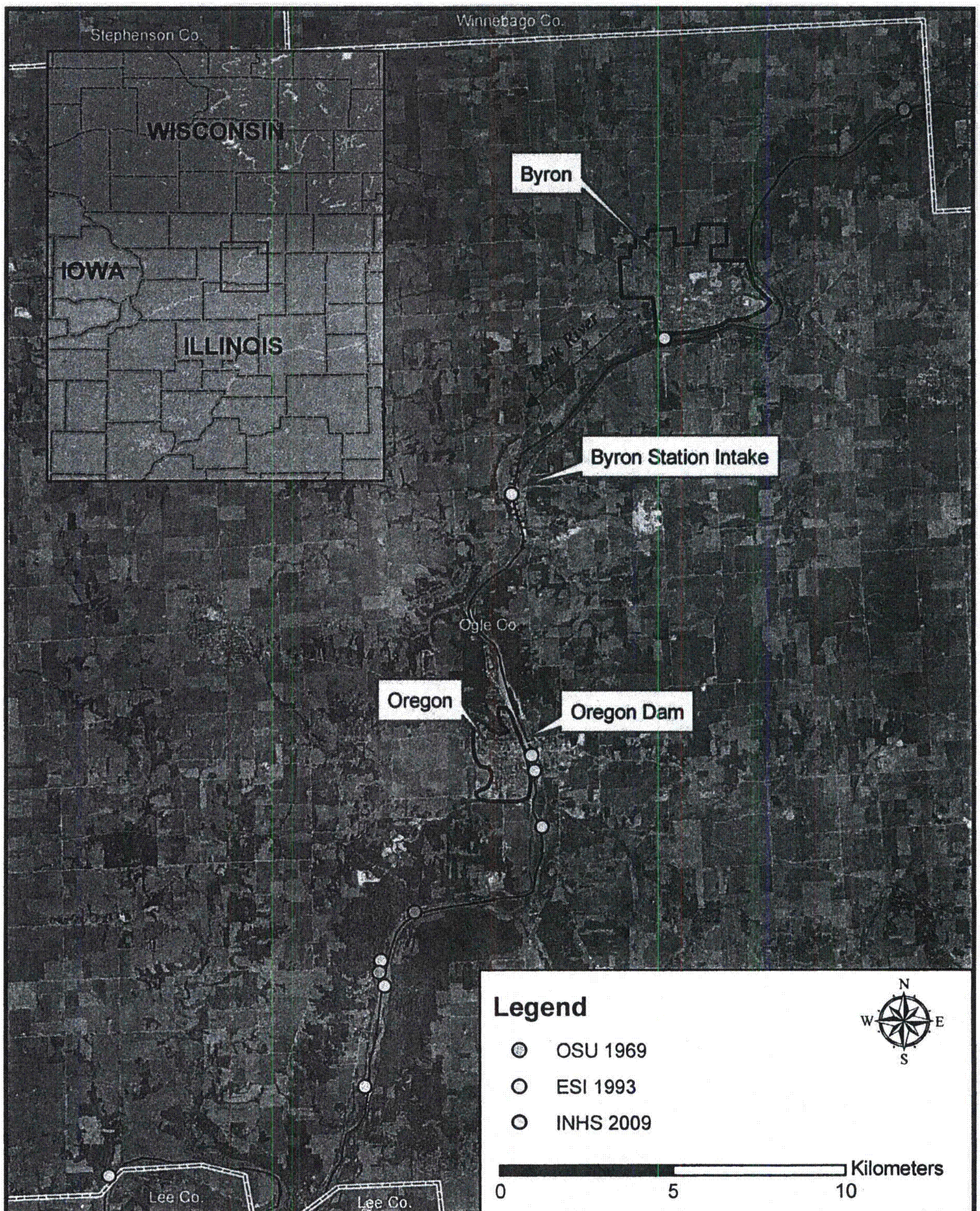
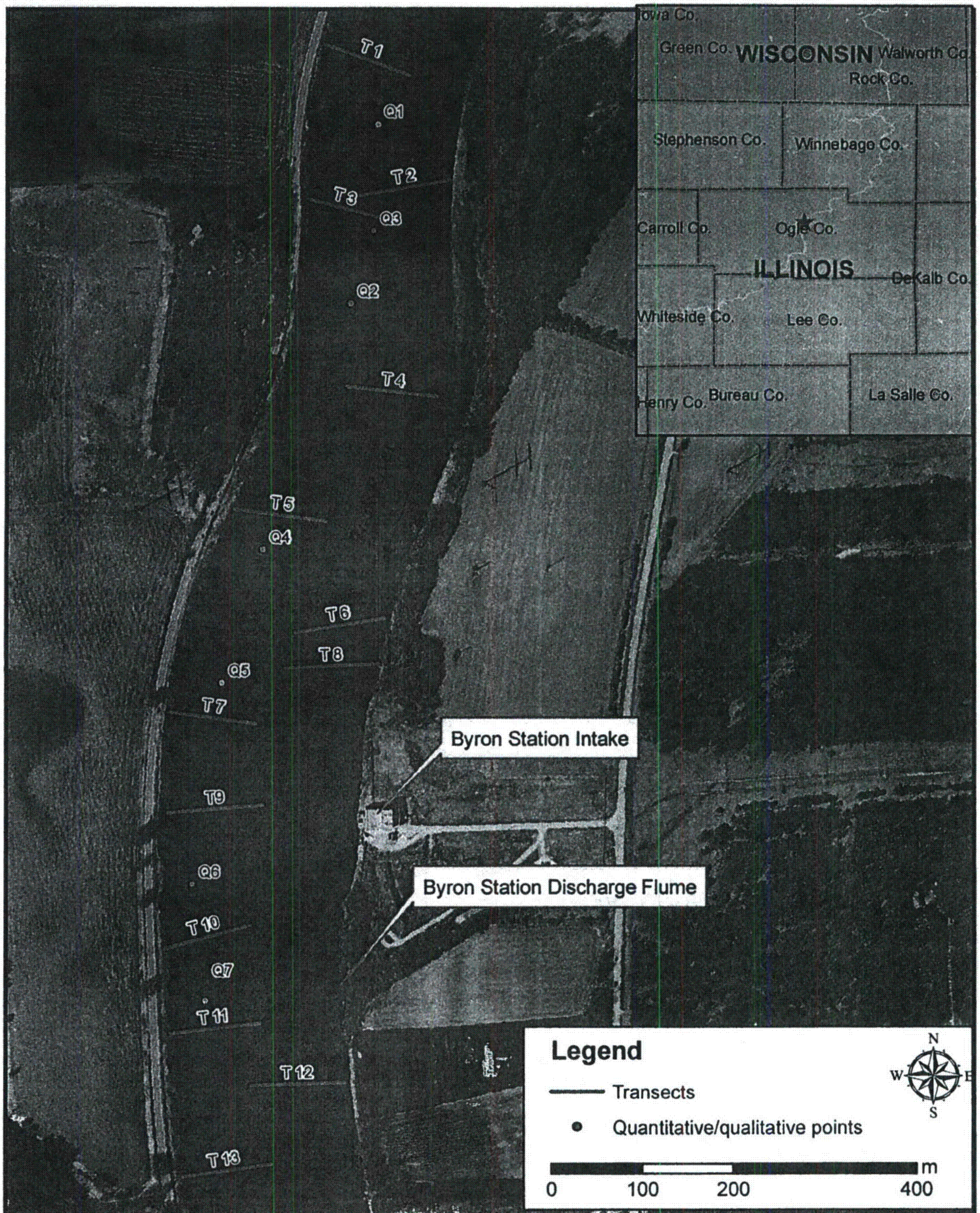


ECOLOGICAL SPECIALISTS, INC.	Figure 1-1. Rock River unionid sample locations in Ogle County, IL.	ESI



ECOLOGICAL SPECIALISTS, INC.	Figure 2-1a. Unionid samples near Byron Station, Rock River, June 2011.	ESI

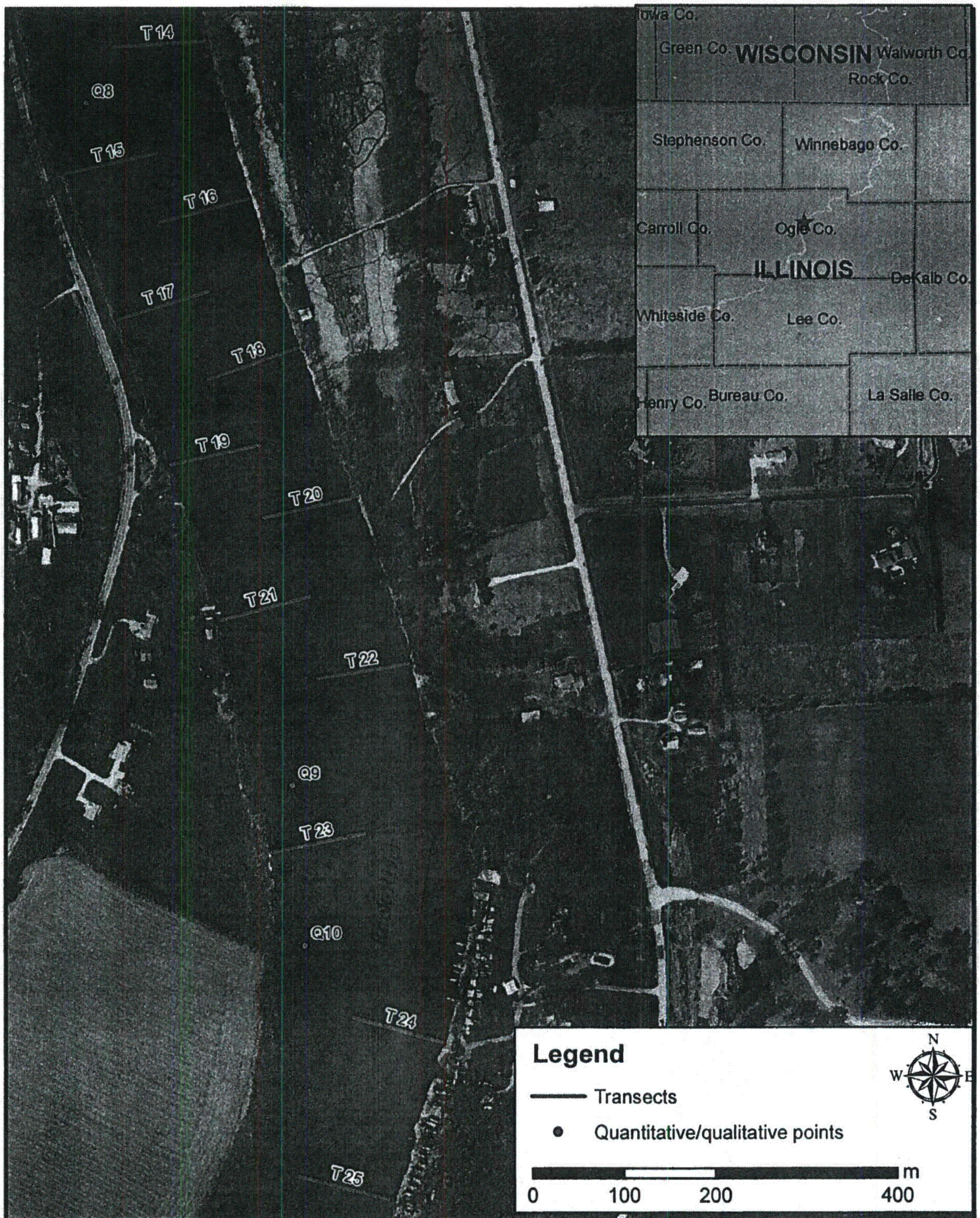


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Figure 2-1b. Unionid samples near Byron Station, Rock River, June 2011.

ESI

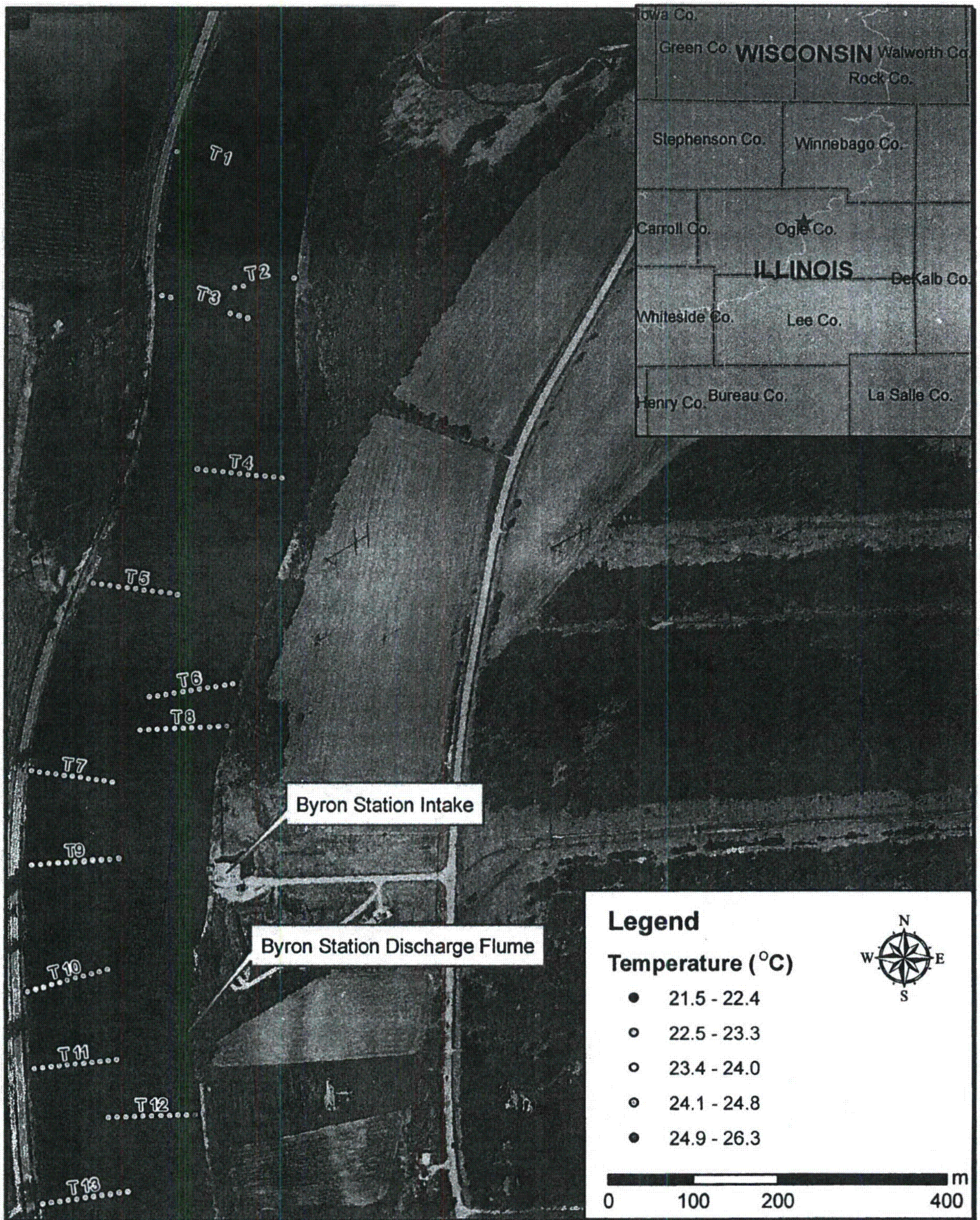

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Figure 3-1a. Temperature (°C) along transects near Byron Station, Rock River, June 2011.

ESI

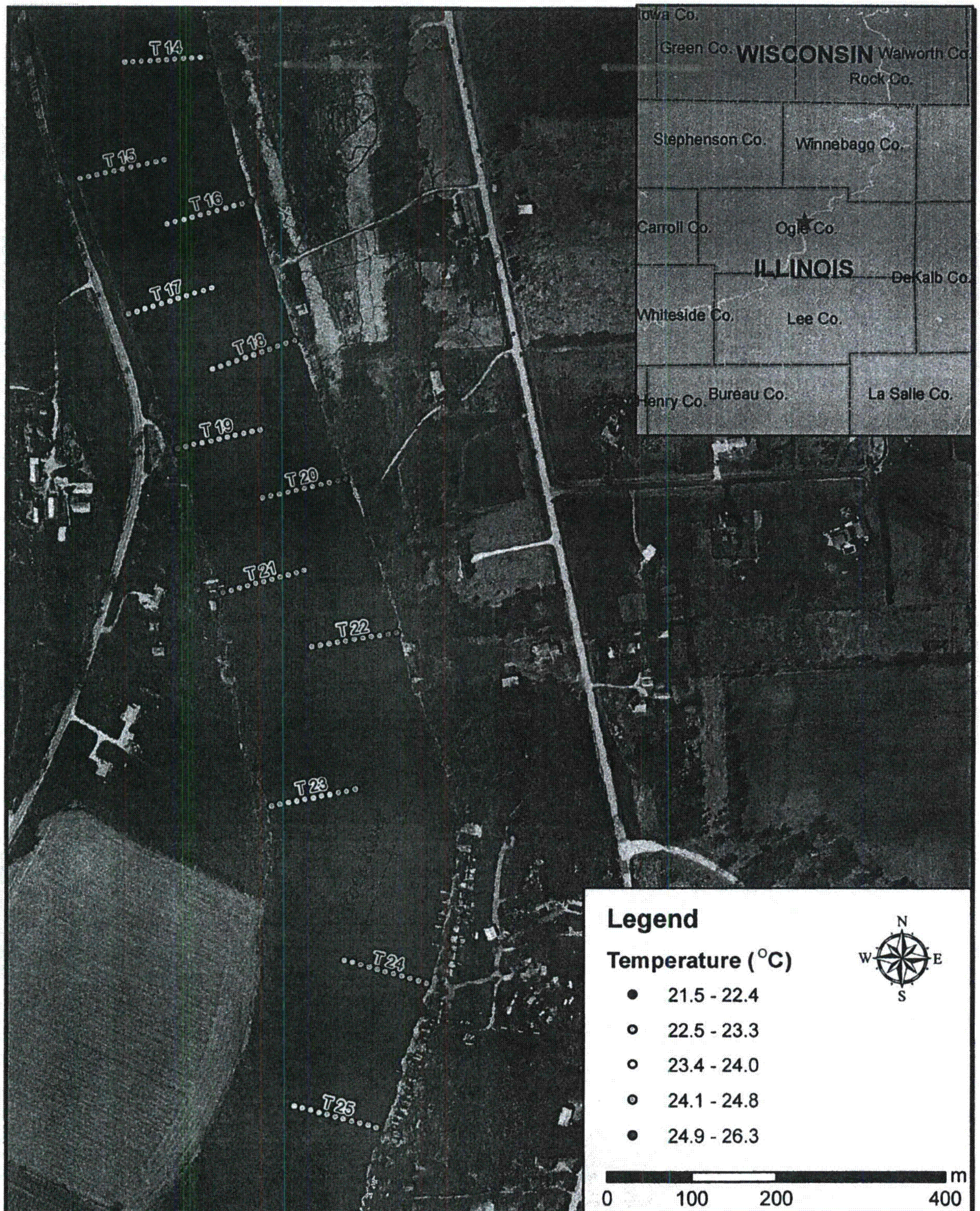

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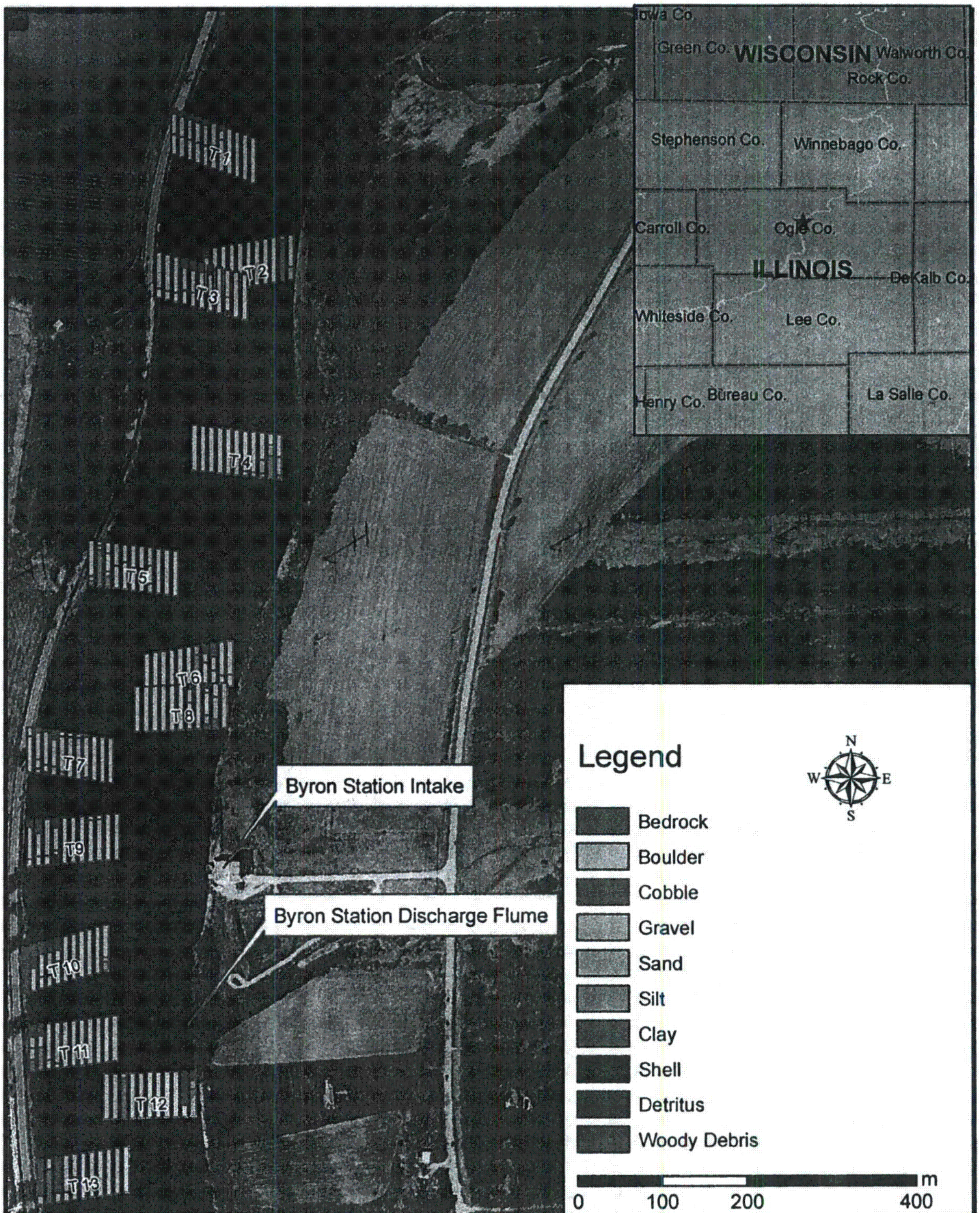
Figure 3-1b. Temperature (°C) along transects near Byron Station, Rock River, June 2011.

