SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2

1985
ANNUAL ENVIRONMENTAL OPERATING REPORT (NONRADIOLOGICAL)

FACILITY OPERATING LICENSE NOS. NPF-14 & NPF-22
DOCKET NOS. 50-387 & 50-388

prepared by
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ANNUAL ENVIRONMENTAL OPERATING REPORT

1985

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FOREWORD

The Susquehanna Steam Electric Station (Susquehanna SES) consists of two boiling water reactors, each with a net electrical generating capacity of 1,050 megawatts. The site is approximately 1,325 acres and is located in Salem Township, Luzerne County, Pennsylvania approximately five miles northeast of Berwick, Pennsylvania. Under terms of an agreement finalized in January 1978, 90% of the Susquehanna SES is owned by the Pennsylvania Power and Light Company (Licensee) and 10% by Allegheny Electric Cooperative, Inc.

The 1985 Annual Environmental Operating Report (Nonradiological) for Units 1 and 2 describes the programs necessary to meet requirements of Section 2F of the Operating License, Protection of the Environment, and Appendix B, Environmental Protection Plan, as well as commitments in the Final Environmental Statement related to operation (NUREG-0564), June 1981. Also, the Operating License, Appendix A, Technical Specifications requires an Annual Radiological Environmental Operating Report which is issued separately from this report.

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Senior Environmental Scientist-Nuclear

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1985

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1.0 OBJECTIVES

The Licensee submitted an Environmental Report--Operating License Stage for the Susquehanna SES to the U.S. Nuclear Regulatory Commission (NRC) in May, 1978. This report reviewed the results of the preoperational impacts of construction and described the preoperational and proposed operational environmental monitoring programs. The NRC and other agencies reviewed this report and made recommendations for operational environmental monitoring programs which were listed in the Final Environmental Statement (FES) related to the operation of the Susquehanna SES, Units 1 and 2, NUREG-0564, June 1981. In addition, the Licensee has developed procedures and guidelines to assure that operation of the Susquehanna SES does not adversely affect the environment in the vicinity of the station.

The Licensee has developed procedures for environmental responsibilities and interfaces necessary in monitoring environmental impacts. This includes coordination of NRC requirements and consistency with other federal, state, and local requirements for environmental protection. To keep the NRC informed of other agency activities, the NRC is being provided copies of environmental correspondence. In addition, this 1985 Annual Environmental Operating Report provides a summary of both operational environmental programs and procedures as required in the FES and Appendix B, Environmental Protection Plans (EPP) of the Operating License, No. NPF-14 (Ref. 1.1-1) and No. NPF-22 (Ref. 1.1-2).

This 1985 report is the fourth Annual Environmental Operating Report submitted to meet EPP requirements. The 1984 report was submitted to the NRC in April 1985 (Ref. 1.1-3).

REFERENCES

1.1-1 Facility Operating License No. NPF-14, Susquehanna Steam Electric Station, Unit 1, Appendix B, Environmental Protection Plan (Non-Radiological), July 17, 1982.

1.1-2 Facility Operating License No. NPF-22, Susquehanna Steam Electric Station, Unit 2, Appendix B, Environmental Protection Plan (Non-Radiological), March 23, 1984.

1.1-3 Susquehanna Steam Electric Station, Unit 1 and 2, 1984 Annual Environmental Operating Report (Nonradiological), Pennsylvania Power and Light Company, Allentown, Pennsylvania, April 1985.

2.0 ENVIRONMENTAL ISSUES

2.1 AQUATIC ISSUES

The aquatic monitoring program for the operation of the Susquehanna SES is divided into two phases. Phase 1 includes effluent monitoring required by a National Pollutant Discharge Elimination System (NPDES) permit issued by the Pennsylvania Department of Environmental Resources (Pa. DER). Monthly discharge monitoring reports are submitted to the Pa. DER as part of the permitting requirements. The station operational NPDES permit No. PA-0047325 was reissued January 22, 1985 and is valid for a period of five years. The permit incorporates effluent monitoring requirements for the sewage treatment plant which were previously regulated under NPDES permit No. PA-0027448. Phase 2 of the aquatic monitoring program deals with programs listed in the FES involving aquatic environmental biological monitoring.

The Pa. DER in Phase 1, is responsible for regulating the water quality permit for the Susquehanna SES. The NPDES permit No. PA-0047325 deals with discharge parameters for the Susquehanna SES sewage treatment plant, the cooling tower blowdown including in plant process streams, and also various sumps and drains that discharge through storm sewers into Lake Took-a-while, and eventually the Susquehanna River. The parameters included in the sewage treatment plant effluent limits are as follows:

Flow
pH
Total Suspended Solids (TSS)
Biochemical oxygen demand (BOD-5)
Percentage removal of TSS
Percentage removal of BOD-5
Chlorine residual
Fecal coliforms

In-plant process effluents combine with the cooling tower flows before being released to the Susquehanna River. These process effluents are monitored for flow, TSS, and the oil and grease component. Parameters monitored on the combined cooling tower blowdown to the Susquehanna River are:

Flow
pH
Chlorine residual
Chromium
Iron
Zinc

The parameters monitored on the various sumps and drains that discharge to storm sewers leading to Lake Took-a-while are:

Flow
pH
TSS
Oil and grease

Phase 2 of aquatic monitoring programs committed to by the Licensee in Appendix B of the Operating License and FES for the Susquehanna SES includes monitoring algae and benthic macroinvertebrates, both above the intake and below the discharge. This information is summarized in Section 4.2.5 of this report. An impingement study for American shad was undertaken in 1985, as in previous years in response to a request by the U.S. Fish and Wildlife Service Commission. This study meets commitments in Section 5.3.4, Aquatic Monitoring, of the FES (Ref. 2.1-1). The Susquehanna River Anadromous Fish Restoration Committee, of which the Licensee is a member, reintroduced American shad and blueback herring to the Susquehanna River during 1985.

Approximately 3100 prespawned adult American shad were collected from the Hudson and Connecticut Rivers during May, 1985 and transported to the upper Susquehanna River (Ref. 2.1-2). Also, approximately 2000 blueback herring were transferred from the Hudson River to the upper Susquehanna River in late May, 1985. Between 6 September and 11 October the Licensee's biological consultant, Ecology III, Inc., monitored fish impingement on the station intake screens. No juvenile shad or herring were collected on the screens during 1985 (Exhibit 1). This consultant is located at the Susquehanna SES Biological Laboratory.

2.2 TERRESTRIAL ISSUES

2.2.1 MONITORING BIRD IMPACTION ON COOLING TOWERS

Consultant biologists conducted systematic searches at the Susquehanna SES for impacted birds at the Unit 1 and 2 cooling towers in 1985 during spring and autumn migrations. Twenty-two birds of 13 species were collected; five birds were found in the spring and 17 in the autumn. All impacted birds were small passerines known to be nocturnal migrants. Typically, spring impactions were associated with the passage of warm fronts and autumn impactions with the passage of cold fronts. All impactions occurred when at least one of the cooling towers was operational. Fewer impacted birds were collected in 1985 than in any previous year except 1984, but it is uncertain if this was due to operation of the cooling towers or other factors.

2.2.2 OPERATIONAL SOUND LEVEL SURVEY

An environmental sound survey was conducted during September, 1985, and October, 1985 by Bolt, Beranek and Newman. Both daytime and nighttime measurements were taken in the vicinity of the Susquehanna SES. Exhibit 2, Sound Level Measurements Near Susquehanna SES Site 1985, discusses the program and gives results. In addition, Section 4.2.3, Sound Level Survey, lists sound survey parameters.

2.2.3 MAINTENANCE OF TRANSMISSION LINE CORRIDORS

The maintenance program for transmission line corridors for the Susquehanna SES is discussed in detail in Subsection 4.2.2 of this report. During 1985, there was maintenance of transmission line corridors by the use of herbicides and by manual clearing. The terrestrial monitoring program for the Susquehanna transmission lines was initiated in response to commitments in Section 5.3.5 of the FES. The three transmission lines associated with the Susquehanna SES are the Stanton-Susquehanna No. 2-500 kV Line, Sunbury-Susquehanna No. 2-500 kV Line and the Susquehanna-Wescosville 500 kV Line. Originally, the Susquehanna-Wescosville 500 kV Line was called the Susquehanna-Siegfried Line. These lines may be operated at either 230 kV or 500 kV.

After their construction, areas around the transmission structures and along access roads were seeded and regraded to prevent soil erosion. The schedule for conducting periodic erosion control inspections of these lines and access roads is based on the age of the line. During the first five years, helicopter patrols will be conducted three times a year. Thereafter, foot-patrols will be conducted every two years and overhead patrols conducted every five years. The dates of patrols and the information collected are logged and recorded by the Licensee, which is responsible for this activity. An audit of the transmission lines in 1984 indicated that there was some erosion along the Stanton-Susquehanna No. 2-500 kV line at a former generating station ash basin. This area was stabilized in 1985.

2.3 CULTURAL RESOURCES ISSUES

In accordance with Title 36, Code of Federal Regulations, Part 800, Protection of Historic and Cultural Properties, the Licensee has taken efforts to mitigate any impacts from either plant construction or operation to sites eligible for inclusion to the National Register of Historic Places. Section 4.2.4, Cultural Resources, addresses this issue.

REFERENCES

2.1-1 Final Environmental Statement related to the operation of Susquehanna Steam Electric Station, Units 1 and 2, Docket Nos. 50-387 and 50-388, Pennsylvania Power and Light Co. and Allegheny Electric Cooperative, Inc., U.S. Nuclear Regulatory Commission, June, 1981.

2.1-2 Restoration of American Shad to the Susquehanna River, Annual Progress Report - 1985, Susquehanna River Anadromous Fish Restoration Committee, January, 1986.