ESI



ECOLOGICAL SPECIALISTS, INC.	Figure 3-2a. Substrate composition along transects near Byron Station, Rock River, June 2011.	ESI

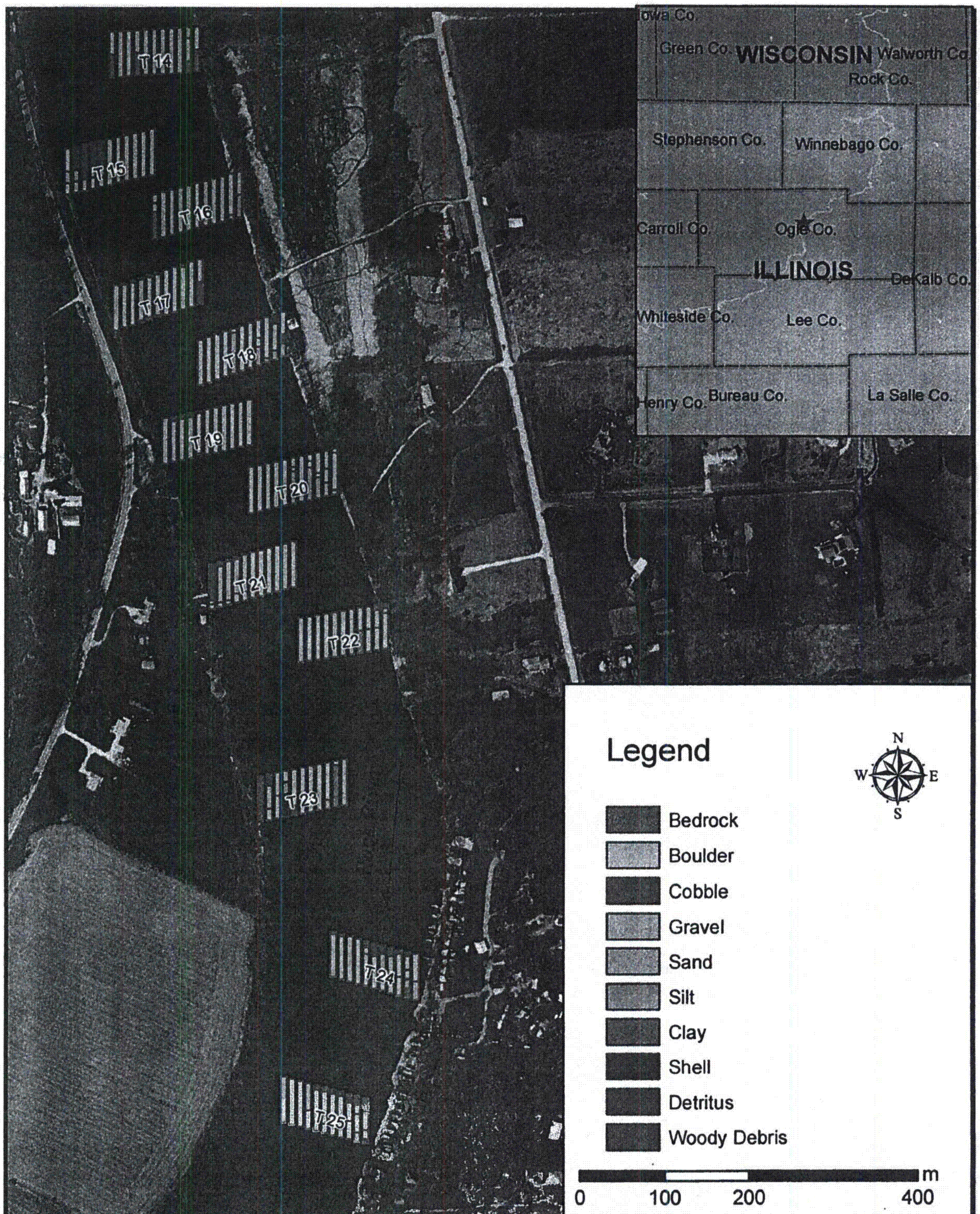


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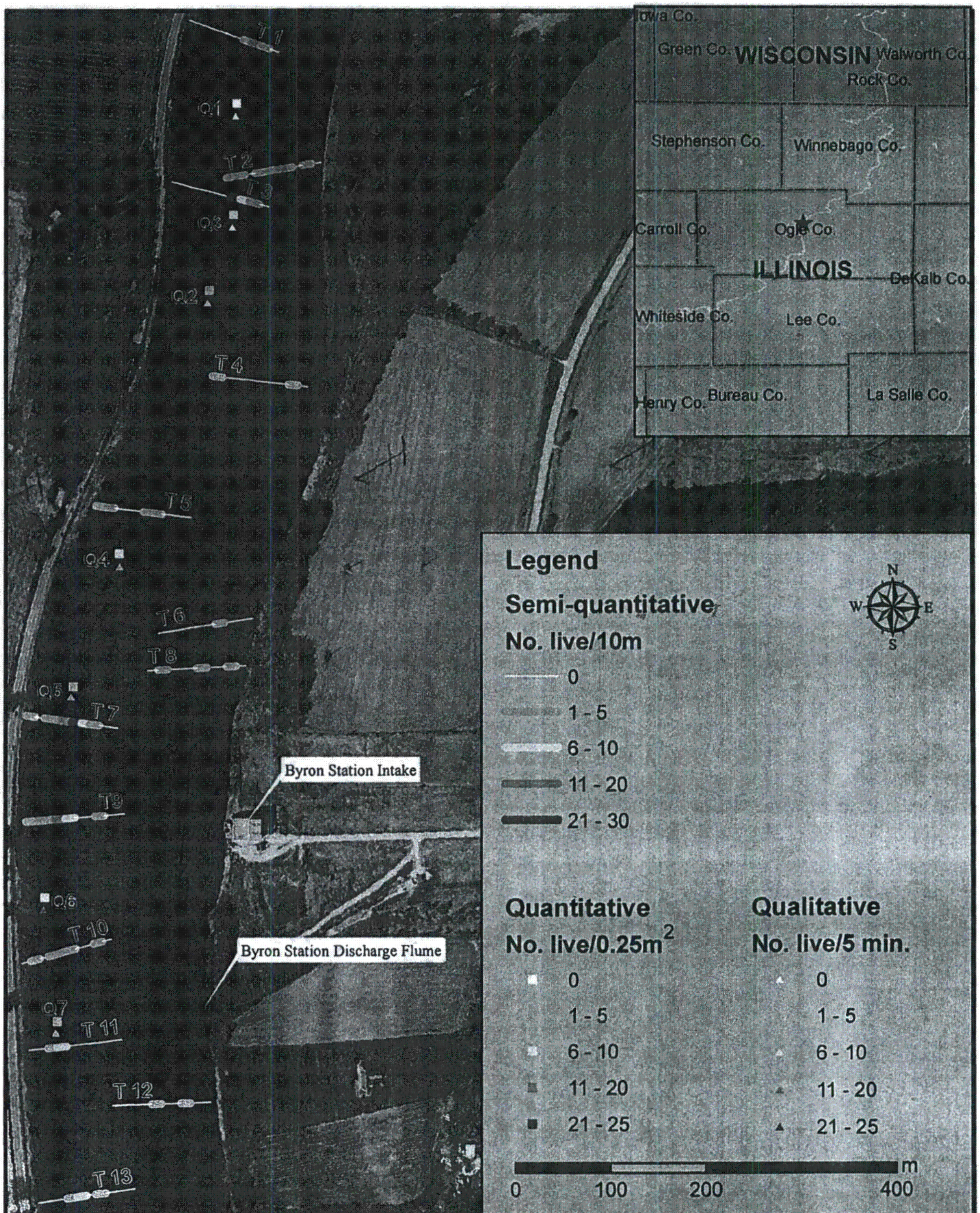
Figure 3-2b. Substrate composition along transects near Byron Station, Rock River, June 2011.

ESI



ECOLOGICAL SPECIALISTS, INC.	Figure 3-3a. Unionid distribution near Byron Station, Rock River, June 2011.	ESI

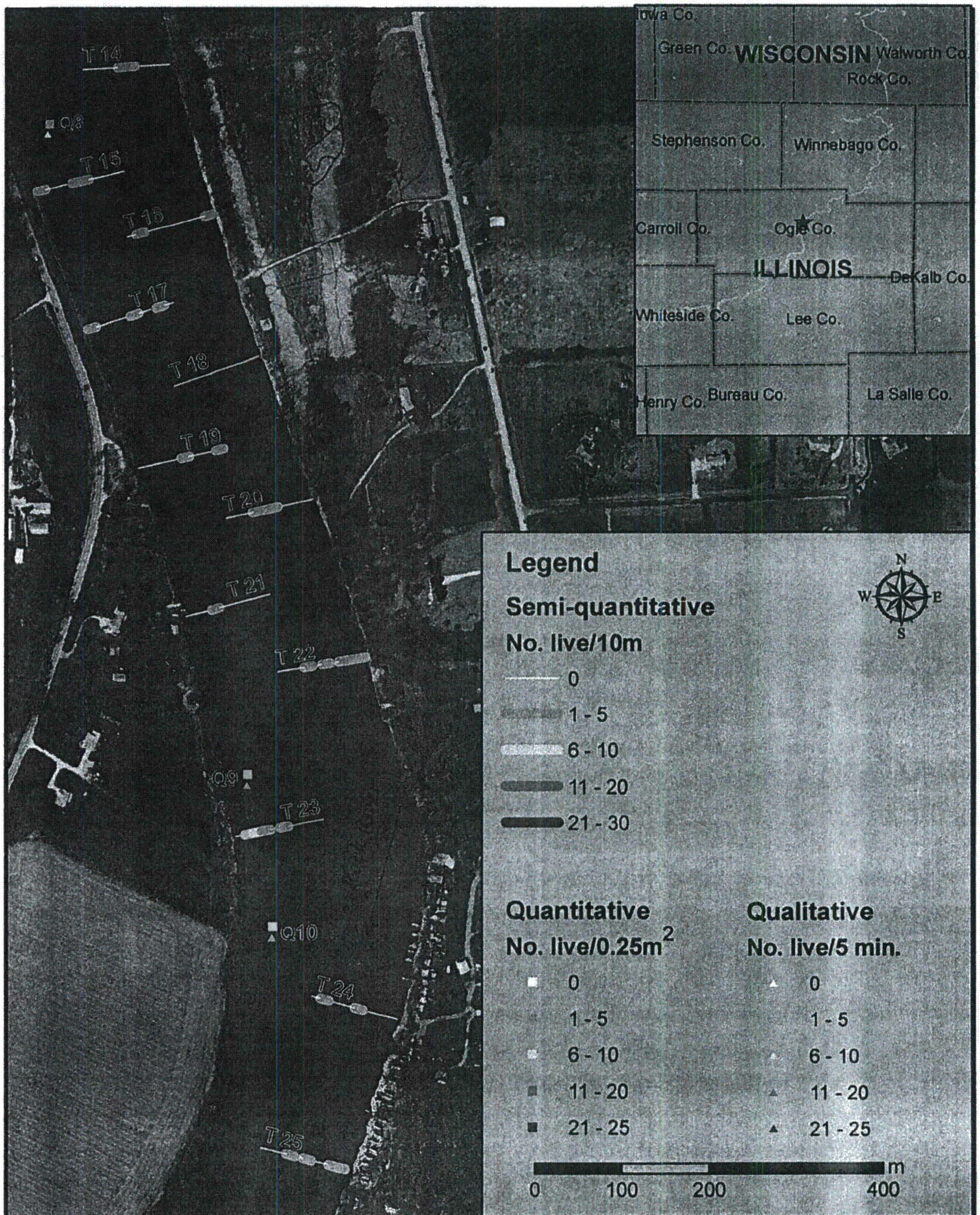


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Figure 3-3b. Unionid distribution near Byron Station, Rock River, June 2011.

ESI

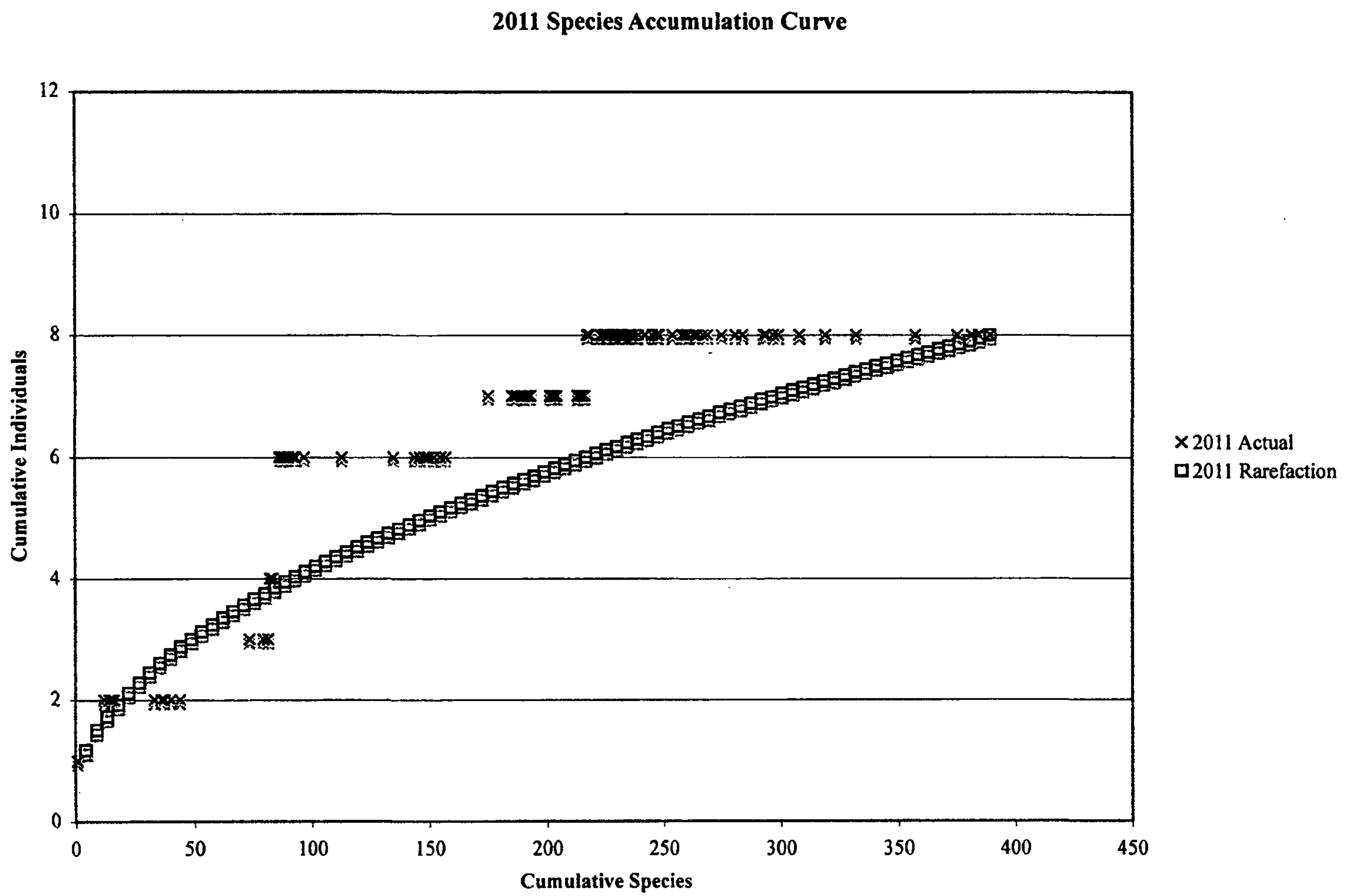

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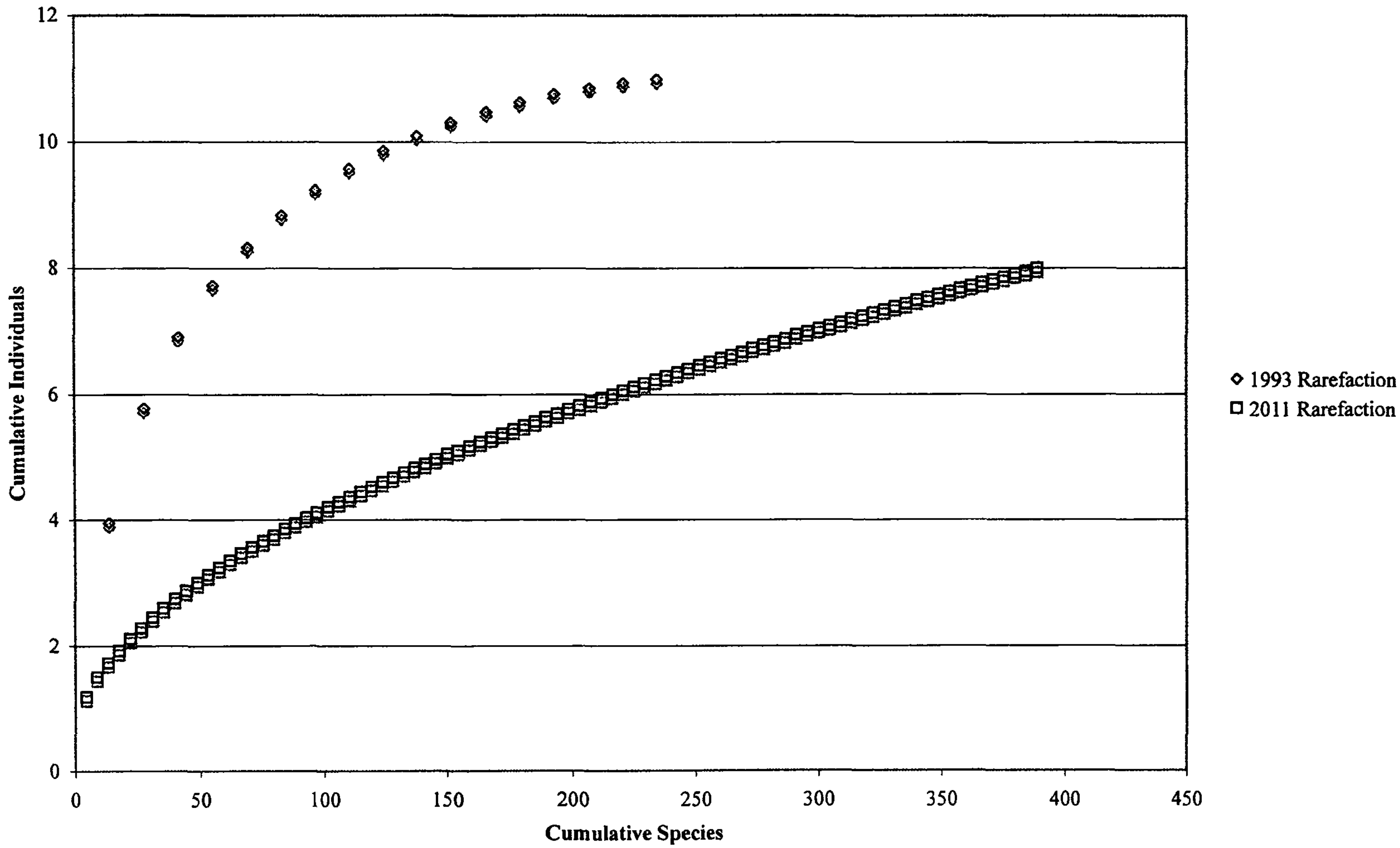
Figure 3-4. Species accumulation curve, Rock River near Byron Station, June 2011.

ESI

1993 vs 2011 Species Accumulation Curve



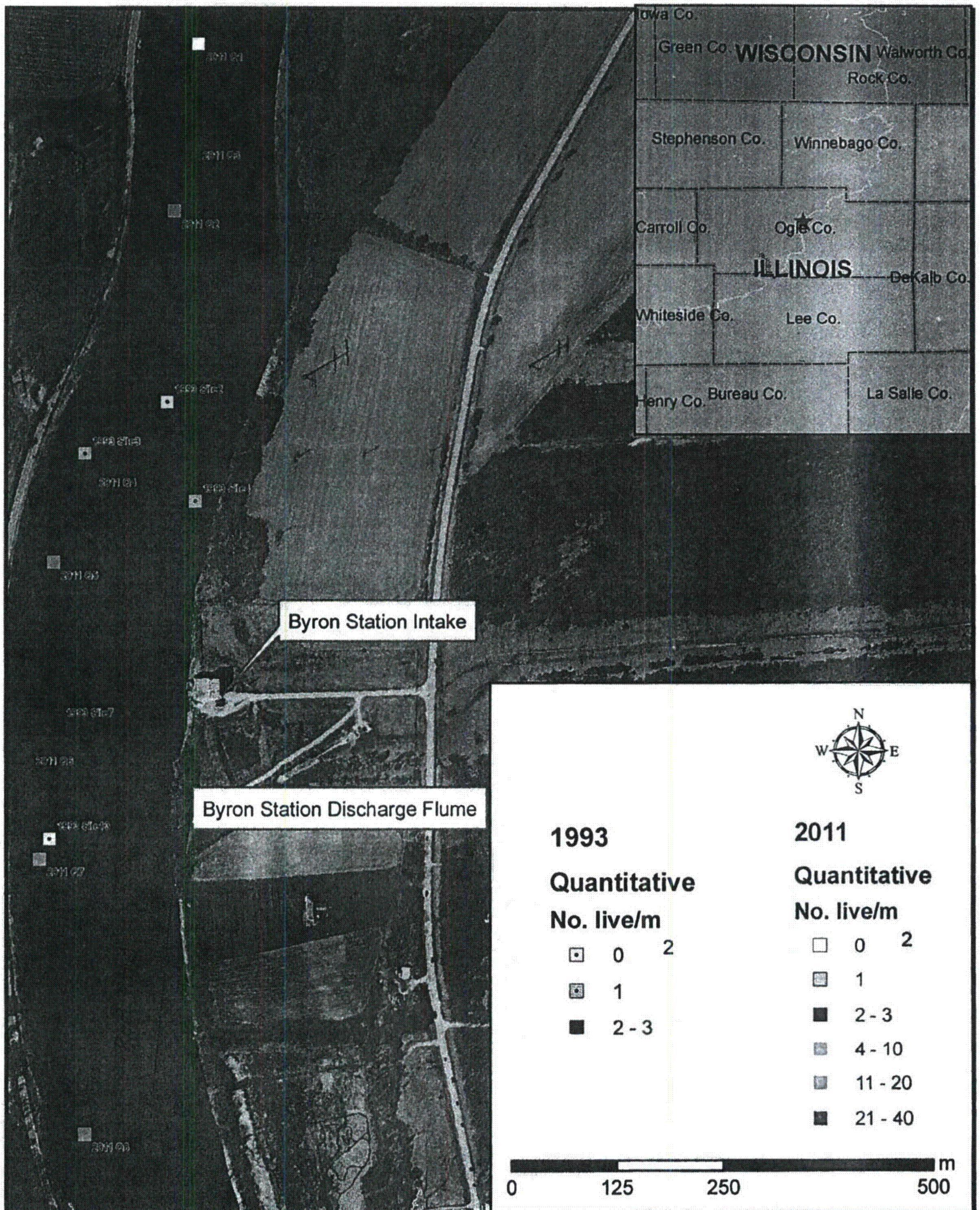


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Figure 4-2. Comparison of quantitative samples near Byron Station, Rock River, 1993 and 2011.