3.0 CONSISTENCY REQUIREMENTS

3.1 PLANT DESIGN AND OPERATION

In accordance with the EPP, the Licensee has prepared and recorded an environmental evaluation of any proposed change in plant design or operation or performance of any test or experiment which may significantly affect the environment. Activities which concern (1) a significant increase in any adverse environmental impact previously evaluated by the NRC or Atomic Safety & Licensing Board, (2) a significant change in effluents or power level or (3) a matter not previously evaluated which may have a significant adverse environmental impact, shall be deemed to involve an unreviewed environmental question. For such activities, the Licensee shall provide a written evaluation of the activity and obtain prior approval from the Director, Office of Nuclear Reactor Regulation.

The Licensee has developed a Nuclear Department Instruction procedure to evaluate unreviewed environmental questions. If it is determined that a particular action will meet any of the three NRC criteria for an unreviewed environmental question, the NRC will be notified. If the change, test or experiment does not meet any of these criteria, the Licensee will provide an environmental approval to the group requesting the action.

During the operation of the Susquehanna SES in 1985, there were four actions that the Licensee reviewed as part of its unreviewed environmental questions program. These four actions were as follows:

1. Installation of 4 wells on the flood plain at the River Intake Structure.

2. Chemical treatment of Emergency Spray Pond.

3. Use of dispersants and corrosion inhibitors in the circulating water system.

4. Placing fill in a farm pond on recently purchased property.

None of these activities were determined to be unreviewed environmental questions since there was not a significant environmental impact associated with any of them.

Records of environmental evaluations are maintained by the Licensee in the Susquehanna Records Management System. These records include brief descriptions, analyses, interpretations, and evaluations of the changes, tests and experiments.

3.2 REPORTING RELATED TO NPDES PERMITS & STATE CERTIFICATIONS

Violations of NPDES Permits have been reported to the NRC by submittal of copies of reports required by the NPDES Permits. It should be noted that Pennsylvania is a NPDES Permitting Agreement State with the U.S. Environmental Protection Agency, and State Certification pursuant to Section 401 of the Clean Water Act is not required. Copies of all changes or renewals to the operational NPDES Permit No. PA-0047325 have been submitted to the NRC within the required 30-day period.

3.3 CHANGES REQUIRED FOR COMPLIANCE WITH OTHER ENVIRONMENTAL REGULATIONS

During 1985, there were several activities which involved changes in plant design and operation which required some upgrading of old Pa. DER permits and applications for new ones.

The sewage treatment plant was modified to provide additional treatment capacity. Capacity was increased from 45,000 to 80,000 gallons per day. This modification was included in the new NPDES permit.

- NPDES Permit - Permit No. PA-0047325, Susquehanna SES, issued January 22, 1985, expires January 21, 1990.

Construction of the fifth diesel generator has taken longer then expected and therefore, an extension of the plan approval (Construction Permit) was necessary.

- Plan Approval - Permit No. 40-306-004, Stand-By Diesel Generators, issued December 30, 1985, expires March 31, 1987.

Preliminary plans to construct a cement storage silo adjacent to the Radwaste Building required approval to construct and/or operate an air contamination source. This project was cancelled in January 1986 and the permit is currently inactive.

- Plan Approval - Permit No. 40-311-014, Cement Silo,issued, September 6, 1985 expires March 30, 1986.

Two solid waste disposal sites were permitted in 1985. A permit application for a third site for a solid waste disposal facility at Susquehanna SES (Site No. 1) was withdrawn in September 1985 because the site was no longer needed.

- Solid Waste Disposal and/or Disposal Facility - Permit No. 101352, Susquehanna SES, Site No. 2, issued July 15, 1985.

- Solid Waste Disposal and/or Disposal Facility - Permit No. 101363, Susquehanna SES, Site No. 3 issued April 15, 1985.

4.0 ENVIRONMENTAL CONDITIONS

4.1 UNUSUAL OR IMPORTANT ENVIRONMENTAL EVENTS

During 1985, there were no unusual or important events that resulted in significant environmental impacts from Susquehanna SES operation.

4.2 ENVIRONMENTAL MONITORING

4.2.1 GENERAL MONITORING FOR BIRD IMPACTION

Preoperational studies of bird impaction were conducted during spring and autumn migrations at the Unit 1 cooling tower since autumn 1978 and at the Unit 2 cooling tower since spring 1981. These studies (Refs. 4.2-1 through 4.2-5) provided data on bird mortality during tower construction. Operational studies were begun in the autumn of 1982 and continued through 1985 (Refs. 4.2-5 through 4.2-7). The basic objective of the operational studies is to monitor and to evaluate bird impaction mortality during operation of the cooling towers.

Collections of impacted birds were made at the Unit 1 and 2 cooling towers during 1985 spring and autumn migrations. Each hyperbolic natural draft tower is 165 m tall with diameters at the base, throat, and top of 128 m, 86 m, and 92 m, respectively. Both towers are illuminated with five, 480-volt aircraft warning strobe lights on the top and seven, 480-volt high-intensity mercury vapor lamps around the lintel, about 12 m above ground level. The strobe lights were installed immediately upon completion of each tower. The towers are about 100 m apart and aligned south to north with Unit 1 the more northerly (Fig. 4.2-1). They are located approximately 1,400 m west of the Susquehanna River and 650 m south of a ridge which extends east and west along the site boundary. The top of the Unit 1 tower is 381 m above mean sea level, 6 m higher than the Unit 2 tower (375 m). Within 1 km of the towers, ground elevations vary from 160 m above mean sea level near the river to 326 m on the ridge. Both towers exceed the highest point on the ridge by at least 49 m. Systematic searches for impacted birds were usually begun prior to 0900 h on weekdays, excluding holidays, from 18 March through 7 June and from 19 August through 8 November. Each search included the tower base, cold water outlet, basin interior, and an area extending at least 10 m out from the base. Impacted birds were tagged to record date and point of discovery. Floating specimens were collected with a dip net and those impinged on the trash screens were removed with a rake. Birds were usually identified in the laboratory with the aid of keys detailed in Reference 4.2-6. Bird nomenclature follows the American Ornithologists' Union Checklist (Ref. 4.2-8). Impacted species were checked against the federal List of Endangered and Threatened Wildlife and Plants (Ref. 4.2-9) and the Pennsylvania Species of Special Concern (Ref. 4.2-10).

An attempt was made to collect all impacted birds during each search; however, some specimens recovered from the turbid water in the cooling tower basins were impacted one or more days before collection. All data were, therefore, tabulated in 5-day groups to reduce day-to-day carryover of impacted birds.

Weather conditions were noted daily at the Susquehanna SES site. These notes were augmented with data recorded at the Biological Laboratory, at the Susquehanna SES Meteorological Tower, and at Avoca, Pennsylvania by the National Oceanic and Atmospheric Administration (Ref. 4.2-11). Barometric pressure was monitored constantly at the Susquehanna SES Biological Laboratory with a Taylor Weather-Hawk Stormscope Barometer adjusted to equivalent sea level pressure.

In 1985, 22 birds of 13 species were collected during systematic searches for impacted birds at Unit 1 and 2 cooling towers of the Susquehanna SES. Since 1 September 1978, 1,453 birds of at least 65 species (Table 4.2-1) have been collected at the towers. During spring migration in 1985, five birds of five species were collected from 18 March through 7 June (Table 4.2-2); two specimens were found at the Unit 1 tower and three specimens at the Unit 2 tower. During autumn migration, 17 birds of at least 11 species were collected from 19 August through 8 November (Table 4.2-3); 13 specimens were found at the Unit 1 tower and four specimens at the Unit 2 tower. In addition to these birds, four bats were collected: two red bats (Lasiurus borealis) and two little brown bats (Myotis lucifugus) were found at the Unit 2 tower in the autumn (Ref. 4.2-12 and 4.2-13).

All bird species were small passerines known to be nocturnal migrants (Ref. 4.2-14). Most of these birds migrate long distances to and from wintering grounds in the American tropics. The two most commonly collected species were the common yellowthroat (5) and the red-eyed vireo (4). Together they composed 41% of the birds collected. A bobolink, a Pennsylvania species of concern - status undetermined (Ref. 4.2-10), was found on September 9, 1985, at the base of the Unit 1 cooling tower. No federally listed threatened or endangered species were collected in 1985, nor have any been found since the study began in 1978.

The total number of spring impactions was less in 1985 than in any previous year (Fig. 4.2-2). No more than one bird was collected on any morning and no more than one specimen was found of any species. Most spring impactions were associated with warm fronts entering Pennsylvania from the west or south. In spring, the northern movement of birds often follows a warm front when warm moist air flows from the Gulf of Mexico and the Caribbean accompanied by a falling barometer (Ref. 4.2-15). All spring impactions occurred during a scheduled outage at Unit 1 when only the Unit 2 tower was creating a visible plume.

Fewer birds impacted on the cooling towers in the autumn of 1985 than in any previous year, except 1984 (Fig. 4.2-2). No more than five specimens were collected on any of the ten days birds were found. This contrasts markedly with the large daily collections of 79 and 81 birds made in 1981 (Ref. 4.2-4) or 26 and 34 birds in 1982 (Ref. 4.2-5). But similar to past years, most autumn impactions were associated with the passage of cold fronts moving

through Pennsylvania from the northwest. South-bound migration is heaviest in this region during cold front movement (Ref. 4.2-15). Also, 9 out of the 17 impactions apparently occurred during periods of fog. All autumn impactions occurred when both towers were functional.

The low numbers of bird impactions in the autumns of 1983, 1984, and 1985 occurred when at least one of the towers was operating throughout most of the migration season. At least three factors associated with operation may warn approaching birds of the towers: 1) visible plume, 2) air turbulence, and 3) noise. The plume can be several hundred meters in length and is well-illuminated by aircraft warning lights which make it visible for long distances, especially at the high altitudes where migrant birds usually fly. Wind currents and the resulting air turbulence caused by the operation of a natural draft tower probably make flight difficult for lightweight birds and may discourage them from flying too close. Generally, noise levels near an operating medium or large cooling tower range from 80 to 90 dBA and are caused principally by the resonance of air drafts and waterfalls in the tower (Ref. 4.2-16). This broad-band low-frequency noise is within the hearing range of most birds (Ref. 4.2-14) and may alert them to the presence of the towers. During the planned outage of Unit 1, northbound migrants may have been warned by the operation of the Unit 2 cooling tower which is the more southerly obstruction in their northerly migration path.