ESI

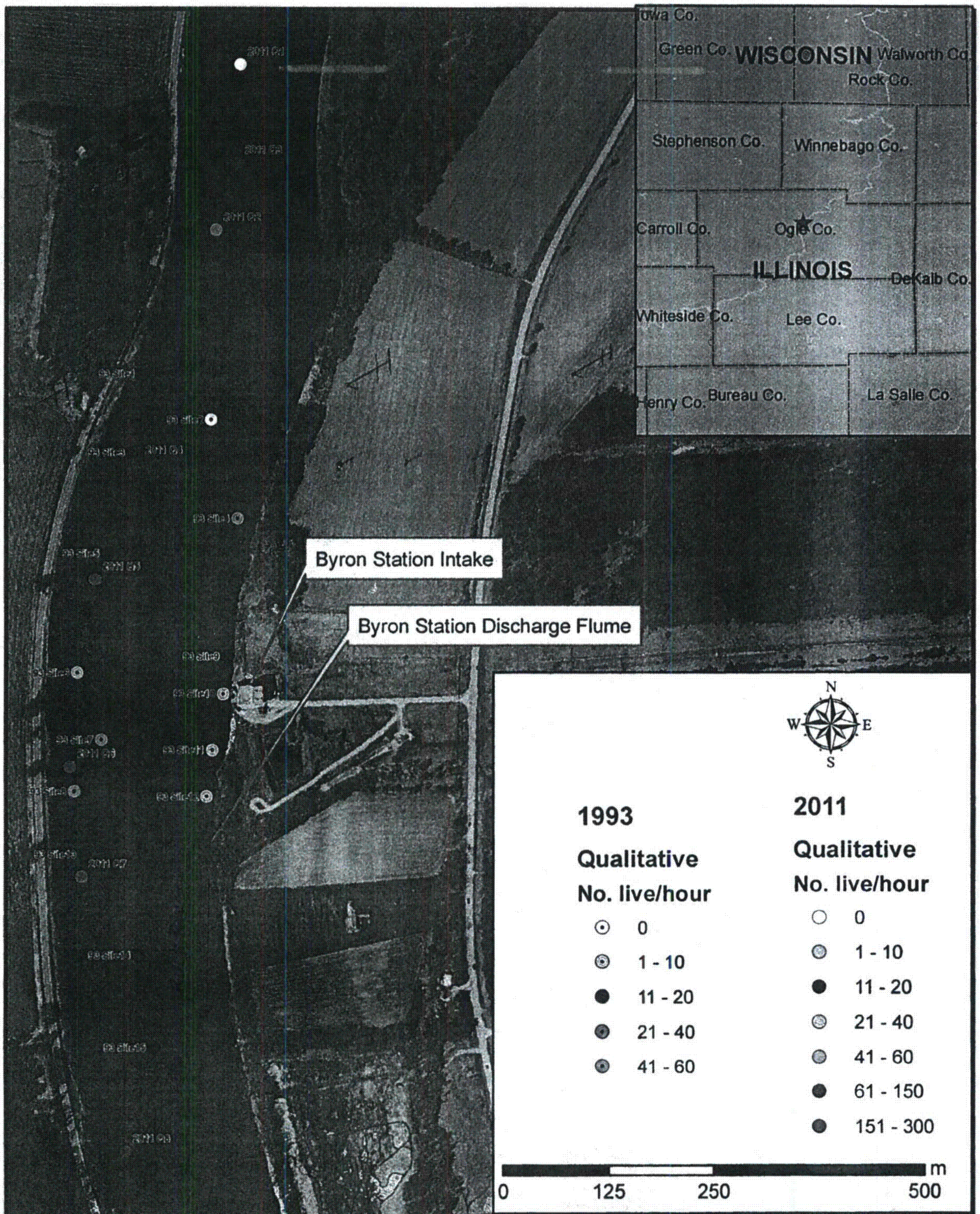

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Figure 4-3. Comparison of qualitative samples near Byron Station, Rock River, 1993 and 2011.

ESI

Table 1-1. Unionid species recorded from Rock River, Illinois.

	Status[1]	Rock River Illinois[2,3,4,5,6]	Ogle Co Near Byron, IL[3,4]	Byron to Oregon, IL[2,5,6]	Downstream of Oregon Dam[3,4]	Last year reported alive
Ambleminae						
Amblema plicata		X	09 (WD)[7]	27, 93	09 (WD)	93
Cyclonaias tuberculata	ILT	X	09 (WD)	27, 93 (WD)	09 (WD)	27
Elliptio dilatata	ILT	X	09 (WD)	27, 93 (WD)	09 (WD)	27
Fusconaia ebena	ILT	X	-	27	-	27
Fusconaia flava		X	69, 09	27, 86, 93	09	09
Plethobasus cyphyus	FP, ILE	X	-	27, 93 (WD)	09 (WD)	27
Pleurobema rubrum		X	-	-	09 (WD)	?
Pleurobema sintoxia		X	69	27, 93 (WD)	09	09
Quadrula metanevra		X	-	-	-	-
Quadrula nodulata		X	-	-	-	-
Quadrula p. pustulosa		X	09	27, 86, 93	09	09
Quadrula quadrula		X	-	-	-	-
Tritogonia verrucosa		X	-	27, 93 (WD)	09 (WD)	27
Anodontinae						
Alasmidonta viridis	ILE	X	-	-	-	-
Alasmidonta marginata		X	69, 09 (WD)	27, 86, 93	09	09
Lasmigona c. complanata		X	-	27, 93	09	09
Lasmigona costata		X	-	27, 93 (WD)	-	27
Pyganodon grandis		X	-	93	69, 09	09
Strophitus undulatus		X	-	27, 93	09	09
Utterbackia imbecillis		X	09	93	09	09
Lampsilinae						
Actinonaias ligamentina		X	09 (WD)	27, 86, 93	09	09
Ellipsaria lineolata	ILT	X	-	-	09 (WD)	?
Lampsilis cardium		X	09	27, 86, 93	09	09
Lampsilis higginsii	FE, ILE	X	-	-	-	-
Lampsilis siliquoidea		X	-	93	09 (WD)	93
Lampsilis teres		X	-	-	-	-
Leptodea fragilis		X	09	27, 93	09	09
Ligumia recta	ILT	X	09	27, 93	09	09
Obliquaria reflexa		X	-	-	-	-
Obovaria olivaria		X	-	-	-	-
Potamilus alatus		X	-	27	09	09
Potamilus ohiensis		X	09	-	09	09
Ptychobranchus fasciolaris	ILE	X	-	93 (WD)	-	?
Toxolasma parvus		X	09	27	-	09
Truncilla donaciformis		X	-	93	09	09
Truncilla truncata		X	-	-	-	-
Venustaconcha ellipsiformis		X	-	-	09 (WD)	?
Total species	9	37	14	24	24	28

[1]FE= federally endangered, FP= proposed for federal endangered status (USFWS, 2011), ILE=Illinois endangered, ILT=Illinois threatened (ILDNR, 2009)
[2]Baker (1927)
[3]OSU (1969, 1970, 1985, 1993)
[4]INHS (2009)
[5]ILDC (1986)
[6]ESI (1993, 2001, 2005, 2008)
[7]Year collected, (WD) indicates collected only as a weathered or subfossil shell, year only indicated collected live or as a fresh shell

Table 1-2. Unionid community characteristics near Byron Station, Rock River, May 1993.

			Age (years)[2]			Length (mm)		
	No. live[1]	%	Ave.	Min.	Max.	Ave.	Min.	Max.
Ambleminae								
Amblema plicata	FD	-	-	-	-	-	-	-
Cyclonaias tuberculata	WD	-	-	-	-	-	-	-
Elliptio dilatata	WD	-	-	-	-	-	-	-
Fusconaia flava	5	2.1	7.0	5	11	58.8	46	75
Plethobasus cyphyus	WD	-	-	-	-	-	-	-
Pleurobema sintoxia	WD	-	-	-	-	-	-	-
Quadrula pustulosa	84	35.7	8.3	3	16	54.4	34	78
Tritogonia verrucosa	WD	-	-	-	-	-	-	-
Anodontinae								
Alasmidonta marginata	2	0.9	3.0	3	3	67.0	63	71
Lasmigona complanata	68	28.9	6.2	2	11	132.7	54	157
Lasmigona costata	WD	-	-	-	-	-	-	-
Pyganodon grandis	11	4.7	3.5	1	6	114.0	59	173
Strophitus undulatus	2	0.9	3.0	2	4	76.5	70	83
Utterbackia imbecillis	FD	-	-	-	-	-	-	-
Lampsilinae								
Actinonaias ligamentina	FD	-	-	-	-	-	-	-
Lampsilis cardium	13	5.5	3.8	2	7	98.2	73	140
Lampsilis siliquoidea	1	0.4	-	-	-	128.0	128	128
Leptodea fragilis	41	17.4	3.4	2	6	95.2	62	128
Ligumia recta	2	0.9	6.5	6	7	124.5	123	126
Ptychbranchus fasciolaris	WD	-	-	-	-	-	-	-
Trucilla donaciformis	6	2.6	2.3	2	3	25.3	20	37
Total no. live	235							
Live species	11							
Total species	21							
ES_200[3]	9.9-11.6							
CPU (catch/hour)	26.3							
Density (no./m^2)	1.0							
% ≤5 years old	46.4							
%FD	35.1							

[1]No. Live or best condition; FD=freshly dead shell, WD=weathered shell
[2]Based on external annuli count
[3]Expected species with collection of 200 individuals

Table 2-1. Sample effort near Byron Station, Rock River, June 2011.

Method	Location	No. samples	Effort/sample	Total effort
Semi-quantitative	Upstream	T1 to T11	100m	1100m
	Downstream	T12 to T25	100m	1400m
Quantitative	Upstream	Q1 to Q7	$0.25m^2$	$1.75m^2$
	Downstream	Q8 to Q10	$0.25m^2$	$0.75m^2$
Qualitative	Upstream	Q1 to Q7	5min	35min
	Downstream	Q8 to Q10	5min	15min

Table 3-1. Temperature and dissolved oxygen near Byron Station, Rock River, June 2011.

		Temperature (°C)				DO (mg/L)			
Site	Transect	Ave.	Min.	Max.	Diff[1]	Ave.	% saturation	Min.	Max.
UP	T1	21.8	21.5	22.5	1.0	8.5	97.3	8.4	8.6
	T2	**22.5**	**22.1**	**23.2**	**1.1**	**8.5**	**97.7**	**8.3**	**8.9**
	T3	22.5	22.0	23.0	1.0	8.6	99.3	8.5	9.6
	T4	**22.8**	**22.7**	**23.4**	**0.7**	**8.4**	**98.0**	**8.3**	**8.6**
	T5	22.9	22.6	24.3	1.7	8.4	98.2	8.3	8.9
	T6	**23.2**	**23.1**	**23.9**	**0.8**	**8.4**	**97.5**	**8.3**	**8.7**
	T7	23.5	23.2	24.2	1.0	8.3	97.4	8.2	8.5
	T8	**23.8**	**23.7**	**24.2**	**0.5**	**8.3**	**99.0**	**8.2**	**8.6**
	T9	23.9	23.7	24.1	0.4	8.3	98.0	8.2	8.4
	T10	24.1	23.9	24.3	0.4	8.3	98.0	8.2	8.3
	T11	22.7	22.5	23.2	0.7	8.1	93.1	7.9	8.1
UP total		23.1	21.5	24.3	2.8	8.4	97.9	7.9	9.6
DN	**T12**	**23.1**	**22.9**	**25.3**	**2.4**	8.0	93.1	7.8	8.1
	T13	22.9	22.7	23.6	0.9	8.1	94.4	8.0	8.3
	T14	**23.4**	**23.1**	**25.0**	**1.9**	**8.0**	**94.0**	**7.9**	**8.2**
	T15	23.2	23.0	24.0	1.0	8.0	93.6	7.9	8.2
	T16	**23.8**	**23.5**	**25.3**	**1.8**	**8.0**	**95.6**	**7.9**	**8.8**
	T17	23.7	23.4	24.7	1.3	8.0	93.9	7.9	8.0
	T18	**24.3**	**23.9**	**25.9**	**2.0**	**7.9**	**94.9**	**7.8**	**8.3**
	T19	24.1	23.9	25.0	1.1	8.0	94.9	7.9	8.0
	T20	**24.7**	**24.3**	**26.3**	**2.0**	**7.8**	**93.6**	**7.7**	**7.9**
	T21	24.4	24.3	24.9	0.6	7.9	94.6	7.8	7.9
	T22	**24.6**	**24.2**	**25.4**	**1.2**	**7.2**	**86.8**	**7.1**	**7.3**
	T23	24.1	23.9	24.5	0.6	7.2	86.1	7.1	7.3
	T24	**24.4**	**24.0**	**24.8**	**0.8**	**7.2**	**86.4**	**7.0**	**7.3**
	T25	**24.3**	**24.0**	**24.7**	**0.7**	**7.2**	**86.7**	**7.0**	**7.3**
DN total		23.9	22.7	26.3	3.6	7.8	92.2	7.0	8.8
Total		23.5	21.5	26.3	4.8	8.0	94.4	7.0	9.6

Bolded transects are along the left descending bank
[1]Difference between maximum and minimum

Table 3-2. Average depth, substrate and number of live unionids per 10m section along semi-quantitative transects, Rock River, June 2011.

Site[1]	Transect	Ave. depth (m)	Ave. % substrate constituents[2] %Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	Ave. no. live unionids
UP-R	T1	2.3	0.0	5.5	26.8	67.7	0.0	0.0	0.0	0.0	0.0	0.3
UP-R	T3	2.3	0.0	7.3	45.5	46.4	0.0	0.0	0.9	0.0	0.0	0.7
UP-R	T5	1.9	0.0	0.0	23.2	61.8	4.5	10.5	0.0	0.0	0.0	0.2
UP-R	T7	1.9	0.0	3.2	22.7	71.4	2.3	0.0	0.0	0.0	0.5	1.6
UP-R	T9	1.9	0.0	5.9	24.5	67.7	0.0	0.0	1.8	0.0	0.0	1.4
UP-R	T10	1.9	0.0	20.5	15.9	60.9	0.9	1.8	0.0	0.0	0.0	0.2
UP-R	T11	2.4	0.0	4.5	20.0	66.4	2.3	6.8	0.0	0.0	0.0	0.4
DN-R	T13	2.4	0.0	14.5	17.7	60.9	0.0	6.8	0.0	0.0	0.0	0.3
DN-R	T15	2.5	4.5	21.4	10.9	63.2	0.0	0.0	0.0	0.0	0.0	0.2
DN-R	T17	2.5	0.0	1.8	43.6	49.5	0.0	0.0	0.0	0.5	4.5	0.3
DN-R	T19	2.7	0.0	2.7	34.1	62.7	0.5	0.0	0.0	0.0	0.0	0.1
DN-R	T21	2.6	0.0	9.1	30.0	60.9	0.0	0.0	0.0	0.0	0.0	0.1
DN-R	T23	2.1	0.0	11.4	9.1	60.9	4.1	8.2	4.5	0.0	1.8	0.5
UP-L	T2	1.9	0.0	1.8	7.3	79.1	3.6	8.2	0.0	0.0	0.0	0.6
UP-L	T4	1.9	0.0	0.0	0.0	83.2	10.5	6.4	0.0	0.0	0.0	0.2
UP-L	T6	2.1	0.0	4.5	18.2	68.2	1.8	7.3	0.0	0.0	0.0	0.1
UP-L	T8	2.0	0.0	1.8	3.6	76.4	15.5	0.0	0.0	0.0	2.7	0.4
DN-L	T12	1.7	0.0	8.6	2.3	72.7	2.7	13.6	0.0	0.0	0.0	0.1
DN-L	T14	2.1	0.0	0.0	2.3	81.8	0.0	15.9	0.0	0.0	0.0	0.1
DN-L	T16	2.3	0.0	0.0	1.8	87.3	5.5	5.5	0.0	0.0	0.0	0.1
DN-L	T18	2.2	4.5	3.6	9.1	65.5	17.3	0.0	0.0	0.0	0.0	0.0
DN-L	T20	2.1	0.0	0.0	11.8	67.7	20.5	0.0	0.0	0.0	0.0	0.1
DN-L	T22	2.0	0.0	1.8	9.1	84.5	0.0	4.5	0.0	0.0	0.0	0.5
DN-L	T24	2.1	0.0	9.5	16.8	66.4	5.5	0.0	0.0	0.0	1.8	0.1
DN-L	T25	2.5	0.0	10.0	37.7	49.5	1.8	0.0	0.0	0.0	0.9	0.2

[1]UP=upstream, DN=downstream of discharge flume; R=right descending bank, L=left descending bank
[2]Bo=Boulder, Cb=Cobble, Gr=Gravel, Sd=Sand, St=Silt, Cl=Clay, Shell=Unionid shell, Dt=Detritus, WD=Woody debris

Table 3-3. Comparison of unionid abundance in semi-quantitative samples, Rock River, June 2011.

	No. of samples	Ave./10m	2SE[1]	Significance[2]
Right bank	130	1.5	0.7	b
Left bank	120	0.6	0.3	a
Upstream	110	1.8	0.9	A
Downstream	140	0.5	0.2	B
Upstream L	40	0.9	0.9	A
Downstream L	80	0.4	0.2	A
Upstream R	70	2.3	1.3	A
Downstream R	60	0.6	0.4	B

[1]2SE=2 standard error units (95% confidence interval)

[2]Mann-Whitney U-test, different small case letters indicate significant difference $p<0.10$, different upper case letters indicate significant difference $p<0.05$

Table 3-4. Quantitative sample habitat characteristics and no. of live mussels, Rock River, June 2011.

Replicate	Ave. depth (m)	% Substrate constituents[1] %Cb	%Gr	%Sd	No. live
1	3.4	20	30	50	0
2	2.7	80	10	10	2
3	2.7	0	50	50	6
4	2.1	0	60	40	6
5	2.1	0	20	80	3
6	3.0	0	50	50	9
7	3.0	0	80	20	1
8	3.0	25	25	50	3
9	2.7	20	40	40	0
10	2.7	0	10	90	0
Average	2.8	14.5	37.5	48	12.0 ± 7.8[2]

[1]Cb=Cobble, Gr=Gravel, Sd=Sand
[2]No./m^2 (average no. live x 4 ±2SE)

Table 3-5. Unionid species collected near Byron Station, Rock River, June 2011.

Subfamily	Species	Status[1]	Upstream	Downstream	Total	%
Ambleminae	*Amblema plicata*		FD	WD	FD	-
	Cyclonaias tuberculata	ILT	WD	WD	WD	-
	Elliptio dilatata	ILT	WD	WD	WD	-
	Fusconaia flava		3	1	4	1.0
	Plethobasus cyphyus	FP, ILE	WD	SF	WD	-
	Pleurobema sintoxia		1	SF	1	0.3
	Quadrula p. pustulosa		284	78	362	93.1
	Tritogonia verrucosa		SF	SF	SF	-
	Total Ambleminae		288	79	367	94.3
Anodontinae	*Alasmidonta marginata*		WD	WD	WD	-
	Lasmigona c. complanata		FD	1	1	0.3
	Lasmigona costata		SF	WD	WD	-
	Pyganodon grandis		WD	WD	WD	-
	Strophitus undulatus		-	WD	WD	-
	Total Anodontinae		0	1	1	0.3
Lampsilinae	*Actinonaias ligamentina*		WD	WD	WD	-
	Ellipsaria lineolata	ILT	SF	-	SF	-
	Lampsilis cardium		14	2	16	4.1
	Lampsilis siliquoidea		1	1	2	0.5
	Leptodea fragilis		2	FD	2	0.5
	Ligumia recta	ILT	WD	WD	WD	-
	Potamilus alatus		WD	-	WD	-
	Potamilus ohiensis		1	WD	1	0.3
	Total Lampsilinae		18	3	21	5.4
Total no. live			306	83	389	
Ave. no./1 x 10m SQ section			1.8	0.5	1.1	
Ave. no./5min			11.1	4.7	9.2	
No./m[2, 2]			15.4 ± 9.8^{A}	4.0 ± 8.0^{A}	12.0 ± 7.8	
No. species live			7	5	8	
Total no. species			20	19	21	
ES_200[3]					2.7-8.8	
No. FD total			22	17	39	
No. FD (quan only[4])			1	0	1	
% FD (quan only)			3.7	0	3.2	
No. ≤5 years old (total)			44	8	52	
No. ≤5 years old (quan only)			12	3	15	
%≤5 years old (quan only)			44.4	100.0	50.0	
% species ≤5 years old (total)			57.1	40.0	50.0	

FD=freshly dead shell, WD=weathered shell, SF=subfossil shell

[1]FE= federally endangered, FP= proposed for federal endangered status (USFWS, 2011); ILE=Illinois endangered, ILT=Illinois threatened (ILDNR, 2009)

[2]Same letter within this row indicates no significant difference among sites (students t-test, $p \geq 0.10$)

[3]Expected species with collection of 200 individuals

[4]Quan only indicates only quantitative data was used in calculations

Table 3-6. Age and length of unionids near Byron Station[1], Rock River, June 2011.

	Age (years[2])			Length (mm)		
Species	Ave.	Min	Max	Ave.	Min	Max
Ambleminae						
Fusconaia flava	7.5	7	8	50.5	45	58
Pleurobema sintoxia	14.0	14	14	82.0	82	82
Quadrula p. pustulosa	8.3	3	17	46.6	12	74
Anodontinae						
Lasmigona c. complanata	15.0	15	15	134.0	134	134
Lampsilinae						
Lampsilis cardium	6.5	2	14	85.8	42	125
Lampsilis siliquoidea	14.5	8	21	102.5	85	120
Leptodea fragilis	3.5	3	4	74.5	68	81
Potamilus ohiensis	3.0	3	3	65.0	65	65
Total	8.1	2	21	54.3	12	134

[1]All methods
[2]Based on external annuli count

Table 4-1. Unionid community characteristics near Byron Station, 1993 vs. 2011.

	Byron to Oregon, IL[1]	1.6km SW Byron (2009)[2]	1993 No. live[2]	1993 %	2011 No. live[2]	2011 %
Ambleminae						
Amblema plicata	27	WD	FD	-	FD	-
Cyclonaias tuberculata	27	WD	WD	-	WD	-
Elliptio dilatata	27	WD	WD	-	WD	-
Fusconaia ebena	27	-	-	-	-	-
Fusconaia flava	27, 69, 86	3	5	2.1	4	1.0
Plethobasus cyphyus	27	-	WD	-	WD	-
Pleurobema sintoxia	27, 69	-	WD	-	1	0.3
Quadrula pustulosa	27, 86	23	84	35.7	362	93.1
Tritogonia verrucosa	27	-	WD	-	SF	-
Anodontinae						
Alasmidonta marginata	27, 69, 86	WD	2	0.9	WD	-
Lasmigona c. complanata	27	-	68	28.9	1	0.3
Lasmigona costata	27	-	WD	-	WD	-
Pyganodon grandis	-	-	11	4.7	WD	-
Strophitus undulatus	27	-	2	0.9	WD	-
Utterbackia imbecillis	-	1	FD	-	-	-
Lampsilinae						
Actinonaias ligamentina	27, 86	WD	FD	-	WD	-
Ellipsaria lineolata	-	-	-	-	SF	-
Lampsilis cardium	27, 86	15	13	5.5	16	4.1
Lampsilis siliquoidea	-	-	1	0.4	2	0.5
Leptodea fragilis	27	FD	41	17.4	2	0.5
Ligumia recta	27	1	2	0.9	WD	-
Potamilus alatus	27	-	-	-	WD	-
Potamilus ohiensis	-	1	-	-	1	0.3
Ptychbranchus fasciolaris	-	-	WD	-	-	-
Toxolasma parvus	27	1	-	-	-	-
Truncilla donaciformis	-	-	6	2.6	-	-
Total no. live		45	235		389	
Live/FD species		8	14		9	
Total species (26)	19	13	21		21	
ES_200 [3]			9.9-11.6		2.7-8.8	
CPU (catch/hour)		11.3	26.3		110.4	
Density (no./m^2)			1.0		12.0 ± 7.8	
% ≤5 years old			46.4		50.0	
% FD			35.1		3.2	

[1]From 8km (5mi) upstream of Byron to Oregon Dam, Year collected, Baker (1927), OSU (1969 [specimens reported with both valves were considered to have been either live or freshly dead when collected]), ILDC (1986)
[2]No. Live or best condition; FD=freshly dead shell, WD=weathered shell (INHS, 2009; relic is listed here as WD, Dead is listed here as FD)
[3]Expected species with collection of 200 individuals

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011.

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	Substrate %Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	No. live Unionids
UP	T1-R[1]	0	0.6	22.5	8.5	-	10	45	45	-	-	-	-	-	
		10	1.2	21.6	8.4	-	10	45	45	-	-	-	-	-	0
		20	1.5	21.5	8.5	-	10	45	45	-	-	-	-	-	0
		30	1.8	21.5	8.5	-	10	45	45	-	-	-	-	-	0
		40	2.1	21.6	8.5	-	10	45	45	-	-	-	-	-	0
		50	3.0	21.8	8.5	-	-	50	50	-	-	-	-	-	0
		60	3.0	21.9	8.6	-	10	20	70	-	-	-	-	-	0
		70	3.0	21.6	8.5	-	-	-	100	-	-	-	-	-	1
		80	3.0	22.0	8.5	-	-	-	100	-	-	-	-	-	11
		90	3.0	22.0	8.5	-	-	-	100	-	-	-	-	-	2
		100	2.7	22.1	8.5	-	-	-	100	-	-	-	-	-	0
UP	T2-L	0	0.3	22.6	8.9	-	-	-	70	30	-	-	-	-	
		10	0.9	22.1	8.3	-	-	-	-	10	90	-	-	-	0
		20	1.5	22.1	8.3	-	-	-	100	-	-	-	-	-	1
		30	1.5	22.1	8.4	-	-	-	100	-	-	-	-	-	0
		40	1.8	22.1	8.4	-	-	-	100	-	-	-	-	-	1
		50	2.1	22.2	8.4	-	-	-	100	-	-	-	-	-	17
		60	2.1	23.2	8.4	-	-	-	100	-	-	-	-	-	3
		70	2.1	23.2	8.5	-	-	-	100	-	-	-	-	-	1
		80	2.4	22.2	8.5	-	-	-	100	-	-	-	-	-	0
		90	2.7	22.2	8.5	-	-	50	50	-	-	-	-	-	3
		100	2.7	23.2	8.5	-	20	30	50	-	-	-	-	-	4
UP	T3-R	0	1.2	22.9	9.6	-	-	80	20	-	-	-	-	-	
		10	1.5	23.0	8.5	-	-	80	20	-	-	-	-	-	0
		20	1.8	22.0	8.5	-	-	80	20	-	-	-	-	-	0
		30	2.4	22.2	8.5	-	20	50	30	-	-	-	-	-	0
		40	2.1	22.3	8.5	-	20	50	30	-	-	-	-	-	0
		50	2.4	22.3	8.5	-	20	50	30	-	-	-	-	-	0
		60	2.4	22.4	8.5	-	20	50	30	-	-	-	-	-	0
		70	2.4	22.4	8.5	-	-	-	100	-	-	-	-	-	29
		80	2.7	22.5	8.5	-	-	60	30	-	-	10	-	-	6
		90	3.0	22.5	8.5	-	-	-	100	-	-	-	-	-	2
		100	3.0	22.5	8.5	-	-	-	100	-	-	-	-	-	0

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	Substrate %Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	No. live Unionids
UP	T4-L	0	0.3	23.4	8.6	-	-	-	50	40	10	-	-	-	
		10	0.6	23.1	8.4	-	-	-	25	25	50	-	-	-	0
		20	1.5	22.7	8.4	-	-	-	60	30	10	-	-	-	1
		30	2.1	22.7	8.4	-	-	-	90	10	-	-	-	-	0
		40	2.1	22.7	8.4	-	-	-	90	10	-	-	-	-	0
		50	2.1	22.7	8.4	-	-	-	100	-	-	-	-	-	0
		60	2.1	22.7	8.3	-	-	-	100	-	-	-	-	-	0
		70	2.4	22.7	8.4	-	-	-	100	-	-	-	-	-	0
		80	2.4	22.7	8.4	-	-	-	100	-	-	-	-	-	0
		90	2.7	22.7	8.4	-	-	-	100	-	-	-	-	-	0
		100	2.4	22.7	8.4	-	-	-	100	-	-	-	-	-	1
UP	T5-R	0	0.3	24.3	8.9	-	-	-	80	10	10	-	-	-	
		10	0.9	23.2	8.3	-	-	-	10	10	80	-	-	-	3
		20	1.5	22.6	8.4	-	-	25	40	10	25	-	-	-	1
		30	2.1	22.6	8.4	-	-	50	50	-	-	-	-	-	0
		40	2.1	22.6	8.4	-	-	40	60	-	-	-	-	-	0
		50	2.1	22.6	8.4	-	-	50	50	-	-	-	-	-	0
		60	2.4	22.7	8.4	-	-	50	50	-	-	-	-	-	1
		70	2.4	22.8	8.4	-	-	40	40	20	-	-	-	-	1
		80	2.4	22.8	8.4	-	-	-	100	-	-	-	-	-	0
		90	2.4	22.9	8.4	-	-	-	100	-	-	-	-	-	0
		100	2.1	22.9	8.3	-	-	-	100	-	-	-	-	-	0
UP	T6-L	0	0.6	23.9	8.7	-	-	75	25	-	-	-	-	-	
		10	1.5	23.3	8.3	-	-	75	25	-	-	-	-	-	0
		20	2.7	23.1	8.3	-	30	30	40	-	-	-	-	-	0
		30	2.7	23.1	8.4	-	20	20	60	-	-	-	-	-	0
		40	2.7	23.1	8.4	-	-	-	-	20	80	-	-	-	1
		50	2.7	23.1	8.4	-	-	-	100	-	-	-	-	-	0
		60	2.4	23.1	8.3	-	-	-	100	-	-	-	-	-	0
		70	2.1	23.2	8.3	-	-	-	100	-	-	-	-	-	0
		80	2.1	23.1	8.3	-	-	-	100	-	-	-	-	-	0
		90	1.8	23.2	8.3	-	-	-	100	-	-	-	-	-	0
		100	1.8	23.2	8.3	-	-	-	100	-	-	-	-	-	0

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	Substrate									No. live Unionids
						%Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	
UP	T7-R	0	0.3	24.2	8.5	-	-	20	80	-	-	-	-	-	
		10	1.2	23.3	8.2	-	10	60	20	10	-	-	-	-	2
		20	2.1	23.2	8.3	-	5	75	15	5	-	-	-	-	0
		30	3.0	23.2	8.4	-	20	60	20	-	-	-	-	-	1
		40	2.7	23.3	8.3	-	-	10	80	10	-	-	-	-	4
		50	2.4	23.4	8.3	-	-	10	90	-	-	-	-	-	16
		60	1.8	23.4	8.3	-	-	10	90	-	-	-	-	-	22
		70	1.8	23.5	8.2	-	-	5	90	-	-	-	-	5	9
		80	1.8	23.5	8.2	-	-	-	100	-	-	-	-	-	2
		90	1.5	23.6	8.2	-	-	-	100	-	-	-	-	-	0
		100	1.5	23.6	8.2	-	-	-	100	-	-	-	-	-	0
UP	T8-L	0	0.3	24.2	8.6	-	-	-	-	100	-	-	-	-	
		10	1.5	23.8	8.5	-	-	-	30	50	-	-	-	20	0
		20	2.7	23.7	8.4	-	10	10	50	20	-	-	-	10	2
		30	2.7	23.7	8.3	-	-	-	100	-	-	-	-	-	0
		40	2.1	23.7	8.3	-	10	30	60	-	-	-	-	-	0
		50	2.4	23.7	8.3	-	-	-	100	-	-	-	-	-	1
		60	2.4	23.7	8.3	-	-	-	100	-	-	-	-	-	0
		70	2.1	23.8	8.4	-	-	-	100	-	-	-	-	-	0
		80	1.8	23.8	8.2	-	-	-	100	-	-	-	-	-	0
		90	1.5	23.8	8.2	-	-	-	100	-	-	-	-	-	1
		100	1.8	23.8	8.2	-	-	-	100	-	-	-	-	-	0
UP	T9-R	0	0.6	23.9	8.4	-	15	70	15	-	-	-	-	-	
		10	1.5	23.7	8.2	-	30	50	20	-	-	-	-	-	2
		20	2.1	23.7	8.3	-	-	80	20	-	-	-	-	-	3
		30	3.0	23.8	8.3	-	20	50	10	-	-	20	-	-	2
		40	2.4	23.8	8.3	-	-	-	100	-	-	-	-	-	18
		50	2.4	23.9	8.3	-	-	-	100	-	-	-	-	-	10
		60	1.8	24.0	8.2	-	-	-	100	-	-	-	-	-	0
		70	2.1	24.0	8.2	-	-	10	90	-	-	-	-	-	0
		80	1.8	24.0	8.2	-	-	10	90	-	-	-	-	-	1
		90	1.5	24.1	8.2	-	-	-	100	-	-	-	-	-	0
		100	1.5	24.1	8.2	-	-	-	100	-	-	-	-	-	0

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	Substrate %Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	No. live Unionids
UP	T10-R	0	0.3	24.1	8.2	-	100	-	-	-	-	-	-	-	
		10	1.2	23.9	8.2	-	50	50	-	-	-	-	-	-	0
		20	1.8	23.9	8.2	-	25	50	25	-	-	-	-	-	1
		30	2.1	23.9	8.3	-	25	50	25	-	-	-	-	-	0
		40	2.7	24.0	8.3	-	25	25	50	-	-	-	-	-	2
		50	2.7	24.1	8.3	-	-	-	100	-	-	-	-	-	1
		60	2.4	24.2	8.3	-	-	-	100	-	-	-	-	-	1
		70	2.1	24.2	8.3	-	-	-	100	-	-	-	-	-	0
		80	2.4	24.2	8.3	-	-	-	100	-	-	-	-	-	0
		90	1.8	24.3	8.2	-	-	-	100	-	-	-	-	-	1
		100	1.5	24.3	8.2	-	-	-	70	10	20	-	-	-	0
UP	T11-R	0	0.6	23.2	8.1	-	25	25	-	25	25	-	-	-	
		10	1.2	22.7	7.9	-	25	25	-	-	50	-	-	-	0
		20	1.8	22.5	8.1	-	-	80	20	-	-	-	-	-	0
		30	2.7	22.5	8.1	-	-	90	10	-	-	-	-	-	1
		40	2.1	22.5	8.1	-	-	-	100	-	-	-	-	-	8
		50	3.4	22.6	8.1	-	-	-	100	-	-	-	-	-	0
		60	3.4	22.7	8.1	-	-	-	100	-	-	-	-	-	0
		70	3.0	22.7	8.1	-	-	-	100	-	-	-	-	-	0
		80	3.0	22.8	8.1	-	-	-	100	-	-	-	-	-	0
		90	3.0	22.8	8.0	-	-	-	100	-	-	-	-	-	0
		100	1.5	22.8	8.0	-	-	-	100	-	-	-	-	-	0
DN	T12-L	0	0.6	25.3	7.8	-	20	-	-	20	60	-	-	-	
		10	1.5	23.1	8.0	-	75	25	-	-	-	-	-	-	0
		20	1.5	23.0	8.0	-	-	-	100	-	-	-	-	-	0
		30	1.5	22.9	8.0	-	-	-	100	-	-	-	-	-	1
		40	1.5	22.9	8.0	-	-	-	100	-	-	-	-	-	0
		50	1.5	22.9	8.0	-	-	-	100	-	-	-	-	-	0
		60	1.5	22.9	8.0	-	-	-	100	-	-	-	-	-	1
		70	1.8	22.9	8.0	-	-	-	100	-	-	-	-	-	0
		80	2.1	22.9	8.0	-	-	-	-	10	90	-	-	-	0
		90	2.4	22.9	8.0	-	-	-	100	-	-	-	-	-	0
		100	2.4	22.9	8.1	-	-	-	100	-	-	-	-	-	0

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	Substrate %Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	No. live Unionids
DN	T13-R	0	0.3	23.6	8.3	-	80	20	-	-	-	-	-	-	
		10	1.5	22.8	8.0	-	-	25	-	-	75	-	-	-	0
		20	1.5	22.7	8.0	-	80	20	-	-	-	-	-	-	0
		30	2.4	22.7	8.1	-	-	80	20	-	-	-	-	-	0
		40	3.0	22.7	8.1	-	-	50	50	-	-	-	-	-	1
		50	3.0	22.7	8.1	-	-	-	100	-	-	-	-	-	9
		60	3.0	22.8	8.1	-	-	-	100	-	-	-	-	-	0
		70	3.0	22.9	8.1	-	-	-	100	-	-	-	-	-	1
		80	3.0	22.9	8.1	-	-	-	100	-	-	-	-	-	0
		90	2.4	22.9	8.1	-	-	-	100	-	-	-	-	-	0
		100	2.4	23.0	8.1	-	-	-	100	-	-	-	-	-	0
DN	T14-L	0	0.9	25.0	8.2	-	-	-	50	-	50	-	-	-	
		10	1.8	23.5	8.0	-	-	25	50	-	25	-	-	-	0
		20	1.8	23.4	7.9	-	-	-	100	-	-	-	-	-	0
		30	1.8	23.3	8.0	-	-	-	100	-	-	-	-	-	0
		40	1.8	23.1	7.9	-	-	-	100	-	-	-	-	-	0
		50	2.1	23.1	8.0	-	-	-	100	-	-	-	-	-	1
		60	1.8	23.1	7.9	-	-	-	100	-	-	-	-	-	1
		70	2.4	23.1	8.0	-	-	-	50	-	50	-	-	-	0
		80	2.1	23.1	8.0	-	-	-	100	-	-	-	-	-	0
		90	2.4	23.1	8.0	-	-	-	100	-	-	-	-	-	0
		100	3.4	23.1	8.0	-	-	-	50	-	50	-	-	-	0
DN	T15-R	0	0.9	24.0	8.2	50	-	25	25	-	-	-	-	-	
		10	1.2	23.3	7.9	-	50	25	25	-	-	-	-	-	1
		20	1.8	23.1	7.9	-	75	25	-	-	-	-	-	-	0
		30	2.7	23.0	8.0	-	50	25	25	-	-	-	-	-	0
		40	3.0	23.0	8.1	-	60	20	20	-	-	-	-	-	0
		50	3.0	23.0	8.1	-	-	-	100	-	-	-	-	-	1
		60	3.0	23.0	8.1	-	-	-	100	-	-	-	-	-	5
		70	3.0	23.2	8.0	-	-	-	100	-	-	-	-	-	0
		80	3.0	23.2	8.0	-	-	-	100	-	-	-	-	-	0
		90	3.0	23.2	8.0	-	-	-	100	-	-	-	-	-	0
		100	3.0	23.2	8.0	-	-	-	100	-	-	-	-	-	0

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	Substrate									No. live Unionids
						%Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	
DN	T16-L	0	0.6	25.3	8.8	-	-	-	50	50	-	-	-	-	
		10	1.5	24.2	8.0	-	-	-	90	10	-	-	-	-	1
		20	2.1	23.9	7.9	-	-	-	100	-	-	-	-	-	0
		30	1.8	23.8	7.9	-	-	-	100	-	-	-	-	-	0
		40	2.1	23.7	7.9	-	-	-	100	-	-	-	-	-	0
		50	2.7	23.6	7.9	-	-	-	100	-	-	-	-	-	0
		60	2.7	23.5	8.0	-	-	-	100	-	-	-	-	-	0
		70	2.7	23.5	8.0	-	-	-	100	-	-	-	-	-	0
		80	3.0	23.6	8.0	-	-	-	100	-	-	-	-	-	0
		90	3.0	23.5	8.0	-	-	-	100	-	-	-	-	-	1
		100	3.0	23.5	8.1	-	-	20	20	-	60	-	-	-	0
DN	T17-R	0	0.6	0	24.7	8.0	-	100	-	-	-	-	-	-	
		10	1.2	10	24.0	7.9	5	95	-	-	-	-	-	-	1
		20	1.8	20	23.6	7.9	5	95	-	-	-	-	-	-	0
		30	2.7	30	23.5	8.0	5	90	5	-	-	-	-	-	0
		40	3.0	40	23.4	8.0	5	90	5	-	-	-	-	-	0
		50	3.0	50	23.4	8.0	-	5	90	-	-	-	5	-	0
		60	2.7	60	23.5	8.0	-	-	100	-	-	-	-	-	2
		70	3.4	70	23.6	8.0	-	-	100	-	-	-	-	-	0
		80	3.0	80	23.7	8.0	-	5	95	-	-	-	-	-	0
		90	3.0	90	23.7	8.0	-	-	100	-	-	-	-	-	1
		100	2.7	100	23.7	8.0	-	-	50	-	-	-	-	50	0
DN	T18-L	0	0.3	0	25.9	8.3	20	-	-	30	-	-	-	-	
		10	1.5	10	24.7	7.8	20	60	-	20	-	-	-	-	0
		20	1.8	20	24.4	7.8	-	-	90	10	-	-	-	-	0
		30	2.4	30	24.3	7.8	-	40	20	40	-	-	-	-	0
		40	2.1	40	24.1	7.9	-	-	100	-	-	-	-	-	0
		50	2.4	50	24.0	7.9	-	-	100	-	-	-	-	-	0
		60	2.7	60	23.9	7.9	-	-	10	90	-	-	-	-	0
		70	2.7	70	23.9	7.9	-	-	100	-	-	-	-	-	0
		80	2.7	80	23.9	7.9	-	-	100	-	-	-	-	-	0
		90	2.7	90	23.9	7.9	-	-	100	-	-	-	-	-	0
		100	3.0	100	23.9	8.0	-	-	100	-	-	-	-	-	0