The cooling tower lights may attract night-flying birds to the towers, but apparently not from great distances. Night-flying birds are sometimes attracted to, then blinded by, bright lights, accounting for impactions on tall buildings (Ref. 4.2-15). When cloud ceiling is low or visibility poor, birds tend to fly at low altitudes and can be confused by tower lights (Ref. 4.2-17). However, it seems that the direction of movement by nocturnally migrant birds flying at higher altitudes is not overtly affected by nuclear power plant lights and the birds are not drawn to operating towers from great distances (Ref. 4.2-18).

Although at this point it might be concluded that operation of the cooling towers deters bird impaction, the number of impactions recorded during the preoperational phase showed high variability and operational phase data may eventually demonstrate a similar pattern. Furthermore, this variability may be caused by factors not associated with tower operation. For example, fewer bird impactions may have occurred in the autumns from 1983 to 1985 because of the lack of strong cold fronts normally associated with waves of nocturnal migrants.

4.2.2 MAINTENANCE OF TRANSMISSION LINE CORRIDORS

4.2.2.1 HERBICIDES USED

All herbicides utilized to control incompatible vegetation within the transmission line corridors from Susquehanna SES conform to approved uses as registered by the U. S. Environmental Protection Agency. In addition, major manufacturers or formulators all have had these products registered for distribution by the Commonwealth of Pennsylvania under the authority of the Pennsylvania Pesticide Control Act of 1973.

The following lists the approved herbicides specified for use in the Licensee's programs. All are applied within the instructions designated on the label.

Commercial Name	Active Ingredients	EPA Registration Number
Krenite	Fosamine	352-376
Krenite S	Fosamine	352-395
Tordon 101	2,4-D, Picloram	464-306
Tordon RTU	2,4-D, Picloram	464-510
Garlon 3A	Triclopyr	464-546
Garlon 4	Triclopyr	464-554
Roundup	Glyphosate	524-308-AA

Additional herbicides may be added to this list in the future depending on new technology and/or other advancements in the state of the art. All herbicides will have an approved EPA registration number.

4.2.2.2 RECORDS

Records are maintained for a period of at least 5 years in the appropriate Division Offices of the Licensee. These include the following:

1. Copies of labels of specified herbicides which designate commercial names, active ingredients, rates of application, warnings, storage and handling.

2. Concentrations of active ingredient formulations diluted for field use.

3. Diluting substances (carriers).

4. Rates of application.

5. Methods of application.

6. Locations and dates of application.

4.2.2.3 TYPES OF MAINTENANCE REPORTED

A. Selective Herbicide Applications

Maintenance of Transmission Line Corridors Selective Herbicide Application, Table 4.2-4, Sheets 1 through 6 summarizes the application for vegetation control for each of the transmission corridors affected. This includes the individual herbicides specified, the active ingredient, its acid equivalent, the specified amount of concentrate in a designated carrier, and additives used to decrease drift and act as wetting agents.

Application data for each of the lines is presented by the number of acres on which herbicides were applied, the total amount of solution used, rate of application in gallons per acre, total amount of concentrate used, average gallons of concentrate applied per acre, the total pounds of acid equivalent and the average pounds per acre applied. Dates and locations, by structure number, of the applications are designated along with the title of the responsible Division Manager, his or her phone number and mailing address.

Two exhibits in the 1982 Annual Environmental Operating Report provide the herbicide application procedures. Exhibit 3 discusses the Licensee's Procedures for Herbicide Use on Transmission Right-of-Way, while Exhibit 4 lists the Procedure for Obtaining Herbicide Samples from Contractors for Laboratory Analyses (Ref. 4.2-19).

B. Vegetation Maintenance by Manual Methods

Maintenance of Transmission Line Corridors, Table 4.2-5, Sheets 1 through 13, summarizes vegetation maintenance activities other than the utilization of herbicides. The six types of manual methods used in 1985 are as follows:

1. Selective Reclearing - utilized to manually cut incompatible vegetation where herbicide applications are restricted.

2. Danger Tree Removals - cutting those trees outside of the cleared right-of-way which are of such a height and position that they create a potentially hazardous condition which could interrupt the line.

3. Side-Trimming - trimming of trees on the edge of the right-of-way which through yearly growth encroach on the line conductors.

4. Screen Trimming - trimming of trees left intentionally on the right-of-way for aesthetic purposes or otherwise to maintain safe clearances to the line conductors.

5. Side Widening - areas selectively cut to the full extent of the original right-of-way easement purchased. This was done to enhance the safety and/or integrity of the line by creating a wider corridor than that which was originally cleared.

Screen Removal - screens which in the judgement of those persons responsible, were threatening the safety and/or integrity of the line and had to be selectively cleared.

4.2.3 SOUND LEVEL SURVEY

An environmental sound survey was conducted in September and October 1985. Sound Level Measurements Near Susquehanna SES Site 1985, an operation noise progress report, Exhibit 2 of this report was prepared by Bolt, Beranek and Newman. It includes the following information:

1. Existing on-site and nearby off-site sources and barriers,
2. Noise sensitive land uses in site vicinity,
3. Daytime and nighttime measurements,
4. Equipment selection and dates of calibration,
5. Background and intrusion sound levels measured,
6. Description of pure tones included in this 1985 survey.

Based upon two unit operation acoustic measurements and lack of community complaints it has been determined by sound experts that the noise level produced at the Susquehanna SES does not cause an adverse impact to the environs in the vicinity of the station. Also, previous annual environmental operating reports for 1982, 1983 and 1984 submitted to the U.S. Nuclear Regulatory Commission contained sound level data for one unit operation and construction of the second unit. In all cases the impacts were not considered adverse. Therefore, in accordance with EPP Section 4.2.3, Sound Level Surveys, the Licensee is terminating this program with submission of Exhibit 2 of this report as the final sound level survey.

4.2.4 CULTURAL RESOURCES

The effect determination of the four historic sites located on Susquehanna SES floodplain (Site SES-3. Site SES-6, Site SES-8 and Site SES-11) has been determined to have the status of "no adverse effect" by the Pennsylvania Bureau for Historic Preservation. Exhibit 3, of this report discusses this effect determination.

4.2.5 AQUATIC PROGRAMS

4.2.5.1 ALGAE

The basic objective in 1985 was to evaluate effects of the Susquehanna SES on periphyton and phytoplankton communities in the Susquehanna River (Fig. 4.2-1). A control sampling site (SSES) was located 460 m upriver from the Susquehanna SES intake structure and 135 m from the west bank. The indicator site (Bell Bend) was located 400 m downriver from the discharge diffuser and 30 m from the west bank.

Periphyton substrates consisted of eight sandblasted plates of clear acrylic (22 x 30 cm) in "detritus-free" holders similar to those of Gale et al. (Ref. 4.2-20). Two holders with four plates each were placed on the river bottom at each site near the main channel, where depths ranged at SSES in 1985 from 1.9 to 5.2 m. From April through October 1985, two plates were sampled bimonthly at each site. Each plate was exposed to colonization for 12 months. Three replicate samples were taken from each plate by a scuba diver using a bar-clamp sampler (Ref. 4.2-21). Sampled plates were replaced with clean plates to be sampled later. The schedule for plate removal was continuation of a plan established in 1977 by random selection.

The 415 mm^2 area of the plate delimited by each bar-clamp sampler was cleaned by scraping and vibration (Ref. 4.2-21) with an ultrasonic dental cleaning probe for 10 minutes. Dislodged cells were carried to a collection jar by water sprayed inside the collecting cup through the cleaning probe. As a result, loosened cells were not subjected to unnecessary vibration. Vibration may have destroyed some cells, but Gale (Ref. 4.2-21) reported that more cells per unit area were obtained by scraping and vibration than by scraping and brushing. Samples (250 ml) were preserved with formalin and, after settling ten days, were concentrated to 50 ml by siphoning. One half of the concentrate was sent to Dr. Rex L. Lowe, Department of Biology, Bowling Green State University, Bowling Green, Ohio, for identification and enumeration of algae. The other half of the concentrate was placed in the licensee reference collection to be retained for at least 12 months.

A 1-liter phytoplankton sample was collected near the river surface at each periphyton sampling site on the same days that periphyton samples were collected. After the samples were preserved and allowed to settle for ten days, the algae in them was concentrated in a similar manner to that used for periphyton samples. The main difference in procedures was that phytoplankton samples, because of their greater initial volume, were siphoned three times instead of once (ten days settling time was allowed between each siphoning).

Algal cells in periphyton and phytoplankton samples that contained chloroplasts were enumerated as "units" (Ref. 4.2-22). In most instances, at least 1,500 units were enumerated and identified in each sample (about 500 per each of 3 subsamples). Extremely low algal densities in some subsamples made it impractical to count 500 units and fewer were counted. Counts were made using a microscope (430X) and a Palmer counting cell. Higher magnification, including electron microscopy, was used for some identifications. Algae were identified by Dr. Lowe to genus and the more abundant forms to species using keys by Hustedt (Ref. 4.2-23) and Prescott (Ref. 4.2-24).

In 1985, a total of 45 genera of algae was collected in 24 samples from acrylic plates upstream from the intake (SSES); 46 genera were found in 24 samples taken downstream from the discharge (Bell Bend). Thirty-eight of the genera were found at both sites. None of the 15 genera that occurred at only one site composed more than 1% of the total units counted in any replicate. These data are summarized in Tables 4.2-6 and 4.2-7.

At SSES and Bell Bend, 19 species of periphytic algae were identified that composed 5% or more of the total units counted in at least one replicate sample (Table 4.2-8). For the fourth consecutive year, green algae (Chlorophyta) were less abundant than in 1981 (Fig. 4.2-3), but they were relatively more abundant in 1985 (20% of the total standing crop) than in 1984, when Chlorophyta composed 14% of the total. The mean standing crop of green algae decreased from 1,400 units/mm^2 in 1981 to 600 units/mm^2 in 1982 and remained at the same level in 1983. In 1984, there were only 100 units/mm^2; in 1985, there were 300 units/mm^2. The most abundant species of green algae were Scenedesmus spp. (mostly S. falcatus and S. quadricauda) which composed 10% of the total standing crop at the two sites combined (Tables 4.2-6 and 4.2-7).