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

						Substrate									
Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	%Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	No. live Unionids
DN	T19-R	0	0.3	25.0	8.0	-	-	100	-	-	-	-	-	-	
		10	1.2	24.4	7.9	-	10	90	-	-	-	-	-	-	0
		20	3.0	24.0	8.0	-	10	90	-	-	-	-	-	-	0
		30	3.0	23.9	8.0	-	10	90	-	-	-	-	-	-	0
		40	3.4	23.9	8.0	-	-	5	90	5	-	-	-	-	0
		50	3.0	23.9	8.0	-	-	-	100	-	-	-	-	-	0
		60	3.7	23.9	8.0	-	-	-	100	-	-	-	-	-	1
		70	3.0	24.0	8.0	-	-	-	100	-	-	-	-	-	0
		80	3.0	24.0	8.0	-	-	-	100	-	-	-	-	-	0
		90	3.0	24.0	8.0	-	-	-	100	-	-	-	-	-	0
		100	3.0	24.1	8.0	-	-	-	100	-	-	-	-	-	1
DN	T20-L	0	0.3	26.3	7.8	-	-	10	80	10	-	-	-	-	
		10	1.2	25.1	7.7	-	-	40	30	30	-	-	-	-	0
		20	1.5	24.8	7.7	-	-	45	10	45	-	-	-	-	0
		30	1.8	24.7	7.8	-	-	15	15	70	-	-	-	-	0
		40	1.8	24.6	7.7	-	-	-	100	-	-	-	-	-	0
		50	2.4	24.5	7.8	-	-	20	10	70	-	-	-	-	1
		60	2.1	24.3	7.8	-	-	-	100	-	-	-	-	-	2
		70	2.4	24.3	7.9	-	-	-	100	-	-	-	-	-	1
		80	2.7	24.3	7.9	-	-	-	100	-	-	-	-	-	0
		90	3.0	24.3	7.9	-	-	-	100	-	-	-	-	-	0
		100	3.0	24.3	7.9	-	-	-	100	-	-	-	-	-	0
DN	T21-R	0	0.6	24.9	7.9	-	80	10	10	-	-	-	-	-	
		10	2.4	24.5	7.8	-	10	80	10	-	-	-	-	-	0
		20	2.4	24.3	7.9	-	5	85	10	-	-	-	-	-	0
		30	2.4	24.3	7.9	-	5	75	20	-	-	-	-	-	0
		40	3.0	24.3	7.9	-	-	80	20	-	-	-	-	-	1
		50	3.0	24.3	7.9	-	-	-	100	-	-	-	-	-	0
		60	2.7	24.3	7.9	-	-	-	100	-	-	-	-	-	0
		70	3.4	24.4	7.9	-	-	-	100	-	-	-	-	-	0
		80	3.0	24.4	7.9	-	-	-	100	-	-	-	-	-	0
		90	2.7	24.4	7.9	-	-	-	100	-	-	-	-	-	0
		100	2.7	24.4	7.9	-	-	-	100	-	-	-	-	-	0

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	Substrate									No. live Unionids
						%Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	
DN	T22-L	0	0.3	25.4	7.3	-	10	10	80	-	-	-	-	-	
		10	1.5	25.1	7.1	-	10	40	50	-	-	-	-	-	1
		20	1.5	24.8	7.2	-	-	50	50	-	-	-	-	-	2
		30	2.1	24.7	7.2	-	-	-	50	-	50	-	-	-	3
		40	2.1	24.5	7.2	-	-	-	100	-	-	-	-	-	0
		50	2.1	24.5	7.2	-	-	-	100	-	-	-	-	-	3
		60	2.1	24.3	7.2	-	-	-	100	-	-	-	-	-	0
		70	2.1	24.3	7.3	-	-	-	100	-	-	-	-	-	2
		80	2.7	24.3	7.3	-	-	-	100	-	-	-	-	-	0
		90	2.7	24.2	7.3	-	-	-	100	-	-	-	-	-	0
		100	2.7	24.2	7.3	-	-	-	100	-	-	-	-	-	0
DN	T23-R	0	0.3	24.5	7.1	-	100	-	-	-	-	-	-	-	
		10	1.5	24.1	7.2	-	25	50	25	-	-	-	-	-	0
		20	1.5	24.0	7.2	-	-	50	50	-	-	-	-	-	1
		30	2.4	23.9	7.3	-	-	-	25	25	-	50	-	-	6
		40	2.4	23.9	7.3	-	-	-	80	-	-	-	-	20	4
		50	2.4	24.0	7.2	-	-	-	100	-	-	-	-	-	0
		60	2.1	24.0	7.2	-	-	-	100	-	-	-	-	-	1
		70	2.7	24.0	7.3	-	-	-	100	-	-	-	-	-	0
		80	2.7	24.1	7.3	-	-	-	80	20	-	-	-	-	0
		90	2.7	24.1	7.3	-	-	-	10	-	90	-	-	-	0
		100	2.4	24.1	7.3	-	-	-	100	-	-	-	-	-	0
DN	T24-L	0	0.3	24.8	7.0	-	-	-	60	40	-	-	-	-	
		10	1.2	24.7	7.1	-	10	30	20	20	-	-	-	20	0
		20	1.5	24.6	7.1	-	10	50	40	-	-	-	-	-	0
		30	1.5	24.6	7.1	-	20	40	40	-	-	-	-	-	0
		40	1.5	24.5	7.2	-	20	40	40	-	-	-	-	-	0
		50	2.4	24.3	7.3	-	30	-	70	-	-	-	-	-	1
		60	2.4	24.2	7.3	-	15	15	70	-	-	-	-	-	0
		70	3.0	24.1	7.3	-	-	-	100	-	-	-	-	-	0
		80	2.7	24.1	7.3	-	-	-	100	-	-	-	-	-	0
		90	3.0	24.0	7.3	-	-	5	95	-	-	-	-	-	1
		100	2.7	24.0	7.3	-	-	5	95	-	-	-	-	-	0

Appendix A. Temperature, dissolved oxygen, depth, substrate and number live unionids along transects, Byron Station, June 2011

Site	Trans.	Dist from bank (m)	Depth (m)	Temp. (°C)	DO (mg/L)	Substrate									No. live Unionids
						%Bo	%Cb	%Gr	%Sd	%St	%Cl	%Shell	%Dt	%WD	
DN	T25-L	0	0.6	24.7	7.0	-	30	40	20	-	-	-	-	10	
		10	1.2	24.7	7.1	-	20	20	40	20	-	-	-	-	2
		20	2.1	24.6	7.2	-	20	40	40	-	-	-	-	-	1
		30	2.4	24.5	7.2	-	10	45	45	-	-	-	-	-	0
		40	2.4	24.3	7.2	-	10	70	20	-	-	-	-	-	0
		50	2.7	24.1	7.3	-	10	70	20	-	-	-	-	-	1
		60	3.0	24.1	7.3	-	10	70	20	-	-	-	-	-	0
		70	3.4	24.0	7.3	-	-	60	40	-	-	-	-	-	2
		80	3.0	24.0	7.3	-	-	-	100	-	-	-	-	-	0
		90	3.0	24.0	7.3	-	-	-	100	-	-	-	-	-	0
		100	3.0	24.0	7.3	-	-	-	100	-	-	-	-	-	0
Ave.			2.2			0	6	18	67	4	4	0	0	0	1.1

Bo=Boulder, Cb=Cobble, Gr=Gravel, Sd=Sand, St=Silt, Cl=Clay, Shell=Unionid shell, Dt=Detritus, WD=Woody debris
[1]T1-R= Transect 1, Right bank

Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-1 **Category: Aquatic**

Statement of Question:

Provide the following information:

c. (Exelon Nuclear 2003a) Exelon Nuclear. 2003. Storm Water Pollution Prevention Plan – Byron Nuclear Power Station. June 2003.

Response:

The Byron Storm Water Pollution Prevention Plan has been updated. The most recent version dated January 2013 is attached to the Request for Additional Information Response WR-SW-1b.

List Attachments Provided:

None

Byron Environmental Audit – Request for Additional Information Response

Question #: **AQ-1** **Category:** **Aquatic**

Statement of Question:

Provide the following information:

d. (Exelon Nuclear 2011c) Exelon Nuclear. 2011. WHC Wildlife Management Plan – Byron Generating Station. Byron, IL.

Response:

The requested information is attached.

List Attachments Provided:

1. (Exelon Nuclear 2011c) Exelon Nuclear. 2011. WHC Wildlife Management Plan – Byron Generating Station. Byron, IL.

Exelon Nuclear 2011c
Byron- 070

WHC WILDLIFE MANAGEMENT PLAN

EXELON NUCLEAR

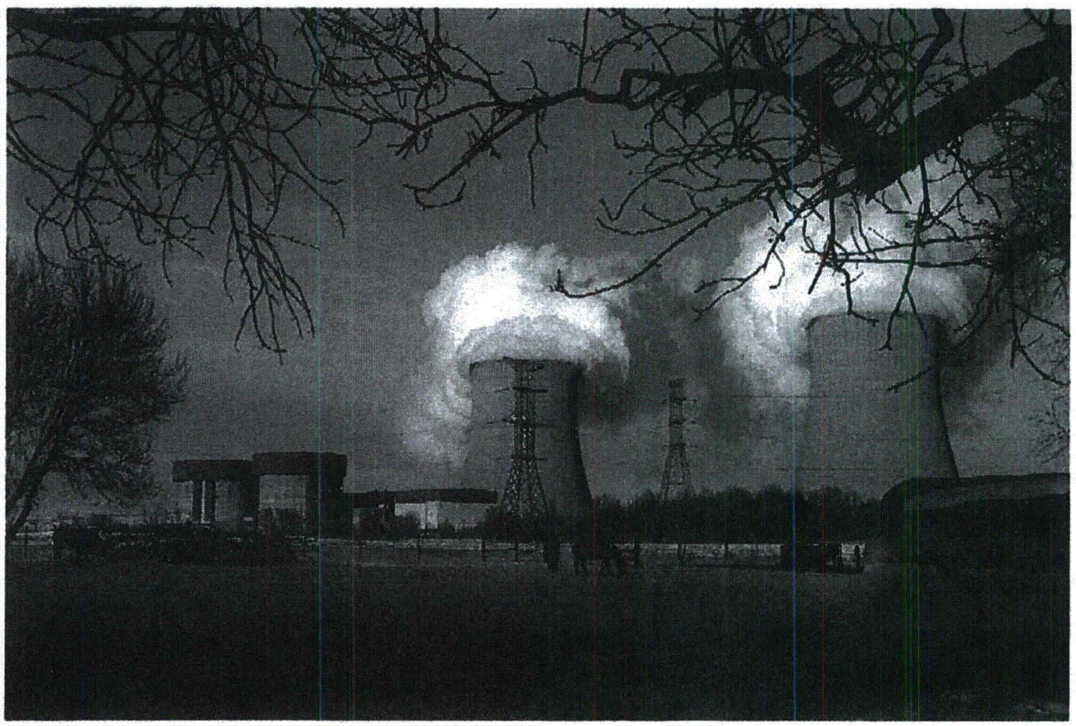
Byron Generating Station

WILDLIFE MANAGEMENT PLAN

2011

Prepared by:

David Starke
Zoe Cox



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SUMMARY

The Exelon Nuclear Byron Generating Station is located in Byron, Illinois, which is in Ogle County, in northern Illinois. The station consists of a two unit nuclear electric generating station capable of generating approximately 1,200 net megawatts per unit. Together they can produce enough power to support the electricity needs of more than two million average American homes. Its massive twin cooling towers reach 495 feet into the air, overlooking the scenic Rock River Valley.

The property was purchased in the 1970's and is situated approximately in the center of the county in a predominantly agricultural area. The Rock River makes the western boundary of the property and is about 2.2 miles from the actual plant location. The local area has many state parks and park district lands and much of the property's woods and meadows are very similar to those public habitats.

To assist in the development of a biodiversity assessment and wildlife habitat management plan, representatives from the Byron Generating Station invited a WHC biologist to visit the site on August 15, 2006. Since then Byron employees have looked at the ecological communities around the Byron Generating Station, focusing on a cavity nesting birds such as, tree swallows, eastern bluebirds, wood ducks and bats that are in need of critical habitats. The Byron Environmental Stewardship Team (BEST) have discussed and outlining opportunities for future enhancement from the WHC recommendations that are designed to augment food, water, cover, and space resources – the four basic components for other species local to our area that require something different than what might presently be found in their habitat.

1. Background

Exelon Nuclear has been a WHC member since 2005, a standing that exemplifies its commitment to improving wildlife habitat through enrichment of pre-existing habitats and the establishment of new habitats on the company's holdings. Induction into the Wildlife at Work program will enable Byron Station to get assistance from WHC in its efforts to improve the facility's wildlife habitat. The partnership with WHC will continue to provide Exelon Nuclear with an opportunity to demonstrate responsible corporate environmental stewardship by formulating and implementing a balanced and operative wildlife management program.

1.1 Corporate Environmental Stewardship

Exelon Nuclear is a leader in providing carbon-free electricity to the eastern half of the United States. As a leader in the local community, Byron Station has provide funding to projects such as CFL lighting for the local Boy & Girl Scout camps, sponsorship of the local animal rehabilitation facility, sponsorship of education programs for Ogle County's Soil Conservation district and the Solid Waste Management Department. Also have been major sponsors of the local effort to cleanup the Rock River, called the Rock River Sweep. Byron Station also gives a yearly donation to a local group that cleans up the Pecatonica River. To achieve the goal of being a good neighbor, the station sponsors several of local events and organizations, including, the Byron Civic Theatre, the annual ByronFest, and Byron Police Department's DARE Program as well as a number of local sports teams, which are often coached by employees. Byron employees give generously to the community through a variety of charitable activities. Employees generously donate to local United Way chapters, sponsor blood drives, and also donate food, toys and clothes to non-profit community groups, especially during the holiday season. Byron Station has also provided donations to Hoo Haven which is a wildlife rehabilitation center and they provide educational program to anyone who might be interested. Last year Byron Station paid for Hoo Haven to give presentations to 5 area schools.

1.2 Facility Description

Byron Station is on 1300 acres of land that was and is primarily agricultural and 750 acres of those acres are leased to local farmers. There are about 300 acres that are wooded and another 150 acres that is meadow or grassland. The wooded and meadow areas have been essentially untouched by any management plan since the property was purchased back in the 1970s. The western portion of the property is the Rock River and it is connected to the other 1000 acres by a 1.5 mile corridor of 300 acres that is mainly wooded. Most of the new habitat projects are along the roadways and meadows that stretch from the building areas down to the river. The site is bordered to the south by agricultural lands and forested acres, to the east by German Church Road, and agricultural lands, also owned by the Byron Generating Station. These agricultural acres are leased to a local farmer, however, and are not available for habitat projects. Land use on the site's northern border is also agricultural, with large areas of woodlands. An unnamed tributary of the Rock River, locally referred to as Woodland Creek, passes

through the northeast quarter of the property and carries stormwater runoff from the station and German Church Road. The Byron Generating Station is a two-unit nuclear power facility that generates enough power to support the electricity needs of over two million average American homes. At this station, Exelon employs nearly 850 permanent employees.

1.2.1. Wildlife Team

The Byron Environmental Stewardship Team (BEST) has had up to 25 employees. The team also enlists the help of volunteers, professionals and community members on a frequent basis.

1.2.2. Ecological Background

Exelon Corporation's Byron Generating Station lies within what *Terrestrial Ecoregions of North America: A Conservation Assessment*, published by Island Press, identifies as the Central Forest-Grassland Transition Ecoregion. The Central Forest-Grassland Transition Zone encompasses much of Illinois, extending across Missouri into eastern Kansas, Oklahoma, and Texas. According to information presented in *Terrestrial Ecoregions of North America: A Conservation Assessment*, the total area of the ecoregion is more than 146,718 square miles, making it one of the largest savannah-dominated areas in North America, although little of the acreage is preserved as native habitat. Uniquely situated between forested and grassland ecoregions, this ecoregion's soil and climate conditions allow woodlands to develop, often in conjunction with an understory of tallgrass prairie species. Throughout the region, oaks and hickories are the most dominant species in the canopy. The vast diversity of habitat types and conditions in the transition zone supports select species that have adapted to the neighboring Great Plains and hardwood forests. This significance of habitat is further demonstrated through the ecoregion's rank among the top ten for diversity of bird, reptile, butterfly, and tree species.

The Central Forest-Grassland Transition Zone separates the forested regions of the east from the tallgrass, mixed prairies of the plains, and therefore exhibits some of the characteristics of each of the ecoregions that surround it. Regional habitats within this transition zone are distinct, however, in that they display a higher density of trees and shrubs than the prairies and savannahs to the west, as well as a more diverse mosaic of savannah and prairie habitats than the hardwood forested zone to the east. In addition, the ecoregion is unified in soil type and general climate conditions. The mix of native grassland, forestland, and wetland habitats in this ecoregion was historically maintained by regular disturbances from periodic droughts and fires. Precipitation throughout the ecoregion reportedly ranges between approximately 20 to 45 inches annually. Areas that receive greater precipitation naturally support a greater diversity and density of tree and shrub species, while drier areas support a greater diversity of grassland savannah species and fewer woody plants.

In addition to the aforementioned classification, the United States Department of Agriculture's (USDA) Forest Service adopted its own policy and subsequent classification of ecosystem types in the publication *Ecoregions of the United States*,

which was compiled by Robert G. Bailey and revised in March 1995; this publication classifies land based on forest cover types, grasslands, and other data from ongoing research programs. This classification of ecoregions is a hierarchical system based on elements of climate, geology, topography, and vegetation. This widely recognized system divides a country into large domains, followed by divisions, and then provinces. Under the Forest Service's classification, the Byron Station lies within the Prairie Parkland Province, near the border of the Eastern Broadleaf Forest Province. This province is further divided into specific sections, which include the Central Loess Plains, South Central Great Lakes, Central Dissected Till Plains, and Beech-Maple Sections.

The Central Loess Plains Section, which includes the Byron Station, is characterized by the Forest Service as having both irregular and smooth rolling plains naturally covered by bluestem prairie grasses and floodplain forests along the drainages.

1.2.3 Watershed Description

In addition to being located in the Central Forest-Grassland Transition Zone, Exelon Corporation's Byron Generating Station is situated within the Lower Rock Watershed. A watershed, or catchment, is an area of land where water drains to a common point. These regions are controlled and defined by topography, bedrock, and soil permeability. Knowledge of watersheds is necessary for industrial development, as the contamination of groundwater at one site affects the water for wildlife and human consumption in the entire drainage area. The Lower Rock Watershed is comprised of 2,180 square miles and drains into the Rock River and its tributaries, which include Pine Creek, Elkhorn Creek, Rock Creek, Stillman Creek, and the Kyte River. This watershed is part of the Rock subregion of the Upper Mississippi drainage region. Watershed management should be a community effort, as the regions are so intricately connected.

1.2.4 Climate Conditions

The Central Forest-Grassland Transition Zone lies within what scientists have termed the Humid Temperate Domain. Climatic conditions in this region are generally classified as humid continental, with hot and humid summers and often severely cold winters. Last year, the city of Bryon reported approximately average temperatures of about 32 degrees Fahrenheit during fall and winter months, and average temperatures of about 63 degrees Fahrenheit during the spring and summer months. The tornado activity level in the region is below the state's average; it is, however, 47 percent greater than the overall U.S. average. While it is important to understand and consider area temperatures, the diversity of vegetative communities will also depend on precipitation amounts. The state of Illinois typically receives 35 to 45 inches of precipitation each year. However, the annual averages are widely varied throughout the state. The city of Byron, which has an average annual precipitation of 37.5 inches, receives the greatest amount of precipitation during the summer months, particularly in June and August.

2. Development

2.1. Facility Inventory

A through assessment of the station plants and animals was conducted in the 1970's by a team of biologists and those documents form the basis for most of the inventories. These multi year inventories were include in the Environmental Report that was generated for the operating license that was submitted to the NRC. Further work was done when the BEST group consulted with the local University of Illinois County Extension agent who came out to assist in looking for a specific legume that is host to the Karner Blue Butterfly. Also a member of the BEST group has a MS degree in Biology and is familiar with many of the area's plants.

On August 15, 2006, Kathleen Koelbl-Crews (WHC Wildlife Biologist) met with Exelon Corporation representatives Jim Bolte, Zoe Cox, and Craig Walter to discuss site biodiversity and wildlife habitat opportunities at the Byron Generating Station. The meeting was held in the Byron Generating Station's training center at approximately nine a.m. on Wednesday morning. Following introductions, Mr. Bolte, Ms. Cox, Mr. Walter and, Ms. Koelbl-Crews conducted a comprehensive tour of the site. The group walked and drove a majority of the property, discussing the layout of the buildings and operations in relation to the undeveloped, potential habitat areas.

Tables of Flora and Fauna Identified at Byron Station Property

Amphibians

Alligator Snapping Turtle	Macroclemys temminckii
Western Chorus Frog	Pseudacris triseriata
American Toad	Bufo americanus
Smooth Softshell Turtle	Apalone mutica
Springer Peeper	Hyla crucifer

Reptiles

Garter Snake	Thamnophis sirtalis
Red Milk Snake	Lampropeltis triangulum syspila
Bull Snake	Pituophis melanoleucus

Birds

American Goldfinch	Spinus tristis
American Woodcock	Philohela minor
American Redstart	Setophaga ruticilla

Bald Eagle	Haliacetus leucocephalus
Bank Swallow	Riparia riparia
Barn Swallow	Hirundo rustica
Black-and-white Warbler	Miriotilta varia
Black-billed Cuckoo	Coccyzus erythropthalmus
Black-capped Chickadee	Parus atricapillus
Black-throated Green Warbler	Dendoica virens
Blue-gray Gnatcatcher	Polioptilla caerulea
Blue Jay	Cyanocitta cristata
Blue-winged Teal	Anas discors
Blue-winged Warbler	Vermivora pinus
Bobolink	Dolichonyx oryzivorus
Bobwhite Quail	Colinus virginianus
Brewster's Warbler	Vermivora chrysoptera x V. pinus
Brad-winged Hawk	Buteo platypterus
Brown Creeper	Certhia familiaris
Brown-headed Cowbird	Molathrus ater
Brown Thrasher	Toxostoma rufum
Canada Goose	Branta Canadensis
Cardinal	Richmondena cardinalis
Catbird	Dumetella carolinensis
Cedar Waxwing	Bombycilla cedrorum
Chimney Swift	Chaetura pelagica
Chipping Sparrow	Spizella passerine
Crow	Corvus brachyrynchos
Common Grackle	Quiscalus quisula
Common Nighthawk	Chodeiles minor
Dickcissel	Spiza Americana
Downy Woodpecker	Dendrocopos pubescens
Eastern Bluebird	Sialia sialis
Eastern Kingbird	Tyrannus tyrannus
Eastern Meadowlark	Sturnella magna
Eastern Phoebe	Sayornis phoebe
Eastern Wood Pewee	Contopus virens
Acadian Flycatcher	Empidonax viresens
Field Sparrow	Spizella pusilla
Fox Sparrow	Passerella iliaca
Golden-crowned Kinglet	Regulus calendula
Grasshopper Sparrow	Ammondramus savannarum
Gray-checked Thrush	Catharas minima
Gray Partridge	Perdix perdix
Great Crested Flycatcher	Myiarchus crinitus
Great Horned Owl	Bubo virginianus
Hairy Woodpecker	Dendrocopos villosus
Hermit Thrush	Catharus guttata

Horned Lark	Eremophila alpestris
House Sparrow	Passer domesticus
House Wren	Troglodytes aedon
Indigo Bunting	Passerina cyanea
Killdeer	Charadrius vociferus
Lincoln's Sparrow	Melospiza lincolnii
Mourning Dove	Zenaida macroura
Myrtle Warbler	Dendroica coronata
Northern Oriole	Icterus galbula
Ovenbird	Serurus aurocapillus
Palm Warbler	Dendroica palmarum
Prairie Warbler	Dendroica discolor
Purple Finch	Carpodacus purpureus
Purple Martin	Progne subis
Red-bellied Woodpecker	Centurus carolinus
Red-breasted Nuthatch	Sitta Canadensis
Red-headed Woodpecker	Melanerpes erythrocephalus
Red-tailed Hawk	Buteo jamaicensis
Red-winged Blackbird	Agelarius pheoniceus
Ring-necked Pheasant	Phasianus colchicus
Robin	Turdus migratorius
Rock Dove (Pigeon)	Columba livia
Rose breasted Grosbeak	Pheucticus ludovicianus
Ruby crowned Kinglet	Regulus calendula
Rofous sided Towhee	Pipilo erythrophthalmus
Savannah Sparrow	Passerculus sandwichensis
Scarlet Tanager	Piranga olivacea
Screech Owl	Otus asio
Sharp-shinned Hawk	Accipiter striatus
Short-billed Marsh Wren	Cistothorus platensis
Slate-colored Junco	Junco hyemalis
Solitary Vireo	Vireo solitarius
Song Sparrow	Melospiza melodia
Sparrow Hawk	Falco sparverius
Spotted Sandpiper	Actitis macularia
Starling	Sturnus vulgaris
Swainson's Thrush	Catharus ustulata
Swamp Sparrow	Melospiza Georgiana
Tennessee Warbler	Vermivora peregrine
Tree Warbler	Spizella arborea
Tree Swallow	Sridoprocne bicolor
Tufted Titmouse	Parus bicolor
Turkey	Meleagris gallopavo
Turkey Vulture	Cathartes aura
Vesper Sparrow	Pooecetes gramineus

Warbling Vireo	Vireo gileres
Western Meadowlark	Sturnella neglecta
White-breasted Nuthatch	Sitta carolinensis
White-throated Sparrow	Zonotrichia albicollis
White Pelican	Pelecanus onocrotalus
Wood Duck	Aix sponsa
Wood Thrush	Hylocichla mustelina
Yellow-bellied Flycatcher	Empidonax flaviventris
Yellow-bellied Sapsucker	Sphyrapicus varius
Yellow-billed Cuckoo	Coccyzus americanus
Yellow-shafted Flicker	Colaptes auratus
Yellow-throat	Geothlypis trichas
Yellow-warbler	Dendroica petechia
Blue Heron	Ardea herodias

Insects

Achilid Planthopper
Ambush Bug
Ant
Anthomyiid Fly
Aphid
Assassin Bug
Bee
Blackfly
Black Scavenger Fly
Branonids
Branch Borer
Broad-headed Bug
Brown Lacewing
Butterfly – Monarch
Butterfly – Swallow-tailed
Chamaemyiid Fly
Chinch Fly
Clear-winged Moth
Common Sawfly
Common Thrip
Cosmopterygid Moth
Crab Spider
Cricket
Cuckoo Wasp
Curtonotid Fly
Cynipids
Daddy Longlegs
Damsel Bug

Delphacid Planthopper
Derbid Planthopper
Dermstid Beetle
Diastatid Fly
Dragonfly
Encyrtids
Eulophids
Eupelmids
False Darkline Beetlw
Fairyfly
Firefly
Flatid Planthopper
Fly (Tephritidae)
Fly (Stratiomyidae)
Froghopper
Fruit Fly
Fulgorid Planthopper
Fungus gnat
Funnel-web Spider
Gall Gnat
Grasshopper
Green Lacewing
Ground Beetle
Heliodinid Moth
Horsefly
Humpbacked Fly
Ichneumon
Issid Planthopper
Katydid
Lacewing
Lady Beetle
Lauxaniid Fly
Leaf Beetle
Leaf Bug
Leafhopper
Leaf Miner Fly
Long-horned Beetle
Long-horned Grasshopper
Long-legged Fly
March Beetle
Milkweed Butterfly
Minute Brown Scavenger beetle
Minute Pirate Bug
Mosquito
Muscid Fly
Narrow-winged Damselfly

Noctid Moth
Perilampids
Picture-winged Fly
Plant Bug
Planthopper
Plasterer Bee
Platygasterid
Platstomatid Fly
Primitive Crane Fly
Psyllids
Pteromalids
Pyralid Moth
Robber Fly
Rove Beetle
Sap Beetle
Scarab Beetle
Seed Chalcid
Shield-backed Bug
Shining Flower Beetle
Skipper Fly
Snout Beetle
Soldier Beetle
Spear-winged Fly
Spider
Spider
Squash Bug
Stem Sawfly
Stilt Bug
Stinkbug
Syrphid Fly
Tachnid Fly
Torymids
Treehopper
Trichogramatids
Tumbling Flower Beetle
Wasp (Ichneumonidae)
Wasp (Vespidae)
Wedge-shaped Beetle
Weevil
Water Strider
Whitefly

Fish

American Eel	Anquilla rostrata
Carp	Cyprinus carpio

Channel Catfish	Ictalurus punctatus
White Crappie	Pomoxis annularis
Bigmouth Buffalo	Ictiobus cyprinellus
Black Bullhead	Ictalurus melas
Black Crappie	Pomoxis nigromaculatus
Bluegill	Lepomis macrochirus
Bluntnose Minnow	Pimephales notatus
Bullhead Minnow	Pimephales vigilax
Emerald Shiner	Notropis atherinoides
Freshwater Drum	Aplodinotus grunniens
Goldfish	Carassius auratus
Green Sunfish	Lepomis cyanellus
Hog Sucker	Hypentelium nigricans
Johnny Darter	Etheostoma nigrum
Largemouth Bass	Micropterus salmoides
Northern Pike	Esox lucius
N. Creek Chub	Semotilus atromaculatus
N. Shorthead Redhorse	Moxostoma macrolepidotum
Mooneye	Hiodon tergisus
Orangespotted Sunfish	Lepomis humilis
Quillback Carpsucker	carpiodes cyprinus
Redhorse	Moxostoma sp.
Redear Sunfish	Lepomis microlophus
River Carpsucker	Carpiodes carpio
Sand Shiner	Notropis stramineus
Silver Chub	Hybopsis storeriana
Smallmouth Bass	Micropterus dolomieui
Smallmouth Buffalo	Ictiobus bubalus
Spottail Shiner	Notropis spilopterus
Walleye	Stizostedion vitreum
White Bass	Morone chrysops
White Sucker	Catostomus commersoni
Yellow Bass	Morone mississippiensis
Yellow Bullhead	Ictalurus natalis

Mammals

Beaver	Castor canadensis
Brown Bat	Myotis lucifugus
Coyote	Canis latrans
Deer Mouse	Peromyscus maniculatus
Eastern Chipmunk	Tamias striatus
Eastern Cottontail Rabbit	Sylvilagus floridanus
Eastern Mole	Scalopus aquaticus

Fox Squirrel	Sciurus nigir
Grey Squirrel	Sciurus carolinensis
Groundhog	Marmota monax
House Mouse	Mus musculus
Meadow Vole	Microtus pennsylvanicus
Muskrat	Ondata zibethica
Opossum	Didelphis marsupialis
Raccoon	Procyon lotor
Red Fox	Vulpes fulva
Short-tailed Shrew	Blarina brevicauda
Striped Skunk	Mephitis mephitis
Wood Mouse	Peromyscus leucopus
White-tailed Deer	Odocoileus virginianus
13-lined Ground Squirrel	Citellus tridecemlineatus

Herbs & Grasses

Alfafa	Medicago sativa
Alsike Clover	Trifolium hybridum
Aster	Aster sp.
Avens	Geum aleppicum
Beggar-ticks	Bidens frondosa or Bidens comosa
Big Bluestem	Andropogon gerardii
Bicknell's Cranesbill	Geranium bicknelli
Black Nightshade	Solnum nigrum
Blackseed Plantain	Plantago rugelii
Blessed Thistle	Cnicus benedictus
Bluegrass	Poa pratensis
Blue Violet	Viola papilionacea
Bracken Fern	Pteridium aquilinum
Bristley Greenbriar	Smilax hispida
Broadleaf Plantain	Plantago major
Bull Thistle	Cirsium vulgare
Butterfly Bush	Buddleia davidii
Canada Bluegrass	Poa compressa
Catnip	Nepeta cataria
Cattails	Typha latifolia
Chickory	Cichorium intybus
Cleavers	Galium aparine
Cocklebur	Xanthium pennsylvanicum
Common Burdock	Arctium minus
Common Mullen	Verbascum Thapsus
Common Yarrow	Achillea millefolium
Creeping Wood Sorrel	Oxalis coriculata
Curly Dock	Rumex crispus

Daisy Fleabane	Erigeron strigosus
Dandelion	Taraxacum officinale
Dutchman's Breeches	Dicentra cucullaria
European Horsemint	Mentha longifolia
Evening Primrose	Genthera biennis
Field Sorrel	Rumex acetosella
Giant Foxtail	Setaria faberii
Giant Ragweed	Ambrosia trifida
Goldenrod	Solidago Canadensis
Ground Cherry	Physalis heterophylla
Herb Robert	Geranium robertianum
Hoary Vervain	Verbena stricta
Jack-in-the-pulpit	Arisaema atrorubens
Kidneyleaf Buttercup	Ranunculus abortivus
Lambsquarters	Chenopodium album
Leafy Spurge	Euphorbia esule
Little Bluestem	Schizachyrium scoparium
May Apple	Podophyllum peltatum
Milkweed	Asclepias syriaca
Pennsylvania Smartweed	Polygonum pennsylvanicum
Poison Ivy	Rhus radicans
Prairie Trillium	Trillium recurvatum
Prickly Lettuce	Lactuca serriola
Purple Avens	Geum rivale
Purple Violet	Viola papilionacea
Pussy Toes	Antennaria plantaginifolia
Queen Anne's Lace	Daucus carota
Ragweed	Ambrosia artemisiifolia
Rattlesnake Root	Nabalus triffoliolatus
Red Clover	Trifolium pretense
Redtop	Agrostis alba
Rough Bedstraw	Galium asprellum
Rough-fruited Cinquefoil	Potentilla recta
Roundleaf Yellow Violet	Viola rotundifolia
Sandbur	Cenchrus longispinus
Self-heal	Prunella vulgaris
Star Chickweed	Stellaria pubera
Sulfur Cinquefoil	Potentilla recta
Swamp Buttercup	Ranunculus septentrionalis
Timothy	Phleum pretense
Trumpet Vine	Campsis radicans
Velvet Leaf	Abutilon theophrasti
Virginia Creeper	Campsis radicans
White Clover	Trifolium repens
White Heath Aster	Aster pilosus

White Sweetclover	Melilotus alba
White Vervain	Verbena urticifolia
Whorled Milkweed	Ascepias verticillata
Whorled Milk Wort	Polygala verticillata
Wild Carrot	Daucus carota
Garlic Mustard	Alliaria petiolata
Wild Oat	Avena fatua
Wild Parsnip	Pastinaca sativa
Wild Strawberry	Fragaria virginiana
Wintergreen	Pyrola americana
Yarrow	Achillea millefolium
Yellow Clover	Trifolium procumbens
Yellow Foxtail	Setaria lutescens
Yellow Sweetclover	Melilotus officinalis
Yellow Toad Flax	Linaria vulgaris
Yellow Wood Sorrel	Oxalis europaea

Shrubs

Blackhaw	Viburnum prunifolium
Black Raspberry	Rubus occidentalis
Bristly Black Currant	Ribes lacustre
Bristly Dewberry	Rubus hispidus
Cat Briar	Smilax glauca
Flowering Dogwood	Cornus florida
Frost Grape	Vitis vulpina
Cat Grape	Vitis palmata
Grape	Vitis sp.
Winter Grape	Vitis cinera
Northern Prickly-ash	Xanthoxylum americanum
Prickly Gooseberry	Ribes cynosbati
Red Leaf Rose	Rosa rubrifolia
Red Raspberry	Rubus idaeus
Rose	Rosa sp.
Rose of Sharon	Hibiscus syriacus
Red-osier Dogwood	Cornus stolonifera
Round-leaf Dogwood	Cornus rugosa
Smooth Gooseberry	Ribes hirtellum
Smooth Sumac	Rhus glabra
Stag Horn Sumac	Rhus typhina
Wild Blackberry	Rubus allegheniensis

Trees

American Crabapple	Pyrus coronaria

American Elm	Ulmus americana
American Hazelnut	Corylus americana
American Plum	Prunus americana
Apple	Malus sp.
Black Cherry	Prunus serotina
Blackjack Oak	Quercus marilandica
Black Locust	Robina psuedoacacia
Black Maple	Acer nigrum
Black Oak	Quercus velutina
Black Walnut	Juglans nigra
Box Elder	Acer negunda
Choke Cherry	Prunus virginiana
Cottonwood	Populus deltoids
Crabapple	Malus coronaria
Hackberry	Celtis occidentalis
Hawthorn	Crataegus sp.
Honey Locust	Gleditsia triacanthos
Hophornbeam	Ostrya virginiana
Jack Oak	Quercus ellipsoidalis
Linden	Tillia americana
Mockernut Hickory	Carya tomentosa
Osage-orange	Maclura pomifera
Pin Oak	Quercus palustria
Prickly Ash	Zanthoxylum americanum
Quaking Aspen	Populus tremuloides
Red Cedar	Juniperus virginiana
Red Maple	Acer rubrum
Red Mulberry	Morus rubra
Red Oak	Quercus rubra
Red Pine	Pinus resinosa
Shagbark Hickory	Carya ovata
Shellbark Hickory	Carya laciniosa
Slippery Elm	Ulmus rubra
Sugar Maple	Acer saccharum
Sycamore	Platanus occidentalis
White Ash	Fraxinus americana
White Oak	Quercus alba
White Pine	Pinus strobus
Variable-thorn Hawthorn	Crataegus punctata

2.2 Timeline of Completed Activities and Future Goals

In spring of 2007 the BEST group started the Wildlife at Work program by first purchasing bird houses for Bluebirds, Woodpeckers, Wood Ducks and Owls as a way of

providing habitats for local birds that were in need of nesting areas. Bat houses were also purchased in an attempt to encourage bats to feed on the plentiful insects found down at the River Screen House (RSH). Monitoring was performed on the houses every Spring and Summer and additional houses were purchased each year. In 2009 the BEST group was able to contact Ducks Unlimited and work with them to locate two new Wood Duck houses in good locations north of the RSH. Monitoring of the houses occurred in April and May of 2009. In September 2009 a local Girl Scout Troop made two bat houses from kits that the BEST group had provided. In April and May 2010 it was time to clean up the houses and then monitor the houses to see who inhabited the houses. In October 2010 an employee asked the BEST group if there might be some project that could be done for an Eagle Scout. By December 2010 the project was approved and Nathan Schlagel and his troop worked to make houses, locate the existing houses and record GPS location which were posted on Google map, and erect the new houses around the Byron Station property while recording GPS locations. This work finished at the end of March, 2011 and all the houses were cleaned for arrival of the seasonal occupants.

In February of 2010 during a BEST meeting it was noted that the area outside the training cafeteria needed to be replanted. The decision was made to try and use the kits that were for sale from the Ogle County Soil Conservation group. Then in April of 2011 the old plant material that was outside the training building's cafeteria was removed and two of the Bird and Butterfly kits were planted. The patio looked much better and employees could see butterflies and some birds visiting the plants.

Future timelines for the BEST group are to maintain current focus on cavity nesting birds and arrange houses in suitable locations on the property to extend the size of the bluebird trail for the foreseeable future. Byron Forest Preserve District had talked to BEST members about the possibility of using some of the station property as a location for prairie plants and these actions would be at least two years in the future.

There have also been discussions that heron platforms could be set up along the edge of the Rock River. These activities for platform building could take place in the Spring of 2012. And there have been other discussions about retention ponds on Woodland Creek and on Kartheiser Creek where birds and animals would have increased access to water. These actions would take more time and equipment to occur and would most likely start some where after 2015.

3. Implementation

3.1. Mission of Byron Station's Wildlife at Work Program

The mission of the Byron Station's Wildlife at Work program is to increase the facility's biological diversity. Individual projects will be actively managed and monitored to ensure that they adhere to this plan. Additionally, the Byron Station program provides educational opportunities to BEST group members, Byron Station employees and the general public.

Project 1. Enhance habitats for cavity-nesting birds

The houses for the bluebirds and wood ducks have been successful in encouraging those species to utilize the habitats present around Byron Station. There is food available

in this grouping of meadows, river side woods, and older hardwoods for the wide variety of nesting cavity birds we are trying to attract. Water is also nearby with an assortment of small creeks, the Rock River and several ponds. There is cover provided the birds by the placement of the houses in relation to the closest trees and branches which can allow the birds to first survey the area around their nest before returning. There is plenty of space between houses so that the birds won't have to feel that they are competing with each other and both houses then end up empty or occupied by sparrows.

The monitoring of the status of the houses was recorded in many cases by taking pictures of what we found during the inspections of the houses. It was always a surprise as to what would await us when we made our observation. Sometimes the adult would just freeze on the nest and the next house might have a family of mice. We would start our observation early in the spring before the leaves would bud out on the trees. This was when we would find the majority of the mice since they found a house that was dry.

We made observations as to what type of house was most often occupied with a nesting family and which ones fell apart after a couple of years. In some cases the smallest and cheapest house was continually occupied but it was hard to determine if it was the location to food or cover that provided the attraction. It was nice that the cavity-nesting birds were the ones that we had the most outside volunteers to help us with our efforts to attract even more of these birds.

Project 2. Enhance habitats for bats

The houses for the bats have been successful in encouraging those species to utilize the habitats present around Byron Station. There is food available for these insectivores from the meadows, river side woods, and other aerial areas for these wide ranging feeders. Water is also nearby with an assortment of small creeks, the Rock River and several ponds. There is cover provided to the bats by the placement of the houses in relation to the closest trees and branches which can keep predators away form them. There is plenty of space between houses so that the bats can have one house for a nursery and another nearby house for bachelors.

The monitoring of the bats has been ongoing for several years ever since we noticed them roosting under awning and on a brick wall at the Main Access Building (MAB) where we enter and exit the plant. The bat houses were part of an effort to find these few bats a roosting place away from a walkway where they could be bothered.

The monitoring of the bat houses is done while on rounds for other bird houses and while visiting the RSH area. So we have been successful in establishing more areas for bats to roost and have noticed a decrease in the number and times bats have used the MAB to roost in the past two years while also still noting bats flying around at dusk.

Project 3. Establish butterfly garden

The butterfly garden outside the training building cafeteria is very nice to look at with the flowers and helpful to the local fauna by allowing pollinators some other plants to forage from. Since this area is frequented by many people who attend training, this is by

far the best opportunity to show our co-workers some of the benefits of supporting wildlife.

The pollinators are attracted to the flowers present in the garden which provides them food and sheltered location since there are buildings on two sides. There is a local water source that is not more than 500 ft from the garden and the garden is close to trees and grasslands where cover could be found for the different pollinators. The creation of this garden provides a space where a variety of species can thrive, due to the availability of food and cover. The area was previously much neglected and not a suitable environment for most pollinators.

4. Evaluation and Project Status

The Byron Station's Wildlife at Work program started with a number of bird and bat houses being mounted in trees in 2007 and monitoring started then. The program has been expanding each year and we have noted increase numbers of bluebirds and wood ducks nesting in the houses that have been set up.

Project 1.

There appears to be very discernable trend that the number of bluebirds has increased in the immediate area. This can be documented by the increase in number of houses with active chicks that have fledged. This shows that Byron Station has created an active bluebird trail and with the bluebird trail established at the Byron Forest Preserve Property about two miles away that bluebirds in this area are on the rise.

The Byron Station wood duck houses also have been successful as last year a dozen ducklings left one of the houses.

Project 2.

The Byron Station bat houses have been in place for over three years and there have been very few observations of actual bats in the houses. There has been indication of bats present in the houses by deposits on foliage below the houses but dusk or dawn observations have not been used to properly document the number of bats. The bat houses have been successful in having one roosting area near a high pedestrian traffic area to have been vacated. With more bat houses present the chances that the bats find and roost in our provided habitats is very high and with proper monitoring at dusk that fact can be documented.

Project 3.

The Byron Station butterfly garden was beautiful last summer and fall with many visits from birds and butterflies. The employees and visitors to the station have commented that the garden was an improvement and thought the idea of a pollinator garden was very good. Several employees thought of buying their own kit of plants from the county soil and water district for a butterfly and bird garden.

4.1. New Projects

There were discussions with Byron Forest Preserve and Byron Station about some of the station property being used to generate prairie seeds which could be used to further reestablish prairies in the local area. And there was discussion with the Illinois Department of Natural Resources about the Wildlife Habitat Incentives Program but those discussions have been put on hold during the present state budget crisis.
Another project that could be implemented is platforms at the Rock River's edge for herons.
Another idea for a project is where retention ponds could be created on local creeks as a way to increase water habitats.
Another thought for a project is to build or purchase a platform for Osprey to nest on to be located down by the Rock River.

5. Documentation

Examples of monitoring sheets, photographs taken while conducting monitoring, seed and plant mixes, receipts, emails, BEST group minutes and examples of what was displayed at employee fairs, correspondence with Eagle Scout, GPS coordinates.