The mean standing crop of diatoms (Bacillariophyta) fluctuated again in 1985 as it has throughout the study. In 1981, for example, the standing crop was 800 units/mm^2; it increased slightly to 900 units/mm^2 in 1982 and then decreased to 500 units/mm^2 in 1983. In 1984, diatom density increased to 600 units/mm^2; in 1985, it more than doubled with 1,300 units/mm^2. Diatoms were relatively more abundant at Bell Bend in 1985 (86% of the total) than at SSES (69% of the total). Overall, diatoms composed 79% of the total periphyton at the two sites. In 1981, diatoms composed 37% of the total algae collected (Ref. 4.2-25), and in 1982, they composed 58% (Ref. 4.2-26). Diatoms composed 42% of the algae collected in 1983 (Ref. 4.2-27); in 1984, they composed 82% (Ref. 4.2-28). The most abundant forms included Cyclotella spp. and Navicula spp., which composed 45% and 10% of the total standing crop at the two sites combined, respectively (Tables 4.2-6 and 4.2-7). Cyclotella spp. were more abundant at Bell Bend (56%) than at SSES (28%). Navicula spp., on the other hand, were more abundant at SSES (12%) than at Bell Bend (8%).

Numbers of blue-green algae (Cyanophyta) decreased from 4% of the total standing crop in 1984 to 1% in 1985. In 1981 and 1982, blue-greens composed less than 1% of the total. Schizothrix calcicola was the most abundant species in 1985 (Table 4.2-8).

Most of the algae found were "clean water" forms and only six of the 19 abundant species in the samples were among the top 20 species listed by Palmer (Ref. 4.2-29) as being most tolerant of heavy organic pollution. These were Nitzschia palea, Scenedesmus quadricauda, Ankistrodesmus falcatus, Melosira varians, Cyclotella menghiniana, and Navicula cryptocephala. Most of the 14 species of abundant diatoms (Table 4.2-8) were rated as "alkaliphilous" by Lowe (Ref. 4.2-30); four were rated "indifferent" and three were "unknown."

In 1982, periphyton abundance on acrylic plates was about equal at Bell Bend and SSES, with an average of 1,500 units/mm^2. In 1983, much more periphyton occurred at Bell Bend (1,700 units/mm^2) than at SSES (600 units/mm^2). In 1984, periphyton density was higher at SSES (1,000 units/mm^2) than at Bell Bend (600 units/mm^2). In 1985, periphyton density was higher at Bell Bend (2,000 units/mm^2) than at SSES (1,300 units/mm^2). Density peaked at both sites in August at 4,100 units/mm^2. Such differences are not unusual and have occurred at other times since the study began (Fig. 4.2-3).

Overall, the mean density of periphyton at SSES and Bell Bend in 1985 (1,600 units/mm^2) increased from the 800 units/mm^2 found in 1984 (Fig. 4.2-3); the 1984 mean was the lowest recorded since the study began in 1977. The results of the 1985 sampling program do not indicate any adverse impact upon the periphyton community resulting from operation of the Susquehanna SES; the increase in abundance of periphyton at both sites was probably due to below normal river levels throughout much of 1985 (Ref. 4.2-31) and above normal river temperatures in the spring. In previous years (Ref. 4.2-32), it was observed that periods of high river discharge, prior to sampling, washed away much of the periphyton which had colonized soft, silty sediments on river stones.

Phytoplankton in samples collected at SSES in 1985 was nearly identical to that in samples taken at Bell Bend, as it has been in previous years (Fig. 4.2-4). There was a total of 43 genera of algae in four samples at SSES and 38 genera in four samples from Bell Bend (Tables 4.2-9 and 4.2-10). Thirty-four genera were found at both sites. None of the 13 genera that occurred at only one site composed more than 1% of the total units counted.

In 1985, as in 1984, green algae were the major component of the phytoplankton, composing 47% of the total standing crop. Scenedesmus spp. were the most abundant green algae at both sites in 1985 with a mean density of 1,300 units/ml (Tables 4.2-9 and 4.2-10). Scenedesmus composed about 12% of the total standing crop; S. bicaudatus and S. quadricauda were the most abundant species. Ankistrodesmus spp. were also abundant (10% of the total) with a mean density of 1,000 units/ml at Bell Bend and SSES; A. falcatus was the most abundant species.

Diatoms were slightly less abundant and composed 45% of the total standing crop at both sites. Cyclotella spp. were the main diatoms at both sites and composed about 28% of the total standing crop. C. meneghiniana and C. pseudostelligera were the most abundant species. Stephanodiscus invisitatus was also abundant and composed about 10% of the total standing crop at both sites (Tables 4.2-9 and 4.2-10).

In 1985, blue-green algae were more abundant at SSES and Bell Bend (8% of the total standing crop) than they were in 1984 (4% of the total). Only one species, Merimopedia tenissima, was abundant (Table 4.2-11).

Eleven species of phytoplankton composed 5% or more of the total units counted in at least one sample from the two sites (Table 4.2-11). Phytoplankton was more abundant in 1985 (11,000 units/ml) than in 1984 (3,500 units/ml).

Most of the phytoplankton found were "clean water" forms and only three of the abundant species (S. quadricauda, A. falcatus, and C. meneghiniana) were among the top 20 species listed by Palmer (Ref. 4.2-29) as being most tolerant of heavy organic pollution. Most of the species of abundant diatoms were rated as "alkaliphilous" by Lowe (Ref. 4.2-30); two were rated "indifferent," and one was rated "unknown."

The 1985 phytoplankton community mean (10,600 units/ml) was only about one-half as great as the previous high (25,700 units/ml in 1981), but was more than triple the standing crop in 1984 (3,500 units/ml). This increase could be attributed to below normal river levels throughout much of 1985 (Ref. 4.2-31) and above normal river temperatures in the spring. Clay and silt particles, usually associated with increased river level, can act as a "nucleus" which aggregates phytoplankton into such a large mass that it settles from the water column (Ref. 4.2-20).

The results of the 1985 sampling program do not indicate any adverse impact upon the phytoplankton community resulting from Susquehanna SES operation.

4.2.5.2 BENTHIC MACROINVERTEBRATES

Density and biomass of benthic macroinvertebrates in the Susquehanna River near the Susquehanna SES were monitored since 1972 and 1975, respectively, to establish a baseline of preoperational conditions (Refs. 4.2-33 through 4.2-42). Unit 1 of the Susquehanna SES became operational in September 1982. Data collected after that date were considered operational (Refs. 4.2-43 through 4.2-45). The objective of the operational studies was to determine if the power station had any impact on the macroinvertebrate community downriver from the discharge diffuser.

From 1978 through 1984, benthic macroinvertebrates were collected in April, June, and October at two stations (four sites) near the Susquehanna SES (Fig. 4.2-1; samples were not collected in April in 1983-84, because of high river level). Two sites (SSES I and II) are 850 m upriver from the intake structure, and two (Bell Bend I and III) are 710 m downriver from the discharge diffuser (Table 4.2-12). Sampling sites remained the same in 1985. On 16-17 April and 17-20 June, three samples were collected at each site; one was for biomass and two were for density estimates. On 6-7 August and 9-10 October, one sample was collected at each site for biomass estimates.

Samples were collected by a scuba diver, using a dome suction sampler (Ref. 4.2-46). After the sampler was lowered from a boat to the river substrate, a scuba diver moved it upriver to the first undisturbed area where an adequate seal between the sampler band and the substrate could be established. The diver then vacuumed the substrate inside the sampler (0.163 m^2) for five minutes with a screened intake nozzle leading to the sampler's pump. Sediments (silt, sand, and fine gravel) and organisms were pumped into a nylon net (216-micron mesh). The diver carefully vacuumed large stones within the dome sampler and then discarded them.

During each sampling period, one sample collected at each site was used for biomass estimates. It was washed and sieved through a U.S. Standard No. 20 sieve (841-micron mesh). The biomass sample was refrigerated (or kept in ice water) until organisms were sorted. Processing was completed within 12 hours of collection. By chilling the sample, it was possible to avoid the use of preservatives which distort organism weight (Refs. 4.2-47 and 4.2-48). Before molluscs were weighed, their shells were decalcified in 1% HCl. Sorted organisms were dried in aluminum foil containers at 100 C for at least 12 hours, then cooled to room temperature, and weighed on a Mettler H10W balance.

In April and June, the other two replicates from each site were used for density estimates. Soon after collection, they were washed, sieved (U.S. Standard No. 60, 250-micron mesh), and preserved (10% buffered formalin) for storage. Later, the residue was placed in white pans for sorting. Readily visible specimens (except naidids and chironomids) were removed, identified, and counted.

Estimates of the number of naidids, chironomids, and other organisms left in the sample were obtained by counting organisms in a subsample of the total residue using a dissecting microscope (10-70X). Naidids and chironomids were counted from 1/23 of the residue; other organisms were counted from 1/4 of the residue. Both the 1/23 and 1/4 subsamples were a composite of three randomly selected portions of the total residue. The number of organisms found in the subsample was multiplied by the appropriate conversion factor (23 or 4) and then added to the total number of organisms previously sorted from pans. The number of organisms per square meter was determined by multiplying the number of organisms per sample by 6.1.

Invertebrates were identified (usually to genus or species) using taxonomic keys cited in Ref. 4.2-45. Some chironomids had to be mounted on microscope slides and examined with a compound microscope (40-1000X) for identification.

Macroinvertebrate sample similarity was analyzed according to abundance and taxonomic composition using BASIC computer programs and a Hewlett-Packard 9830-A computer. Chance and Deutsch (Ref. 4.2-49) found that the Bray and Curtis index (Ref. 4.2-50) was the best of four similarity indexes for analysis of Susquehanna River macroinvertebrate samples. The similarity matrix was then subjected to a cluster analysis by a group-average sorting technique (Ref. 4.2-51).

The mean macroinvertebrate density in April and June 1985 (stations combined) was 39,200 org/m^2 (Table 4.2-13), 43% greater than that found in 1984 and 45% greater than the mean density found from 1978 to 1984 (Fig. 4.2-5). Chironomids composed 42% of the total number of organisms collected in 1985; hydropsychid caddisflies and oligochaetes composed 30% and 15% of the total, respectively (Table 4.2-13). A listing of the macroinvertebrates collected in dome samples since 1975 is in Table 4.2-14. No new species were added in 1985, though Eukiefferiella spp. was collected for the first time at Bell Bend.

Mean density at SSES was more than twice that at Bell Bend (Fig. 4.2-5). At SSES, the total number of organisms was composed primarily of hydropsychids and chironomids (Fig. 4.2-6). At Bell Bend, 56% of the total organisms were chironomids; naidids and hydropsychids each composed 12% of the total (Table 4.2-15).

Mean macroinvertebrate density in April was more than 3-fold greater than mean density in April 1978-82 (Fig. 4.2-7). High river flows generally occur in the early spring due to snow melt and/or rainfall in upper Pennsylvania and lower New York. High flow generally results in catastrophic drift of macroinvertebrates and thus contributes to lower benthic density. In 1985, however, mean flow between 1 January and the beginning of April sampling period was lower than in any year since 1978 (Table 4.2-16). The maximum flow during this period was only 1,581 m^3/s (14 March), considerably less than in previous years. Under these conditions, scouring of the river bed that often takes place in the spring did not occur; this was probably the main reason macroinvertebrate density was unusually high in 1985.

Chironomids were the most abundant macroinvertebrates in April, composing 48% of the total number collected at both stations combined (Fig. 4.2-6). Rheotanytarsus spp. and Cricotopus spp. were the most abundant chironomid genera. Naidid worms and hydropsychid caddisflies each composed 20% of the total density (Table 4.2-15).

At SSES, mean April density was 46,500 org/m^2; this was almost 4-fold the density from 1978 to 1982 (Fig. 4.2-7). Chironomids composed 43% of the total density; Rheotanytarsus spp. and Cricotopus spp. were the most abundant genera. Hydropsychids and naidids composed 27% and 22% of the total, respectively.

At Bell Bend, density in April was 3-fold greater than the mean from 1978 to 1982 (Fig. 4.2-7). Chironomids composed 60% of the June density; Nanocladius spp., Cricotopus spp., Microtendipes sp., and Rheotanytarsus spp. were the most abundant genera. Unlike in previous years, Microtendipes sp. was slightly more abundant at site I (2,100 org/m^2) than at site III (1,900 org/m^2). Naidids composed 16% of the total density; nematodes and hydropsychids each composed 6% of the total.

In June, mean macroinvertebrate density was over 3-fold greater than in June 1984. It was almost twice the mean of the previous seven years (Fig. 4.2-7). Hydropsychids and chironomids each composed 38% of the total number of macroinvertebrates. Cheumatopsyche spp. composed 88% of the hydropsychids. Microtendipes sp., Polypedilum spp., and Thienemannimyia gr. composed 75% of the chironomids.

At SSES, mean density in June was more than twice the mean of the previous seven years (Fig. 4.2-7). Hydropsychids and chironomids composed 78% of the total. Polypedilum spp., Microtendipes sp., and Thienemannimyia gr. were the most abundant chironomids. Naidids composed 9% of the total density.

At Bell Bend, mean June density was 25% greater than the mean of the previous seven years (Fig. 4.2-7). Chironomids (mostly Microtendipes sp., Polypedilum spp., and Thienemannimyia gr.) composed 52% of the total density. Hydropsychids and naidids composed 18% and 8% of the total, respectively. Sphaeriid clams composed 5% of the total density.

In the cluster analysis, samples were grouped by season before they were grouped by station or site (Fig. 4.2-8), indicating that seasonal differences in the macroinvertebrate community were more important than station and site differences. Since 1979, the cluster analysis usually segregated SSES samples from those at Bell Bend within a sampling period, suggesting that macroinvertebrate communities at the two stations were seasonally distinct.

The mean macroinvertebrate biomass in 1985 (Table 4.2-17) was 31% greater than the mean of the previous seven years. Trichopterans and ephemeropterans composed 57% and 16%, respectively, of the total mean biomass (Table 4.2-17). Biomass at SSES was 4.5 g/m^2; trichopterans composed 73% of the total. Biomass at Bell Bend was 1.8 g/m^2 and was composed primarily of dipterans, ephemeropterans, and trichopterans. Dry weight of trichopterans at SSES was more than 10-fold that at Bell Bend (Table 4.2-17). Mean biomass at Bell Bend has remained relatively stable during the past seven years (Fig. 4.2-5). Since 1978, annual mean biomass at SSES has been between 2- and 5-fold greater than at Bell Bend. Differences in macroinvertebrate biomass at the two stations were largely attributed to differences in substrate and river current. For example, SSES is located in a riffle area which is more suitable than Bell Bend for rheophilic organisms, such as hydropsychids.

Combined mean biomass at both stations was greatest in April (5.5 g/m^2) and decreased during each subsequent sampling period (Table 4.2-17). By October, combined mean biomass was 1.5 g/m^2. Biomass at SSES was between 2- and 3-fold greater than at Bell Bend in each sampling period. At SSES, trichopterans composed more than 50% of the biomass collected during each sampling period. At Bell Bend, dipterans predominated in April and August and ephemeropterans, in June and October.

Macroinvertebrate density and biomass steadily increased at both stations between 1977 and 1980 (Fig. 4.2-5). This followed a six-year period of significant (P less than 0.05) improvement in Susquehanna River water quality (Ref. 4.2-52). In particular, there was a decrease in acid mine drainage, which was found to suppress the macroinvertebrate community in the study area (Ref. 4.2-53). Since 1978, no significant trends in water quality improvement have been observed at either SSES or Bell Bend (Ref. 4.2-54). River temperature and flow in the months preceding the sampling periods seem to be determining factors which control macroinvertebrate density.

The Susquehanna SES has had no detectable impact on the macroinvertebrate community downriver from the discharge diffuser.

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Table 4.2-1

Species of birds collected at the Unit 1 and 2 cooling towers of the Susquehanna SES, 1978-85. An asterisk (*) denotes species found in 1985.

Accipitridae
- Accipiter cooperii - Cooper's hawk

Columbidae
- Columba livia - rock dove

Picidae
- Picoides pubescens - downy woodpecker
- Colaptes auratus - northern flicker

Tyrannidae
- Contopus virens - eastern wood-pewee
- Empidonax flaviventris - yellow-bellied flycatcher
- E. virescens - Acadian flycatcher
- E. minimus - least flycatcher

Sittidae
- Sitta canadensis - red-breasted nuthatch
- S. carolinensis - white-breasted nuthatch

Certhiidae
- Certhia americana - brown creeper

Troglodytidae
- * Troglodytes aedon - house wren

Muscicapidae
- * Regulus satrapa - golden-crowned kinglet
- * R. calendula - ruby-crowned kinglet
- Catharus guttatus - hermit thrush
- Hylocichla mustelina - wood thrush

Mimidae
- * Dumetella carolinensis - gray catbird
- Toxostoma rufum - brown thrasher

Vireonidae
- Vireo griseus - white-eyed vireo
- V. solitarius - solitary vireo
- * V. flavifrons - yellow-throated vireo
- V. philadelphicus - Philadelphia vireo
- V. gilvus - warbling vireo
- * V. olivaceus - red-eyed vireo
- Vireo spp. - vireo spp.

Emberizidae
- Vermivora pinus - blue-winged warbler
- * V. chrysoptera - golden-winged warbler
- V. peregrina - Tennessee warbler
- V. ruficapilla - Nashville warbler
- Parula americana - northern parula
- Dendroica petechia - yellow warbler
- D. pensylvanica - chestnut-sided warbler
- D. magnolia - magnolia warbler
- D. tigrina - Cape May warbler
- D. caerulescens - black-throated blue warbler
- D. coronata - yellow-rumped warbler
- * D. virens - black-throated green warbler
- * D. fusca - Blackburnian warbler
- D. pinus - pine warbler
- D. discolor - prairie warbler
- D. palmarum - palm warbler
- * D. castanea - bay-breasted warbler
- D. striata - blackpoll warbler
- Mniotilta varia - black-and-white warbler
- Setophaga ruticella - American redstart
- Helmitheros vermivorus - worm-eating warbler
- * Seiurus aurocapillus - ovenbird
- Oporornis formosus - Kentucky warbler
- O. agilis - Connecticut warbler
- * Geothlypis trichas - common yellowthroat

Emberizidae (cont.)
- Wilsonia pusilla - Wilson's warbler
- W. canadensis - Canada warbler
- Icteria virens - yellow-breasted chat
- Parulinae spp. - warbler spp.
- Piranga olivacea - scarlet tanager
- Piranga sp. - tanager sp.
- Pheucticus ludovicianus - rose-breasted grosbeak
- Guiraca caerulea - blue grosbeak
- Spiza americana - dickcissel
- Spizella pusilla - field sparrow
- Melospiza lincolnii - Lincoln's sparrow
- M. georgiana - swamp sparrow
- Zonotrichia leucophrys - white-crowned sparrow
- Junco hyemalis - dark-eyed junco
- Ammodramus savannarum - grasshopper sparrow
- * Dolichonyx oryzivorous - bobolink
- Icterus galbula - northern oriole

Fringillidae
- Carpodacus purpureus - purple finch

Table 4.2-2

Weekly bird impaction totals from Unit 1 and 2 cooling towers, 18 March through 7 June 1985.