Additional Documentation included in the application is found in:

"Photograph Journal" folder contains folders of Bat Photos, Bluebird Photos, Eagle Scout Project, Foliage Photos, Mammals Photos, Other Birds Photos, Other Fauna Photos, Other Projects Photos, and Wood Duck Photos.

"Wildlife Management Plan Documents" folder contains folders such as Assorted Photos Not related to Projects, Other Projects, GPS Coordinates and Maps, and files such as BEST Meeting Minutes, Description of Bluebird Houses Locations, Monitoring Logs and Location Descriptions, Project List & Invites to Environmental Fair, and Purchases and Agreements.

"PSS Bats" contains the Project Summary Sheet and other documents for Bat Houses.
"PSS Bluebird" contains the Project Summary Sheet and other documents for Bluebird Houses.
"PSS Butterfly Garden" contains the Project Summary Sheet and other documents for the Butterfly and Bird Pollinator Garden.
"PSS Wood Duck" contains the Project Summary Sheet and other documents for Wood Ducks.
Also included are documents such as several different maps and a Species Inventory List.

Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-2 Category: Aquatic

Statement of Question:

The ER (Section 3.1.3.1, Page 3-6) states, "Byron has an agreement with the Illinois DNR [Illinois] Department of Natural Resources] to limit consumption of water from the Rock River for makeup to the Byron cooling systems to no more than 9 percent of total river flow during times when the river flow rate drops below 19,200 L/sec (679 cfs)." Is this a condition of the National Pollutant Discharge Elimination System (NPDES) permit? If not, when was this agreement made and where is it documented?

Response:

The agreement with Illinois DNR limiting consumption of water from the Rock River is not a condition of the NPDES permit.

The agreement was made in 1977 during the process for obtaining a permit from the Illinois Department of Transportation (IDOT) Division of Water Resources (now Illinois Department of Natural Resources) to construct the Byron intake and discharge structures. It was documented in the IDOT Permit No. 15001, dated April 7, 1977, which is attached to the Request for Additional Information Response WR-SW-1e. The agreement is implemented by Byron procedures, as described below.

Byron procedure 0BOA ENV-2 defines actions that Byron operating personnel must take during conditions of low water in the Rock River. If the National Weather Service forecasts that the Rock River level will remain above 698.68 feet MSL, then the river flow rate at the River Screen House is calculated weekly using data from USGS gage stations in accordance with Byron procedure 0BOSR CW-W1. If the calculated river flow rate at the River Screen House falls to 2,400 cubic feet per second (cfs) or less, the river flow rate calculation frequency changes to daily. If the calculated river flow rate at the River Screen House falls to 679 cfs or less, then the river consumption rate must also be calculated. If the river consumption rate exceeds 9 percent of total Rock River flow at that time, then Byron procedure 0BOL EPA 1 dictates that circulating water makeup and blowdown flows be reduced until the Rock River consumption rate is less than 9 percent of total Rock River flow. Byron procedure 0BOL EPA 1 further dictates that, if necessary to meet this criterion, Unit 1 and Unit 2 MW outputs must also be reduced.

List Attachments Provided:

None

Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-3 Category: Aquatic

Statement of Question:

The ER (Section 3.1.3.1, Page 3-7) states that the river screen house is equipped with bar grills, traveling screens, and trash racks and that debris is collected in a trash basket and disposed of offsite.

a. During the environmental audit conducted in September 2013, a written description of the flow path from when water enters the river screen house to the point at which it enters the pipelines that carry the water to the Byron site was provided and included details such as the spacing of the bar grills, size of traveling screen mesh, and periodicity of traveling screen and trash rack operation.

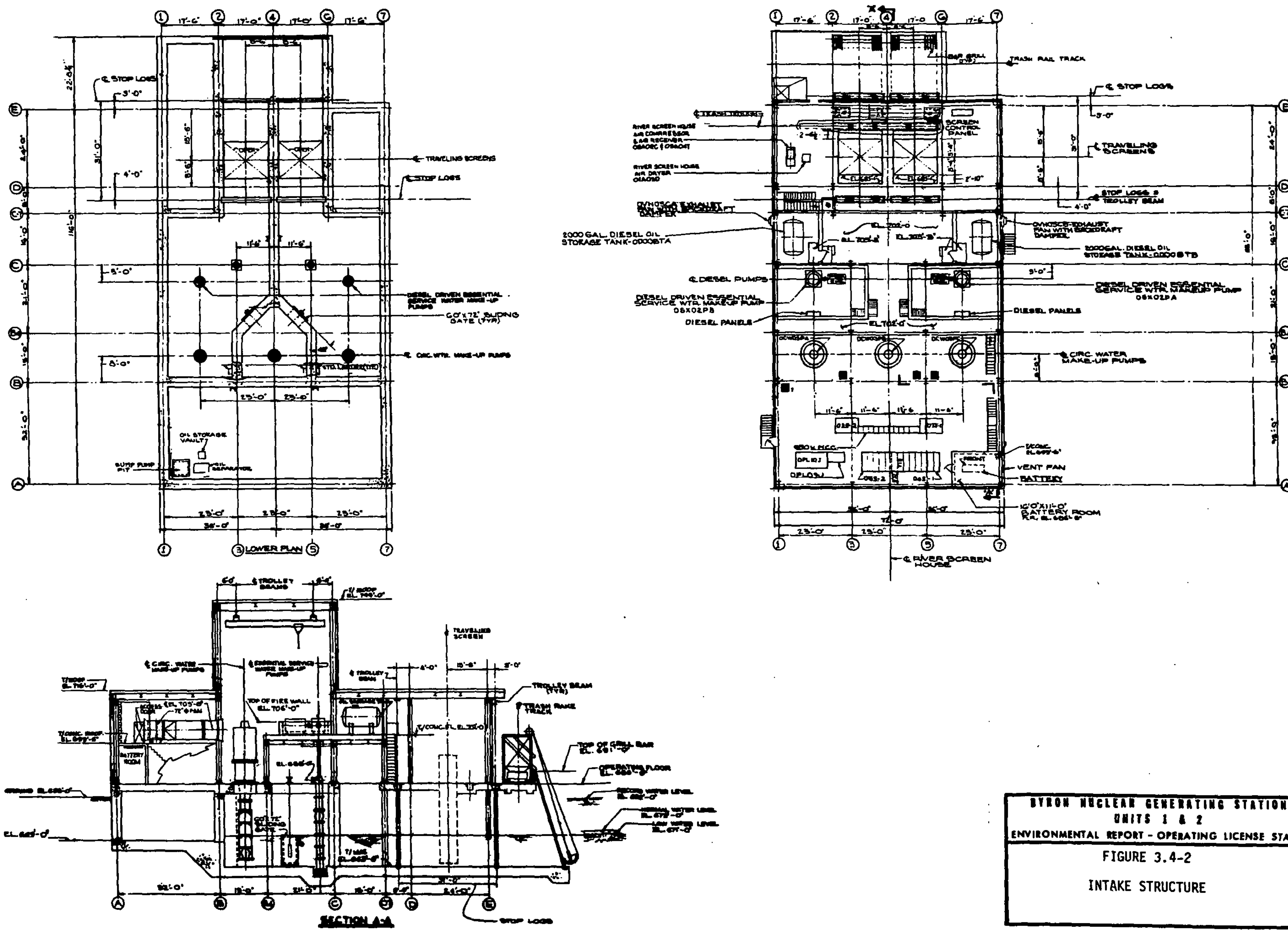
Response:

Water pumped from the Rock River first encounters the trash rack grill bars, which are located outside the river screen house. These grill bars protect the circulating water makeup pumps and essential service water makeup pumps from floating ice and large debris. They extend at a slight angle from the floor of the intake channel to a vertical height of approximately 28 ft (8.5 m) [Byron ER-OL, Fig. 3.4-2] with a bar spacing of 3 inches [Sargent & Lundy Drwg S-415; Sargent & Lundy Standard 1743, p. 7, Dwg 43-1, Detail C5]. After passing through the trash rack at a speed between 0.43 and 0.55 fps [Byron ER-OL, p. 3.4-3], the river water enters the screen house where it encounters traveling screens composed of stainless steel wire screen cloth having 3/8-inch square openings [FMC Corp. Dwg. JK2242-2]. The design through-screen flow rate for the Byron traveling screens is 1.65 fps for a 100% clean screen at a low-water level of 671.0 ft (FMC Corp. Dwg. JK2242-2, Note A). During impingement monitoring at Byron in 1985-86 and 1987-88, the maximum intake through-screen velocity was measured at 0.91 fps ([IEPA 1989] Letter from IEPA (T. McSwiggin) to Commonwealth Edison Company regarding NPDES Permit No. IL0048313 Determination under Section 316(b) of the Clean Water Act, May 15, 1989). The traveling screens typically operate automatically based on pressure differential setpoints and timer settings. Absent actuation due to pressure differential, the timer setting actuates the traveling screens every 12 hours for 55 minutes (BOP CW-15, p. 2).

After passing through the traveling screens, the water enters a chamber containing the circulating water makeup pumps and the diesel-driven essential service water makeup pumps. The circulating water makeup pumps direct water into one 48-inch pipeline, which supplies makeup water to the two natural draft cooling towers and during normal operation, to the essential service water cooling towers [Byron UFSAR, sections 2.4.8 (p. 2.4-16) and 2.4.11.6 (p. 2.4-22)]. The essential service water makeup pumps direct water into two 12-inch pipelines, which supply makeup water to the essential service water mechanical draft cooling towers during conditions in which makeup is not available from the circulating water system [Byron UFSAR, sec. 2.4.8 (p. 2.4-16) and 2.4.11.6 (p. 2.4-22)]. Blowdown water from the essential service water system is directed into the flume between the natural draft cooling towers, and the combined plant blowdown flows from the flume back into the Rock River through a 30-inch pipeline parallel to the makeup pipelines [Byron UFSAR, sec. 2.4.8, p. 2.4-16].

List of Attachments Provided:

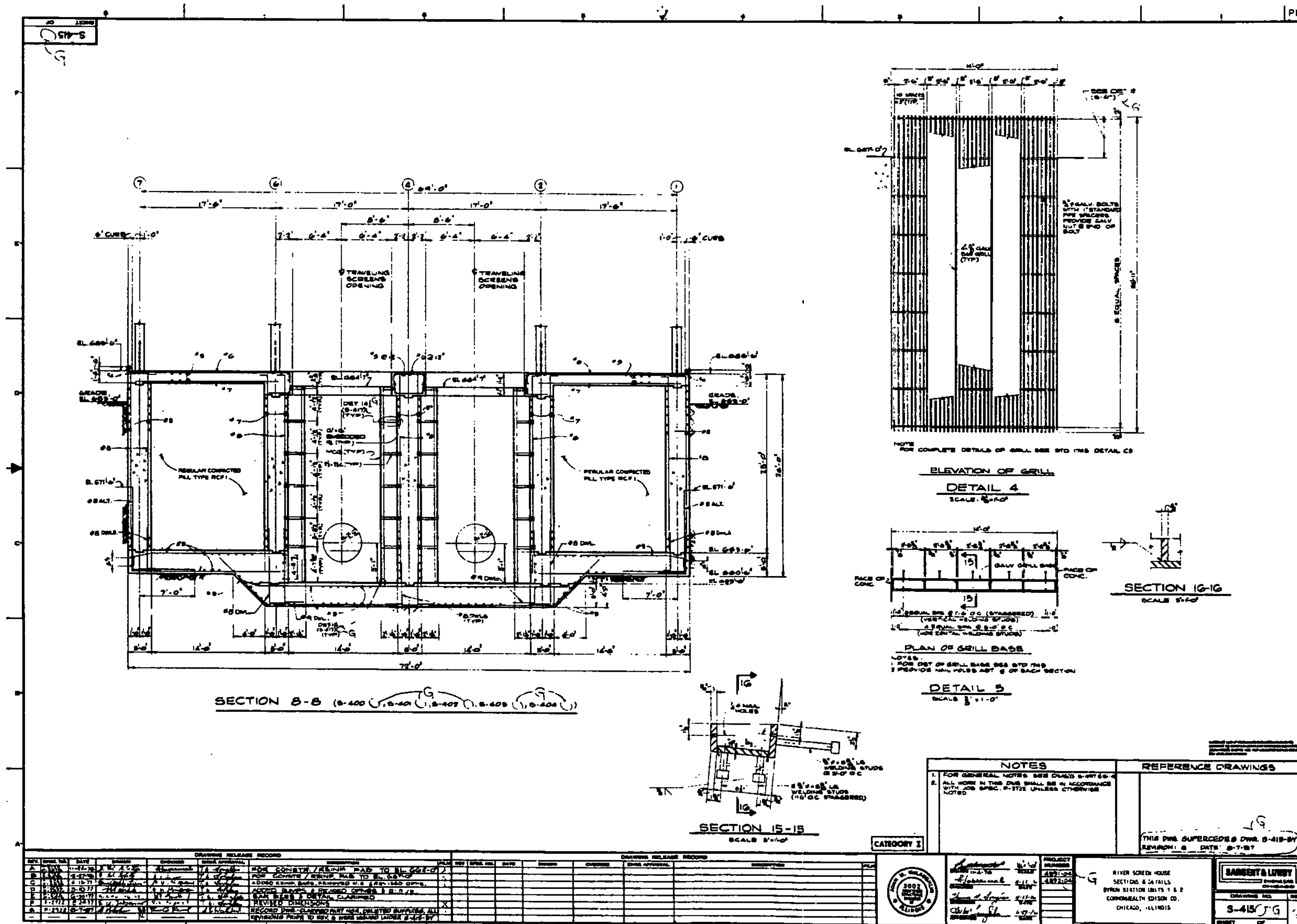
1. Byron ER-OL, Fig. 3.4-2
2. Sargent & Lundy Dwg S-415
3. Sargent & Lundy Standard 1743, Dwg 43-1
4. Byron ER-OL, p. 3.4-3
5. FMC Corp. Dwg. JK2242-2
6. Byron UFSAR, sec. 2.4.8, p. 2.4-16
7. IEPA 1989



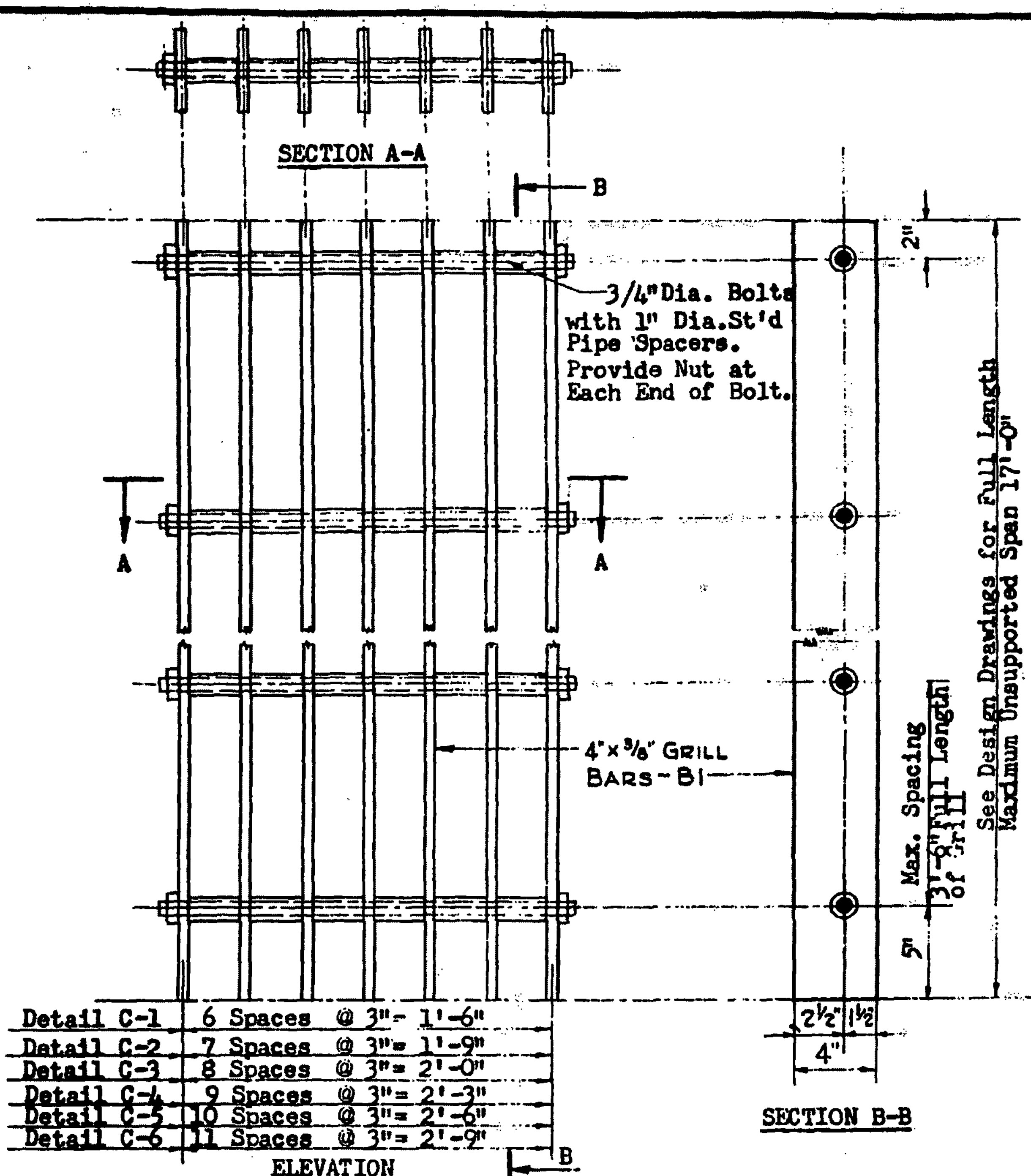
BYRON NUCLEAR GENERATING STATION
UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE 3.4-2

INTAKE STRUCTURE



SECTION 8-8
ELEVATION OF GRILL
DETAIL 4
PLAN OF GRILL BARS
DETAIL 5
SECTION 16-16
SECTION 15-15
NOTES
1. FOR GENERAL NOTES SEE DWG S-
2. ALL WORK IN THIS DWG SHALL BE IN ACCORDANCE WITH JOB SPEC. F-2722 UNLESS OTHERWISE NOTED
REFERENCE DRAWINGS
THIS DWG. SUPERCEDES DWG. S-415-BY
CATEGORY I
RIVER SCREEN HOUSE
SECTIONS & DETAILS
BYRON STATION UNITS 1 & 2
COMMONWEALTH EDISON CO.
CHICAGO, ILLINOIS
SARGENT & LUNDY
S-415



See Design Drawings for Width

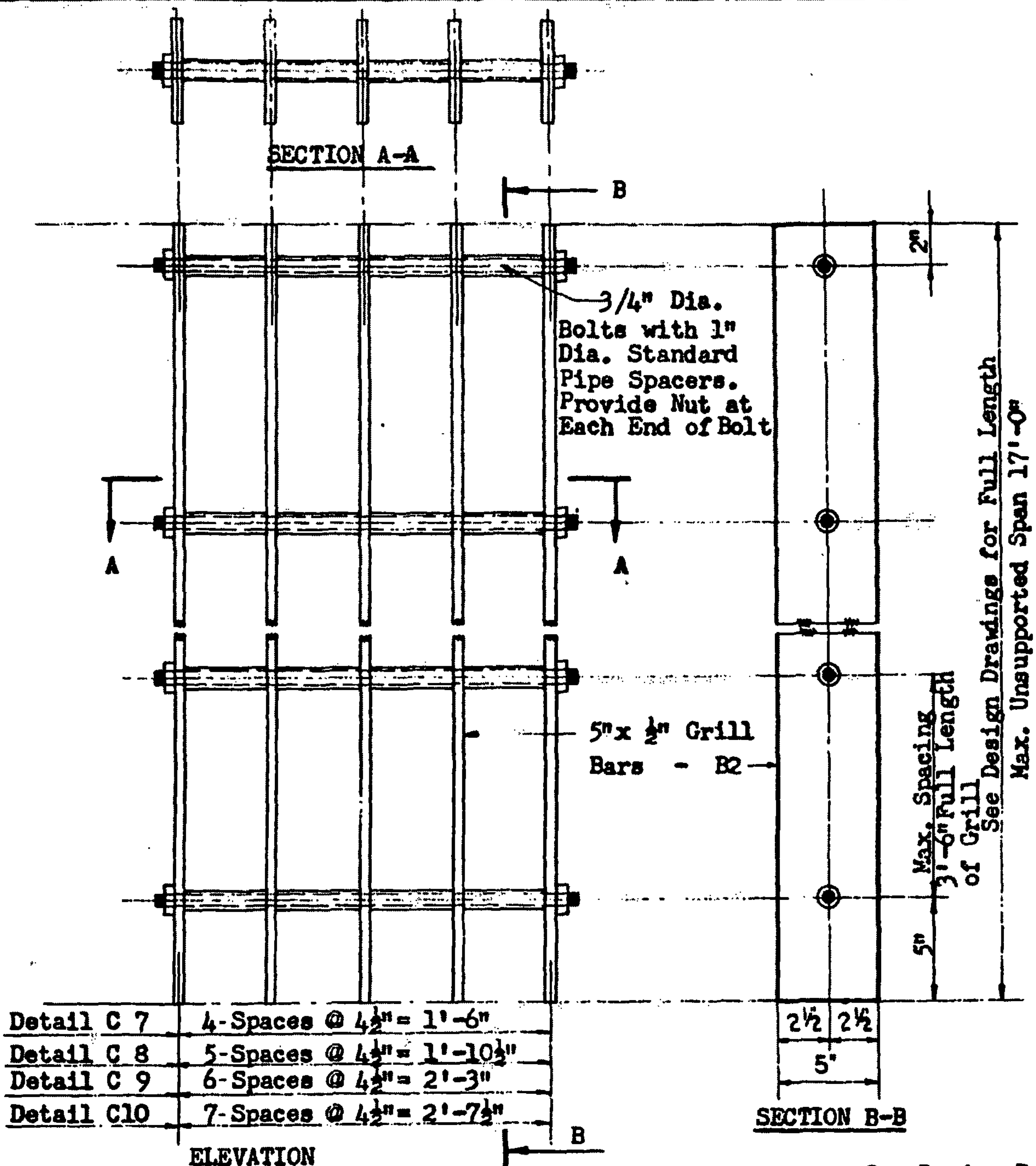
See Design Drawings for Location of Grill