FAMILY/SPECIES	MAR		APR					MAY				JUN	TOTAL
	18-22	25-29	1-4	8-12	15-19	22-26	29-3	6-10	13-17	20-24	28-31	3-7	
UNIT 1													
MUSCICAPIDAE													
RUBY-CROWNED KINGLET	0	0	0	0	0	1	0	0	0	0	0	0	1
VIREONIDAE													
RED-EYED VIREO	0	0	0	0	0	0	0	0	0	0	0	1	1
TOTAL INDIVIDUALS	0	0	0	0	0	1	0	0	0	0	0	1	2
TOTAL SPECIES	0	0	0	0	0	1	0	0	0	0	0	1	2
UNIT 2													
TROGLODYTIDAE													
HOUSE WREN	0	0	0	0	0	0	0	1	0	0	0	0	1
EMBERIZIDAE													
GOLDEN-WINGED WARBLER	0	0	0	0	0	0	0	0	0	1	0	0	1
COMMON YELLOWTHROAT	0	0	0	0	0	0	0	1	0	0	0	0	1
TOTAL INDIVIDUALS	0	0	0	0	0	0	0	2	0	1	0	0	3
TOTAL SPECIES	0	0	0	0	0	0	0	2	0	1	0	0	3

Table 4.2-3

Weekly bird impaction totals from Unit 1 and 2 cooling towers, 19 August through 8 November 1985.

FAMILY/SPECIES	AUG		SEP				OCT				NOV		TOTAL
	19-23	26-30	3-6	9-13	16-20	23-27	30-4	7-11	14-18	21-25	28-1	4-8	
UNIT 1													
MUSCICAPIDAE													
GOLDEN-CROWNED KINGLET	0	0	0	0	0	0	0	0	1	0	0	0	1
RUBY-CROWNED KINGLET	0	0	0	0	0	0	0	0	0	1	0	0	1
MIMIDAE													
GRAY CATBIRD	0	0	0	1	0	0	0	0	0	0	0	0	1
VIREONIDAE													
YELLOW-THROATED VIREO	0	0	0	1	0	0	0	0	0	0	0	0	1
RED-EYED VIREO	0	0	0	3	0	0	0	0	0	0	0	0	3
EMBERIZIDAE													
BLACK-THROATED GREEN WARBLER	0	0	0	0	0	0	0	1	0	0	0	0	1
OVENBIRD	0	0	0	1	0	0	0	0	0	0	0	0	1
COMMON YELLOWTHROAT	0	0	0	0	0	2	0	0	0	0	1	0	3
BOBOLINK	0	0	0	1	0	0	0	0	0	0	0	0	1
TOTAL INDIVIDUALS	0	0	0	7	0	2	0	1	1	1	1	0	13
TOTAL SPECIES	0	0	0	5	0	1	0	1	1	1	1	0	9
UNIT 2													
EMBERIZIDAE													
BLACK-THROATED GREEN WARBLER	0	0	0	0	0	0	0	1	0	0	0	0	1
BLACKBURNIAN WARBLER	0	0	0	1	0	0	0	0	0	0	0	0	1
BAY-BREASTED WARBLER	0	0	0	0	0	1	0	0	0	0	0	0	1
COMMON YELLOWTHROAT	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTAL INDIVIDUALS	0	0	0	1	0	2	0	1	0	0	0	0	4
TOTAL SPECIES	0	0	0	1	0	2	0	1	0	0	0	0	4

SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

1985 (Year) — Stanton - Susquehanna & Montour Susquehanna (Parallel) (Line Names) — Susquehanna (Division)

Herbicides					Additives		Carrier	
Alt. No.	Commercial Name	Active Ingredient	Acid Equiv.	Spec. Am't. Per 100 Gal. Solution	Commercial Name	Spec. Am't. Per 100 Gal. Solution	Name	Spec. Am't Per 100 Gal. Solution
1	Garlon 3A	Triclopyr	3#/gal.	2 qts.	clean cut	1	water	99 gal.
	Tordon 101	Picloram	.54#/gal.	2 qts.	clean way	6 oz.		
		(2.4-D)	2#/gal.					

Application Data

Alt. No.	No. Of Acres	Total Gallons Solution	Application Rate Gal./A.	Total Gallons Concentrate	Rate Gal./A.	Total Pounds Acid Equivalent	Pounds Per Acre
1	8.9	250	28.09	Garlon 3A 1.25	.14	Triclopyr 3.75	.42
				Tordon 101 1.25	.14	Picloram .67	.07
						2.4-D 2.50	.28
				Totals: 2.50	.28	6.92	.77

Alt. No.	Application Dates From	To	Location By Grid No. From	To
1	8-5-85	8-5-85	44394n34285	44290n34277
			44290n34277	44224n34273

Supervisor of Distribution Services — 717-327-5306 — Old US Route 220, P.O. Box 158, Montoursville, Pa. 17754
(Name) (Phone) (Address)

SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

1985 (Year) — Stanton - Susquehanna & Montour - Susquehanna (Parallel) (Line Names) — Susquehanna (Division)

Herbicides					Additives		Carrier	
Alt. No.	Commercial Name	Active Ingredient	Acid Equiv.	Spec. Am't. Per 100 Gal. Solution	Commercial Name	Spec. Am't. Per 100 Gal. Solution	Name	Spec. Am't Per 100 Gal. Solution
2	Krenite S	Fosamine	400/gal.	1.5 gal.	clean way	6 oz.	water	100 gal.
					clean cut	1 qt.		

Application Data

Alt. No.	No. Of Acres	Total Gallons Solution	Application Rate Gal./A.	Total Gallons Concentrate	Rate Gal./A.	Total Pounds Acid Equivalent	Pounds Per Acre
2	10.67	1,000	93.72	15	1.40	60	5.62

Alt. No.	Application Dates		Location By Grid No.	
	From	To	From	To
2	8-24-85	8-24-85	44016n34256	43998n34322
			44016n34256	44069n34259
			44069n34259	44128n34271
			44128n34271	44447n34271
			44394n34285	44447n34289

Supervisor of Distribution Services (Title) — 717-327-5306 (Phone) — Old US Route 220, P.O. Box 158, Montoursville, Pa. 17754 (Address)

SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

Year	Line Names	Division
1985	Susquehanna - Wescosville 500 KV	Central

Herbicides

Alt. No.	Commercial Name	Active Ingredient	Acid Equiv.	Spec. Am't. Per 100 Gal. Solution
1	Garlon 3A	Triclopyr	3 lb./gal.	.5 gal.
	Tordon 101	Picloram	.54 lb/gal.	.5 gal.
		2,4-D	2 lb./gal.	

Additives

Commercial Name	Spec. Am't. Per 100 Gal. Solution
Clean way	6 oz.
Clean cut	1 qt.

Carrier

Name	Spec. Am't Per 100 Gal. Solution
Water	99 gal.

Application Data

Alt. No.	No. Of Acres	Total Gallons Solution	Application Rate Gal./A.	Total Gallons Concentrate	Rate Gal./A.	Total Pounds Acid Equivalent	Pounds Per Acre
1	416.45	37,125	89.15	Garlon 3A-187.5	.45	562.50	1.35
				Tordon 101-187.5	.45	Picloram-101.25	.24
						2,4-D - 375.00	.90

Alt. No.	Application Dates From	To
1	6-3-85	7-19-85

Location By Grid No. From	To
44403 n 33148	45132 n 33489
45625 n 33830	46407 n 33647
46502 n 33634	47333 n 33584
47452 n 33634	50196 n 34602
52674 n 35040	53083 n 33973
53151 n 33790	53438 n 32896

Supervisor of Distribution Services — Title
717-459-7414 — Phone
344 S. Poplar Street, Hazleton, Pa. 18201-7155 — Address

SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

1985 (Year) — Susquehanna - Wescosville 500 Kv (Line Names) — Central (Division)

Herbicides					Additives		Carrier	
Alt. No.	Commercial Name	Active Ingredient	Acid Equiv.	Spec. Am't. Per 100 Gal. Solution	Commercial Name	Spec. Am't. Per 100 Gal. Solution	Name	Spec. Am't Per 100 Gal. Solution
1	Garlon 3A	(continued)						
	Tordon 101	(continued)						

Application Data

Alt. No.	No. Of Acres	Total Gallons Solution	Application Rate Gal./A.	Total Gallons Concentrate	Rate Gal./A.	Total Pounds Acid Equivalent	Pounds Per Acre

Alt. No.	Application Dates From	To	Location By Grid No. From	To
1	6-3-85	7-19-85	53573 n 32436	55114 n 31227
			55233 n 31149	55568 n 31087
			55746 n 30972	56140 n 30453
			57761 n 29669	58509 n 28789
			59661 n 26260	59903 n 25564
			59958 n 25420	60349 n 25265

Supervisor of Distribution Services (Title) — 717-459-7414 (Phone) — 344 S. Poplar Street, Hazleton, Pa. 18201-7155 (Address)

SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Central (Division)

Herbicides					Additives		Carrier	
Alt. No.	Commercial Name	Active Ingredient	Acid Equiv.	Spec. Am't. Per 100 Gal. Solution	Commercial Name	Spec. Am't. Per 100 Gal. Solution	Name	Spec. Am't Per 100 Gal. Solution
2	Krenite	Fosamine	4 lb./gal.	1.5 gal.	Clean way	6 oz.	Water	100 gal.
					Clean cut	1 qt.		

Application Data

Alt. No.	No. Of Acres	Total Gallons Solution	Application Rate Gal./A.	Total Gallons Concentrate	Rate Gal./A.	Total Pounds Acid Equivalent	Pounds Per Acre
2	181.47	18,400	101.39	276	1.52	1104	6.08

Alt. No.	Application Dates From	To	Location By Grid No. From	To
2	8-5-85	9-6-85	50196 n 34602	52674 n 35040
			54760 n 31465	54900 n 31370
			55114 n 31227	55331 n 31082
			55568 n 31087	55746 n 30972
			56693 n 30459	57069 n 30113
			57542 n 29827	57761 n 29669

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SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Central (Division)

Herbicides					Additives		Carrier	
Alt. No.	Commercial Name	Active Ingredient	Acid Equiv.	Spec. Am't. Per 100 Gal. Solution	Commercial Name	Spec. Am't. Per 100 Gal. Solution	Name	Spec. Am't Per 100 Gal. Solution
2	Krenite	(continued)						

Application Data

Alt. No.	No. Of Acres	Total Gallons Solution	Application Rate Gal./A.	Total Gallons Concentrate	Rate Gal./A.	Total Pounds Acid Equivalent	Pounds Per Acre

Alt. No.	Application Dates From	To	Location By Grid No. From	To
2	8-5-85	9-6-85	58509 n 28789	58958 n 28100
			58981 n 28045	59076 n 27908
			59958 n 25420	59990 n 25332

Supervisor of Distribution Services (Title) | 717-459-7414 (Phone) | 344 S. Poplar Street, Hazleton, Pa. 18201-7155 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Stanton - Susquehanna (Line Names) | Susquehanna (Division)

Selective Reclearing

Dates From	Dates To	Grid Location From	Grid Location To	Acres

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Removal

Dates From	Dates To	Grid Location From	Grid Location To	
		43971n34394	43920n34528	1
		43892n34600	43859n34741	2
		43839n34741	43794n34858	3
		43764n34941	43727n35032	4
		43653n35465	43645n35514	5

Supervisor of Distribution Services (Title) | 717-327-5306 (Phone) | Old US Route 220, P.O. Box 158, Montoursville, Pa. 17754 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

Year	Line Names	Division
1985	Susquehanna - Wescosville 500 KV	Lehigh

Selective Reclearing E-15254-2

Dates From	Dates To	Grid Location From	Grid Location To	Acres
4/85		61296 s 51051	61442 s 51098	
		61442 s 51098	61571 s 51097	
		61571 s 51097	61678 s 51081	
		61678 s 51081	61808 s 51118	
		61808 s 51118	61860 s 51143	
			Total	5.46

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To

Line Clearance Forester	215-398-4258	R.D. #2,P.O. Box 811B, Allentown, Pa. 18106-0500
Title	Phone	Address

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985	Susquehanna - Wescosville 500 KV	Lehigh
Year	Line Names	Division

Selective Reclearing E-118029-2 1 of 6

Dates From	Dates To	Grid Location From	Grid Location To	Acres
4/85		60882 s 46023	60889 s 46124	
		60889 s 46124	60917 s 46220	
		60942 s 46297	60950 s 46386	
		60950 s 46386	60942 s 46478	
		60942 s 46478	60920 s 46555	
		60843 s 46822	60814 s 46919	
			Total	1.15

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To

Line Clearance Forester	215-398-4258	R. D. #2, P.O. Box 811B, Allentown, Pa. 18106-0500
Title	Phone	Address

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Lehigh (Division)

Selective Reclearing E-118029-4 2 of 6

Dates From	Dates To	Grid Location From	Grid Location To	Acres
4/85		60780 s 47042	60745 s 47155	
		60745 s 47155	60718 s 47251	
		60718 s 47251	60692 s 47337	
		60652 s 47443	60607 s 47557	
		60607 s 47557	60534 s 47724	
		60534 s 47724	60484 s 47819	
		60484 s 47819	60457 s 48080	
			Total	9.7

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.
4/85		60745 s 47251	60718 s 47251	300
		60652 s 47443	60607 s 47557	700

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees
4/85		60652 s 47443	60607 s 47557	56
		60534 s 47724	60484 s 47819	10

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To

Line Clearance Forester (Title) | 215-398-4258 (Phone) | R. D. #2, P. O. Box 811B, Allentown, Pa. 18106-0500 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Lehigh (Division)

Selective Reclearing

E-118029-2
3 of 6

Dates From	Dates To	Grid Location From	Grid Location To	Acres
4/85		60454 s 47963	60424 s 48080	
		60424 s 48080	60392 s 48184	
		60392 s 48184	60354 s 48302	
		60354 s 48302	60313 s 48429	
		60282 s 48519	60242 s 48641	
		60242 s 48641	60215 s 48757	
		60215 s 48757	60176 s 48907	
		60141 s 49046	60110 s 49165	
			Total	8.8

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	

Line Clearance Forester (Title) | 215-398-4258 (Phone) | R.D. #2, P.O. Box 811B, Allentown, Pa. 18106-0500 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Lehigh (Division)

Selective Reclearing

E-118029-2
4 of 6

Dates From	Dates To	Grid Location From	Grid Location To	Acres
4/85		60110 s 49165	60084 s 49297	
		60079 s 49395	60096 s 49496	
		60096 s 49496	60143 s 49613	
		60181 s 49703	60211 s 49762	
		60211 s 49762	60254 s 49820	
		60254 s 49820	60355 s 49917	
		60403 s 49993	60463 s 50088	
		60463 s 50088	60532 s 50193	
			Total	5.43

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	

Line Clearance Forester (Title) | 215-398-4258 (Phone) | R. D. #2, P. O. Box 811B, Allentown, Pa. 18106-0500 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985	Susquehanna - Wescosville 500 KV	Lehigh
Year	Line Names	Division

Selective Reclearing E-118029-4 5 Of 6

Dates From	Dates To	Grid Location From	Grid Location To	Acres
4/85		60532 s 50193	60614 s 50282	
		60697 s 50369	60781 s 50456	
		60781 s 50456	60859 s 50539	
		60859 s 50539	60942 s 50637	
		61092 s 50819	61188 s 50929	
			Total	2.56

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To

Line Clearance Forester	215-398-4258	R. D. #2, P.O. Box 811B, Allentown, Pa. 18106-0500
Title	Phone	Address

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Lehigh (Division)

Selective Reclearing LE-83849-2

Dates From	Dates To	Grid Location From	Grid Location To	Acres
11/85		61936 s 55181	61972 s 51328	.5
		62020 s 51536	62040 s 51624	.75
			Total	1.25

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To
11/85		62040 s 51624 (Removed 85' of screen South of L.R. 48068)	62081 s 51792
		(Removed all of Screen North of L.R. 48068)	

Line Clearance Forester (Title) | 215-398-4258 (Phone) | R. D. #2, P.O. Box 811B, Allentown, Pa. 18106-0500 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Lehigh (Division)

Selective Reclearing LE-83849-1

Dates From	Dates To	Grid Location From	Grid Location To	Acres
11/85		61962 s 52172	61929 s 52218	.45
		61889 s 52275	61810 s 52389	.22
		61810 s 52389	61788 s 52516	.25
		61759 s 52615	61753 s 52699	1.00
			Total	1.92

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	
11/85		62019 s 52080 (Screen South of L.R. 48068 eliminate all Hardwood species save Hemlocks)	61962 s 52172	
		61725 s 52835 (Eliminate screen trees not trimable)	61610 s 52942	
		61528 s 53012 (Eliminate fencerow S of T-511	61456 s 53098	

Line Clearance Forester (Title) | 215-398-4258 (Phone) | R. D. #2, P.O. Box 811B, Allentown, Pa. 18106-0500 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Lehigh (Division)

Selective Reclearing LE -83849-0

Dates From	Dates To	Grid Location From	Grid Location To	Acres
9/85		61456 s 53098	61394 s 53170	.16

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	
9/85		61375 s 53269 (Removed Screen south of L.R. 48057 trees Non-trim)	61356 s 53372 (Removed Hardwood North of L.R. 48057 saved all Evergreens)	

Line Clearance Forester (Title) | 215-398-4258 (Phone) | R. D. #2, P.O. Box 811B, Allentown, Pa. 18106-0500 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

Year	Line Names	Division
1985	Susquehanna - Wescosville 500 KV	Lehigh

Selective Reclearing LE-83849-3

Dates From	Dates To	Grid Location From	Grid Location To	Acres
9/85		61257 s 53743	61219 s 53871	.20
↓		61219 s 53871	61180 s 54000	.10
		61219 s 53871	61180 s 54000	.20
			Total	.50

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	
9/85		61400 s 53508	61329 s 53623	
		(Road screen N of L.R. 48062 removed all Hardwoods and saved all Evergreens)		

Line Clearance Forester	215-398-4258	R. D. #2, P.O. Box 811B, Allentown, Pa. 18106-0500
Title	Phone	Address

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Susquehanna - Wescosville 500 KV (Line Names) | Lehigh (Division)

Selective Reclearing

LE-83849-1

Dates From	Dates To	Grid Location From	Grid Location To	Acres

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	
8/85		60741 n 24356	60734 n 24513	
		(Removed screen next to Aquashicola Creek trees not trimable)		
		(Screen N. Side of L.R. 13013 removed all Hardwoods - saved Pines)		
7/85		60577 n 24925	60533 n 24994	
		(Removed Tall Hardwoods Species)		

Line Clearance Forester (Title) | 215-398-4258 (Phone) | R. D. #2, P.O. Box 811B, Allentown, Pa. 18106-0500 (Address)

SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

1985 (Year) | Stanton-Susquehanna #2-230 KV (Line Names) | Northern (Division)

Selective Reclearing

Dates From	Dates To	Grid Location From	Grid Location To	Acres
11-12-85	11-15-85	52502 n 44199	52641 n 44280	7.8
12-9-85	12-27-85	52106 n 43386	52083 n 43166	10.25
			Total	18.05

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	

George R. Hahn, Jr. Line Clearance Forester (717) 253-3591 PP&L, R#4, Honesdale, Pa. 18431
Title Phone Address

Table 4.2-6

Mean density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at SSES on the Susquehanna River, 1985.