For 7'-6" Compartment	3½	1'-6" C1	3½	1'-6" C1	4"	1'-6" C1	3½	1'-6" C1	3½
" 8'-0" "	"	"	"	1'-9" C2	"	1'-9" C2	"	"	"
" 8'-6" "	"	1'-9" C2	"	"	"	"	"	1'-9" C2	"
" 9'-0" "	"	"	"	2'-0" C3	"	2'-0" C3	"	"	"
" 9'-6" "	"	2'-0" C3	"	"	"	"	"	2'-0" C3	"
" 10'-0" "	"	"	"	2'-3" C4	"	2'-3" C4	"	"	"
" 10'-6" "	"	2'-3 C4	"	"	"	"	"	2'-3" C4	"
" 11'-0" "	"	"	"	2'-6" C5	"	2'-6" C5	"	"	"
" 11'-6" "	"	2'-6" C5	"	"	"	"	"	2'-6" C5	"
" 12'-0" "	"	"	"	2'-9" C6	"	2'-9" C6	"	"	"
" 12'-6" "	"	2'-9" C6	"	"	"	"	"	2'-9" C6	"

GRILL ARRANGEMENT FOR VARIOUS COMPARTMENT WIDTHS

STANDARD	1743
CRIB HOUSE GRILL	
SCALE ..... DRAWN R.C.O. APPROVED ..... DATE 1-27-42 REVISED 10-22-47, 6-11-66	SARGENT & LUNDY ENGINEERS CHICAGO
	DRAWING 43-1

STRUCTURAL



See Design Drawings for Location of Grill

See Design Drawings for Width

For 7'-6" Compartment	3½"	1'-6" C 7	3½"	1'-6" C7	4"	1'-6" C7	3½"	1'-6" C7	3½"
For 8'-0" Compartment	4¾"	"	4¾"	"	5"	"	4¾"	"	4¾"
For 8'-6" Compartment	4"	"	4¼"	1'-10½" C8	4½"	1'-10½" C8	4¼"	"	4"
For 9'-0" Compartment	3½"	1'-10½" C8	3½"	"	4"	"	3½"	1'-10½" C8	3½"
For 9'-6" Compartment	4¾"	"	4¾"	"	5"	"	4¾"	"	4¾"
For 10'-0" Compartment	4"	"	4¼"	2'-3" C9	4½"	2'-3" C9	4¼"	"	4"
For 10'-6" Compartment	3½"	2'-3" C9	3½"	"	4"	"	3½"	2'-3" C9	3½"
For 11'-0" Compartment	4¾"	"	4¾"	"	5"	"	4¾"	"	4¾"
For 11'-6" Compartment	4"	"	4¼"	2'-7½" C10	4½"	2'-7½" C10	4¼"	"	4"
For 12'-0" Compartment	3½"	2'-7½" C10	3½"	"	4"	"	3½"	2'-7½" C10	3½"
For 12'-6" Compartment	4¾"	"	4¾"	"	5"	"	4¾"	"	4¾"

GRILL ARRANGEMENT FOR VARIOUS COMPARTMENT WIDTHS

STANDARD	1743

CRIB HOUSE GRILL

SCALE ....
DRAWN RCO
APPROVED
DATE 1-22-46
REVISED 10-23-47, 6-17-66

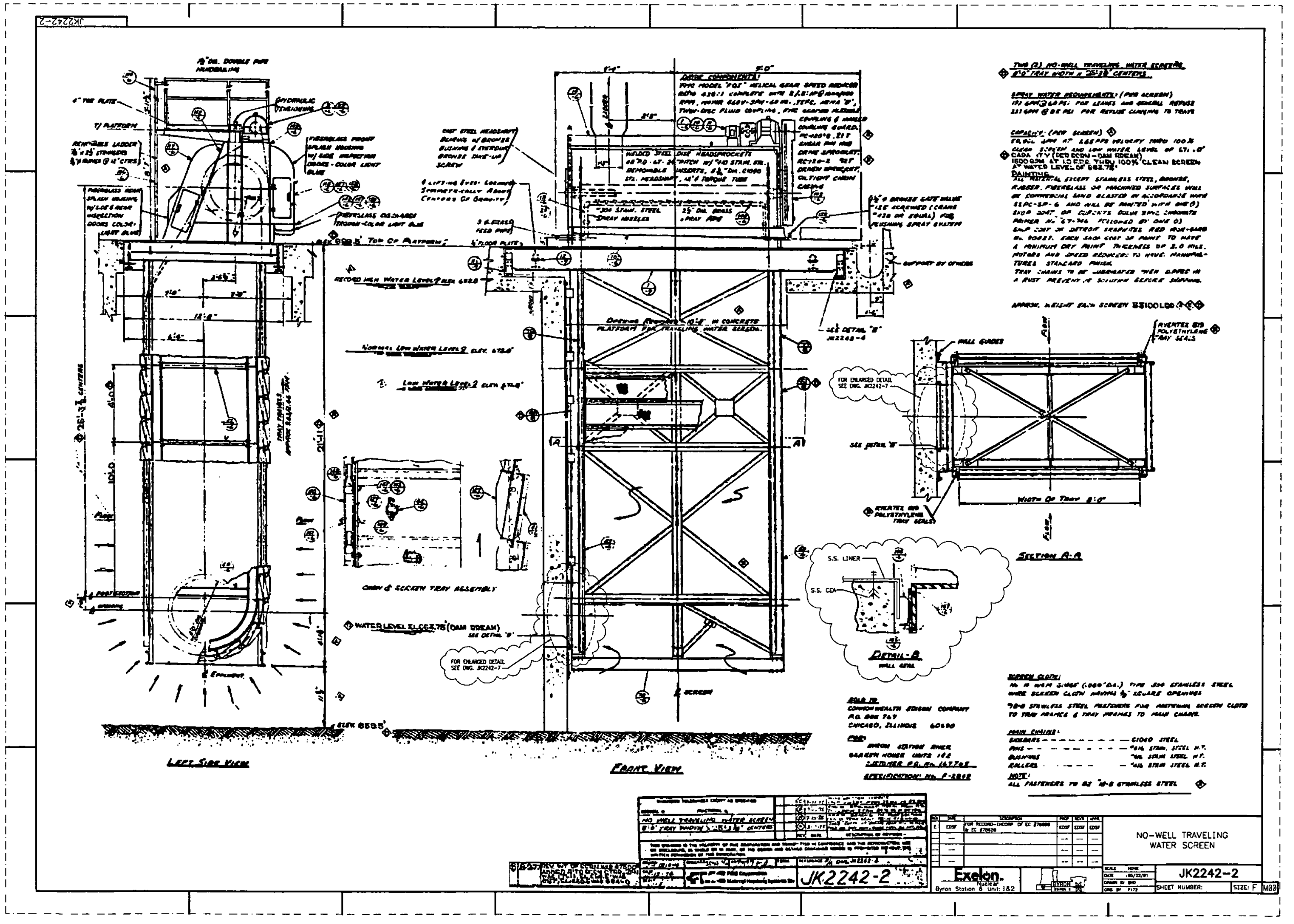
SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING 43-2

The mean annual flow and 1-day low flow at the intake are 4730 and 400 cfs, and the corresponding water surface elevations are 672 and 670.4 feet MSL. The pump invert elevation of the intake channel is 663.6 feet and the velocity in the intake channel is between 0.43 and 0.55 feet per second. The structure contains three circulating water pumps, two for normal operation and one for standby, each of which has a capacity of about 53.5 cfs. The structure also contains two diesel-engine-driven essential service water makeup pumps, one for each mechanical draft tower. Each pump has a capacity of about 3.5 cfs.

The intake is protected by bar grills and traveling screens. The velocity at the intake is between 0.43 and 0.55 feet per second and decreases considerably with distance toward the center of the river. This velocity exists from the mouth of the intake at the bar racks to within a few feet of the traveling screens. The velocity through the traveling screens increases approximately two-fold because of the presence of the screens themselves. Debris removed from these screens is disposed of off the site by an independent contractor.

These heat dissipation systems are summarized in the plant water usage diagram, Figure 3.3-1.


JK2242-2
LEFT SIDE VIEW
FRONT VIEW
SECTION A-A
DETAIL-B
WALL GUIDES
S.S. LINER
FOR ENLARGED DETAIL SEE DWG. JK2242-7
WATER LEVEL EL.683.75' (DAM BREAK)
CAPACITY (PER SCRN - DAM BREAK)
1500 GPM AT 1.0 F.P.S. THRU 100% CLEAN SCREEN
AT WATER LEVEL OF 683.75'
PAINTING
ALL FASTENERS TO BE 18-8 STAINLESS STEEL
NO-WELL TRAVELING
WATER SCREEN
Exelon Nuclear
Byron Station & Unit: 1&2
BYRON
SCALE NONE
DATE 05/22/01
SHEET NUMBER:
SIZE: F
M00
JK2242-2

flood on the Rock River at Rockton. More recently, in the early spring of 1971, there was major ice flooding approaching the magnitude of the 1937 ice floods; ice jams occurred all the way from Rockford downstream to Grand Detour, 15 miles below the site area. However, the 1937 flood stage was 0.94 feet lower than the second largest recorded flood of March 1975 at Rockton. The computed March 1975 flood reached an elevation of 679 feet at the intake. Since the safety-related equipment at the river screen house is at elevation 702.0 feet, ice-induced high flood levels will not have an adverse effect on the performance of the river screen house. Similarly, ice jams cannot create low water levels at the river screen house since the water level at the screen house is controlled by the downstream dam at Oregon.

2.4.8 Cooling Water Canals and Reservoirs

The only canal associated with the plant is an open flume which returns the circulating water from the natural draft cooling towers to the circulating water pumphouse. The flume is not safety-related and has a 2-foot freeboard. There are no reservoirs for the plant.

Makeup water is withdrawn from the Rock River and is pumped uphill to the plant in three pipelines. Two 12-inch essential service water makeup lines supply makeup to the essential service water cooling towers and one 48-inch circulating water makeup line supplies makeup to the intake bay of the circulating water pumphouse. Plant blowdown water from the circulating water system is discharged back into the Rock River in a 30-inch pipeline parallel to the makeup pipelines.

2.4.9 Channel Diversions

Due to the great width of the Rock River and the relatively flat surrounding terrain, there is little possibility that rock falls, ice jams, or subsidence could completely divert the flow away from the makeup water intake. The minimum daily flow of record (1915-1971) in the Rock River at the intake is estimated to be 400 ft^3/sec. Low flows are usually associated with the months of August, September, and October. No ice-induced low flow levels at the intake were reported. The intake is designed to prevent ice jamming against it and cutting off inflow. In order to prevent blockage of the intake structure by the accumulation of floating sheet ice, a floating boom and sheet piling are installed to deflect sheet ice away from the intake structure bar grills, allowing the river current to carry the sheet ice downstream. The upstream sheet piling provides a continuous shoreline to increase the river current past the intake, minimizing the potential for an ice jam at the bar grills. Even if the river flow were temporarily cut off, makeup for the essential service cooling towers would still be available from groundwater wells at the plant site.

Illinois Environmental Protection Agency · P. O. Box 19276, Springfield, IL 62794-9276

217/782-1696

Commonwealth Edison Company
Byron Nuclear Power Station
NPDES Permit No. IL0048313
Determination under Section 316(b) of the Clean Water Act

May 15, 1989

Commonwealth Edison Company
2 North LaSalle
Post Office Box 767
Chicago, Illinois 60690-0767

Gentlemen:

On November 5, 1986 and September 2, 1988, Commonwealth Edison Company submitted to the IEPA documents titled Impingement Monitoring at Bryon Generating Station 1985-1986 and Impingement Monitoring at Byron Generating Station 1987-1988 respectively. The objective of the documents was to satisfy the test established by Section 316(b) of the CWA and 35 Ill. Admin. Code 306.201.

Byron Nuclear Power Station consists of two pressurized water reactors with a rated capacity of 2240 MW. A closed-cycle cooling water system using two natural draft hyperbolic cooling towers is used to dissipate heat from the condensation of steam formed in the secondary cycle by the steam generator. The source for make-up water to the system is the Rock River. The two intake pumps operated at a maximum of 45,000 gpm (100.3 cfs) during the study. The 7Q10 of the Rock River at the location of the station intake is estimated at 1100 cfs. Intake velocity was a maximum 0.91 ft./sec. measured during the study.

The number and species of fish impinged on the revolving intake screens at Byron Station have been recorded for two periods July 9, 1985 to July 18, 1986 and November 3, 1987 to April 29, 1988. Twenty four hour samples were collected twice per week during these periods. Extrapolation of the catch is required in order to estimate weekly impingement. The available data established which fish species are likely to be impinged and their seasonal occurance. Data for the period of study shows that the estimated number of fish impinged is low (11 fish/day 1985-1986; 37.8 fish/day 1987-1988) and impingement is dominated by juvenile fish (Appendix B List of Raw Fish Data). Based on the low numbers of fish impinged during the study and the fact that impinged fish are dominantly juvenile channel catfish, juvenile bluegill and cyprinid (minnow) species, the operation of Byron Station cooling water intake will have no measurable impact on the Fishery of the Rock River.

The effects of construction of the Byron Station intake were limited to the immediate shoreline where the structure is located. No detrimental impacts on fish were anticipated due to construction.

Intake design alternatives include other structurally or mechanically different intake systems which could be constructed at the location. In review of the general layout of the existing system being an on shoreline structure (flush mounted screen system) which is designed to minimize funneling of fish toward the intake acording to the available literature, the existing intake structure is designed and is providing minimal adverse environmental impact.

The intake capacity is subject to station water requirement to replace evaporative losses plus the necessary blowdown to maintain cooling water quality in the closed-cycle system. The closed cycle cooling system is Best Available Technology (BAT) reducing the total intake volume to approximately 5 percent of what a plant of equivalent size would require under open cycle operation.

The IEPA herein determines that the Demonstration Documents satisfactorily show that the location, design, construction and capacity of the Byron Station intake structure reflects the best available technology for minimizing adverse environmental impact. The NPDES Permit for this Facility, IL0048313, will be modified to reflect this determination when the permit is reissued.

Should you have any questions or comments regarding the Agency's review of this matter, please advise.

Very truly yours,

Thomas G. McSwiggin, P.E.
Manager, Permit Section
Division of Water Pollution Control

TGM:GC:dls/1585k,84-85

cc: IEPA-RU
Rockford Regional Office

Byron Environmental Audit – Request for Additional Information Response

Question #: AQ-3 Category: Aquatic

Statement of Question:

The ER (Section 3.1.3.1, Page 3-7) states that the river screen house is equipped with bar grills, traveling screens, and trash racks and that debris is collected in a trash basket and disposed of offsite.

b. Does the Byron intake include a fish return system? If not, are impinged fish disposed of offsite along with the debris collected in the trash basket?

Response:

The Byron intake traveling screen has no fish return system. The small number of impinged fish is disposed offsite with debris collected in the trash basket.

List Attachments Provided:

None

Byron Environmental Audit – Request for Additional Information Response

Question #: EJ-1 Category: Environmental Justice

Statement of Question:

To help address the provisions of Section 4-4 "Subsistence Consumption of Fish and Wildlife" in Executive Order 12898, the following information is needed to assist the NRC in its environmental justice review:

a. Information about current or past wildlife sampling and testing of game animals such as deer, squirrel, turkey, pheasant, duck, fish and other game birds and animals that may have been conducted in the vicinity of Byron. Wildlife sampling and testing may have been conducted before, during, and after plant construction and in the early days of plant operation, but was discontinued after determining that tissue samples consistently showed no significant or measurable radiological impact on the environment from plant operations.

Response:

The Byron Station FES, Section 5.9.3.4 describes the preoperational and operational radiological environmental monitoring programs. Neither wildlife sampling nor testing of terrestrial game animals was included in either program. Fish sampling was included in both programs and continues to be conducted as part of the current annual radiological environmental monitoring program. Results of the fish sampling program as reported in the Byron Station Annual Radiological Environmental Operating Reports for 2006 through 2012 are summarized in the table below. Fish samples were collected at two locations (BY-29 and BY-31) semiannually. Location BY-29 (control) is located approximately 3 miles north from the Byron site and upstream from the river discharge. Location BY-31, which could be affected by Byron Station's effluent releases, is located approximately 2.2 miles west-north-west from the Byron site and at the river discharge. Gamma Spectrometry Analysis was performed on the edible portion of fish samples from both locations.

Year	Species in Samples	Results of Gamma Spectrometry Analysis
2006	smallmouth bass, channel catfish, freshwater drum, golden redhorse, river carpsucker	The edible portion of fish samples from both locations was analyzed for gamma emitting nuclides. No nuclides were detected, and all required LLDs were met.
2007	smallmouth bass, channel catfish, river carpsucker, freshwater drum, silver redhorse	The edible portion of fish samples from both locations was analyzed for gamma emitting nuclides. No nuclides were detected, and all required LLDs were met.
2008	Smallmouth bass, channel catfish, river carpsucker, common carp	The edible portion of fish samples from both locations was analyzed for gamma emitting nuclides. No nuclides were detected, and all required LLDs were met.

Year	Species in Samples	Results of Gamma Spectrometry Analysis
2009	common carp, freshwater drum, river carpsucker, shorthead redhorse	The edible portion of fish samples from both locations was analyzed for gamma emitting nuclides. No nuclides were detected, and all required LLDs were met.
2010	channel catfish, freshwater drum, golden redhorse, quillback, shorthead redhorse, common carp	The edible portion of fish samples from both locations was analyzed for gamma emitting nuclides. No nuclides were detected, and all required LLDs were met.
2011	golden redhorse, quillback, river carpsucker, smallmouth bass, common carp	The edible portion of fish samples from both locations was analyzed for gamma emitting nuclides. No nuclides were detected, and all required LLDs were met.
2012	shorthead redhorse, quillback, freshwater drum, common carp	The edible portion of fish samples from both locations was analyzed for gamma emitting nuclides. No nuclides were detected, and all required LLDs were met.

List Attachments Provided:

None

Byron Environmental Audit – Request for Additional Information Response

Question #: EJ-2 **Category:** Environmental Justice

Statement of Question:

Provide copies of any interviews or reports related to investigation of subsistence consumption near Byron conducted by Exelon.

Response:

The requested information is provided.

List Attachments Provided:

1. Compilation of Telephone Logs Investigating Potential Existence of Subsistence-Like Populations In Ogle County, Illinois, July 18, 2013

Compilation of Telephone Logs

Investigating Potential Existence of Subsistence-Like Populations

in Ogle County, Illinois

July 18, 2013

Tetra Tech, Inc., Aiken, South Carolina called selected government agencies and private social welfare organizations to determine if there is positive or anecdotal evidence of populations exhibiting subsistence-like living. No such populations were identified by those called.

Those called were:

- Ogle County office of Illinois State University Extension
- Ogle County office of Illinois Department of Human Services
- Ogle County Health Department (both environmental and medical departments)
- Ogle County Office of United Way

TELEPHONE LOG

Date/Time: 12 July 2013 10:15 am

Topic: subsistence living in Ogle County, Illinois

Involved Parties (name, company or agency, title, phone number):

Tetra Tech: Steve Connor, Tetra Tech, environmental justice analyst, 803 641-4939

Vicky Broos, County Director for Illinois State University Extension, 815 732-2191

Summary of Conversation:

Ms. Broos states that Rochelle has a concentration of minorities and also perhaps Mt. Morris, but she was not able to be more specific about the communities.

She is not aware of any subsistence living activities in Ogle County.

Follow-up:

Tetra Tech Representative Signature: S J Connor

Byron Station License Renewal Environmental Report
Project 112C03617

TELEPHONE LOG

Date/Time: 15 July 2013 1030

Topic: subsistence living in Ogle County, Illinois

Involved Parties (name, company or agency, title, phone number):

Tetra Tech: Steve Connor, Tetra Tech, environmental justice analyst, 803 641-4939

Illinois Department of Human Services (Ogle County Office): Cindy (last name lost), 815 723-2166 x223

Summary of Conversation:

Cindy responded that their function is to hand out food stamps so that people do not need to engage in subsistence living. Therefore, she has no knowledge of subsistence living patterns in Ogle County.

Follow-up:

Tetra Tech Representative Signature: S J Connor

TELEPHONE LOG

Date/Time: 16 July 2013 11:45

Topic: subsistence living in Ogle County, Illinois

Involved Parties *(name, company or agency, title, phone number)*:
Tetra Tech: Steve Connor, Tetra Tech, environmental justice analyst, 803 641-4939

Ogle County Health Department, Cindy Gehrke, Administrative Assistant, 815 732-7330, ext 282

Summary of Conversation:

Not aware of subsistence populations but states there are low-income people living in tents in county parks.

Follow-up:

Paul, ext 363 Environmental Department, will call back with his viewpoint.

Tetra Tech Representative Signature: S J Connor

TELEPHONE LOG

Date/Time: July 17, 2013 11:15

Topic: subsistence living in Ogle County, Illinois

Involved Parties (name, company or agency, title, phone number):

Tetra Tech: Steve Connor, Tetra Tech, environmental justice analyst, 803 641-4939

Ogle County Health Department, Linda Johnson, Administrative Assistant, 815 732-7330, ext 279

Summary of Conversation:

Ms. Johnson is aware of one family but not any subpopulation engaged in subsistence living.

Follow-up:

Will give more consideration and email any new information

Tetra Tech Representative Signature: S J Connor

Byron Station License Renewal Environmental Report
Project 112C03617

TELEPHONE LOG

Date/Time: 16 July 2013 1045

Topic: subsistence living in Ogle County, Illinois

Involved Parties (name, company or agency, title, phone number):
Tetra Tech: Steve Connor, Tetra Tech, environmental justice analyst, 803 641-4939

Jennie Beckman, Ogle County Director for United Way, 815 986-4812

Summary of Conversation:

Ms. Beckman requested time to consider the question on subsistence living and to check some sources. She called back later in the day and left a voicemail which stated that although many people in the county hunt and fish for recreation and food, she believes there are very few with a subsistence living lifestyle.

Follow-up:

Tetra Tech Representative Signature: S J Connor