TAXON	12 APR	14 JUN	15 AUG	7 OCT	MEAN	% TOTAL
CHLOROPHYTA						
ACTINASTRUM	0.0	0.4	1.1	0.0	0.4	<0.1
ANKISTRODESMUS	1.6	57.6	232.3	12.3	76.0	6.0
CHLAMYDOMONAS	0.0	0.4	32.6	0.0	8.2	0.6
COELASTRUM	0.0	0.0	125.3	1.5	31.7	2.5
COSMARIUM	0.3	0.0	2.1	0.6	0.8	0.1
CRUCIGENIA	0.0	1.5	10.9	0.0	3.1	0.2
DICTYOSPHAERIUM	0.0	0.0	40.4	0.0	10.1	0.8
FRANCEIA	0.0	0.0	1.1	0.0	0.3	<0.1
KIRCHNERIELLA	0.0	3.9	18.6	0.9	5.8	0.5
OOCYSTIS	21.2	16.8	6.6	2.2	11.7	0.9
PEDIASTRUM	0.3	0.3	33.3	1.5	8.9	0.7
POLYEDRIOPSIS	0.0	0.6	0.0	0.0	0.2	<0.1
SCENEDESMUS	2.2	45.7	553.6	23.4	156.2	12.3
STAURASTRUM	3.2	0.0	0.0	0.0	0.8	0.1
TETRAEDRON	0.0	0.3	1.1	0.3	0.4	<0.1
TETRASTRUM	0.0	0.0	7.4	0.0	1.8	0.1
UNIDENTIFIED CHLOROPHYTA	1.6	16.5	165.0	34.8	54.5	4.3
BACILLARIOPHYTA						
ACHNANTHES	0.9	2.3	737.9	0.0	185.3	14.6
AMPHORA	0.0	0.3	0.0	0.3	0.2	<0.1
ASTERIONELLA	1.9	0.0	0.0	1.2	0.8	0.1
COCCONEIS	0.6	5.9	0.7	0.9	2.0	0.2
CYCLOTELLA	9.4	87.3	1269.3	33.0	349.7	27.5
CYMBELLA	22.9	12.1	1.6	0.6	9.3	0.7
DIATOMA	4.0	0.3	0.0	0.3	1.2	0.1
FRAGILARIA	0.0	1.2	0.0	0.0	0.3	<0.1
FRUSTULIA	1.2	0.0	0.0	0.0	0.3	<0.1
GOMPHONEMA	16.6	13.9	3.3	5.6	9.9	0.8
GYROSIGMA	0.3	0.0	0.0	0.0	0.1	<0.1
MELOSIRA	1.4	5.3	6.5	4.0	4.8	0.4
MERIDION	0.9	0.3	0.0	0.0	0.3	<0.1
NAVICULA	398.4	145.5	25.3	37.3	151.7	11.9
NITZSCHIA	330.3	71.2	26.4	25.0	113.2	8.9
RHOICOSPHENIA	0.3	0.7	0.0	0.0	0.3	<0.1
STEPHANODISCUS	0.0	109.0	0.0	13.6	30.7	2.4
SURIRELLA	1.9	0.3	0.0	0.0	0.6	<0.1
SYNEDRA	7.3	2.4	0.3	0.3	2.6	0.2
TABELLARIA	0.0	0.3	0.0	0.0	0.1	<0.1
THALASSIOSIRA	0.0	76.5	0.0	0.0	19.1	1.5
CYANOPHYTA						
CHROOCOCCUS	0.0	6.8	6.0	0.6	3.4	0.3
COELOSPHAERIUM	0.0	0.0	4.2	0.3	1.1	0.1
MERISMOPEDIA	0.0	0.0	8.6	0.0	2.2	0.2
OSCILLATORIA	1.9	0.0	0.0	0.0	0.5	<0.1
SCHIZOTHRIX	1.2	0.0	6.8	32.4	10.1	0.8
EUGLENOPHYTA						
TRACHELOMONAS	0.0	0.0	0.0	2.2	0.5	<0.1
PYRRHOPHYTA						
PERIDINIUM	0.0	0.0	5.3	0.0	1.3	0.1
RHODOPHYTA						
RHODOCHORTON	0.0	0.0	0.0	0.3	0.1	<0.1
TOTAL	834.0	685.8	3313.5	235.6		

Table 4.2-7

Mean density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 1985.

TAXON	12 APR	14 JUN	15 AUG	7 OCT	MEAN	% TOTAL
CHLOROPHYTA						
ACTINASTRUM	0.0	2.1	4.2	0.0	1.6	0.1
ANKISTRODESMUS	0.0	70.2	73.2	0.0	35.8	1.8
COELASTRUM	0.0	2.7	23.9	0.0	6.6	0.3
COSMARIUM	0.0	0.0	2.1	0.0	0.5	<0.1
CRUCIGENIA	0.0	1.1	0.0	0.0	0.3	<0.1
DICTYOSPHAERIUM	0.0	0.0	7.7	0.0	1.9	0.1
ELAKATOTHRIX	0.0	0.0	0.0	0.1	0.0	<0.1
KIRCHNERIELLA	0.0	2.7	13.9	0.0	4.2	0.2
OOCYSTIS	15.1	2.9	0.0	0.0	4.5	0.2
PEDIASTRUM	0.3	2.7	30.4	0.0	8.3	0.4
SCENEDESMUS	0.3	124.6	552.5	0.6	169.5	8.6
STAURASTRUM	0.3	0.0	0.0	0.0	0.1	<0.1
TETRAEDRON	0.0	0.6	3.5	0.0	1.0	0.1
TETRASTRUM	0.0	3.7	11.2	0.0	3.7	0.2
ULOTHRIX	0.0	0.0	2.1	0.0	0.5	<0.1
UNIDENTIFIED CHLOROPHYTA	0.0	21.0	67.6	0.2	22.2	1.1
BACILLARIOPHYTA						
ACHNANTHES	0.0	2.7	0.0	0.0	0.7	<0.1
AMPHIPLEURA	0.0	0.0	0.0	0.1	0.0	<0.1
AMPHORA	0.0	2.7	0.0	0.0	0.7	<0.1
ASTERIONELLA	0.0	0.0	0.0	1.3	0.3	<0.1
COCCONEIS	2.5	37.9	5.0	0.2	11.4	0.6
CYCLOTELLA	3.1	619.4	3801.3	1.7	1106.4	56.1
CYMBELLA	13.9	60.5	3.2	0.7	19.6	1.0
DIATOMA	0.6	6.4	0.0	0.3	1.8	0.1
EUNOTIA	0.0	0.0	0.0	0.1	0.0	<0.1
FRAGILARIA	0.0	12.5	0.0	0.2	3.2	0.2
FRUSTULIA	0.3	1.1	0.0	0.0	0.3	<0.1
GOMPHONEMA	20.0	38.7	0.3	0.1	14.8	0.8
GYROSIGMA	0.3	0.0	0.0	0.1	0.1	<0.1
HANTZSCHIA	0.0	0.0	2.1	0.0	0.5	<0.1
MELOSIRA	1.2	26.1	46.5	0.5	18.6	0.9
MERIDION	2.2	3.3	0.0	0.1	1.4	0.1
NAVICULA	337.9	268.8	52.5	4.5	165.9	8.4
NITZSCHIA	262.4	116.5	47.5	4.3	107.7	5.5
PINNULARIA	0.0	0.0	2.4	0.0	0.6	<0.1
RHOICOSPHENIA	0.9	6.0	0.0	0.1	1.7	0.1
STEPHANODISCUS	0.3	311.4	1.1	0.0	78.2	4.0
SURIRELLA	3.7	2.7	0.0	0.0	1.6	0.1
SYNEDRA	2.2	3.8	3.1	0.0	2.3	0.1
THALASSIOSIRA	0.0	619.4	0.0	0.0	154.9	7.8
TROPIDONEIS	0.0	0.0	2.1	0.0	0.5	<0.1
CYANOPHYTA						
CHROOCOCCUS	0.0	10.9	22.8	0.0	8.4	0.4
MERISMOPEDIA	0.0	0.0	31.1	0.0	7.8	0.4
MICROCYSTIS	0.0	0.6	0.0	0.0	0.1	<0.1
OSCILLATORIA	0.6	0.0	0.0	0.0	0.2	<0.1
SCHIZOTHRIX	0.0	0.0	9.6	0.9	2.6	0.1
EUGLENOPHYTA						
TRACHELOMONAS	0.3	0.0	0.0	0.1	0.1	<0.1
TOTAL	668.5	2385.4	4822.8	16.1		

Species of periphytic algae composing 5% or more of the total units counted in at least one replicate sample from SSES or Bell Bend on the Susquehanna River, 1985; pH affinity as rated by Lowe (Ref. 4.2-30): 1 = alkaliphilous, 2 = acidophilous, 3 = indifferent, and 4 = unknown.

Species	pH Affinity	SSES	Bell Bend
CHLOROPHYTA			
Ankistrodesmus falcatus		Jun, Aug, Oct	Jun
Oocystis parva		Apr, Jun	
Scenedesmus falcatus		Jun	
S. quadricauda		Jun, Aug, Oct	Jun, Aug, Oct
BACILLARIOPHYTA			
Asterionella formosa	(1)		Oct
Cyclotella meneghiniana	(1)	Aug, Oct	Jun, Aug, Oct
C. pseudostelligera	(1,3)	Jun	Jun
Melosira varians	(1)		Oct
Navicula cryptocephala	(1)	Jun	Jun
N. cryptocephala var. *veneta*	(1)	Apr	Apr
N. gregaria	(4)	Oct	
N. salinarum var. *intermedia*	(4)	Oct	Oct
N. tripunctata	(1)	Apr	Apr, Jun
N. viridula	(1,3)	Apr, Jun	Apr
Nitzschia dissipata	(1)	Apr, Jun	Apr
N. palea	(1,3)	Apr, Oct	Apr, Oct
Stephanodiscus invisitatus	(4)	Jun, Oct	Jun
Thalassiosira pseudonana	(3)	Jun	Jun
CYANOPHYTA			
Schizothrix calcicola		Oct	Oct

Table 4.2-9

Density (units/ml) of phytoplankton in bimonthly samples (indicated by date and collection number) at SSES on the Susquehanna River, 1985.

TAXON	12 APR AJG-85-003	14 JUN AJG-85-034	15 AUG AJG-85-062	7 OCT AJG-85-094	MEAN	% TOTAL
CHLOROPHYTA						
ACTINASTRUM	0	0	167	0	41.7	0.4
ANKISTRODESMUS	11	2179	1500	114	951.1	9.1
CHLAMYDOMONAS	6	154	733	0	223.2	2.1
CLOSTERIOPSIS	0	0	0	3	0.7	<0.1
COELASTRUM	3	26	567	3	149.5	1.4
CRUCIGENIA	0	51	200	19	67.7	0.6
DICTYOSPHAERIUM	0	154	1100	17	317.6	3.0
ELAKATOTHRIX	0	0	33	0	8.3	0.1
FRANCEIA	0	26	33	0	14.7	0.1
KIRCHNERIELLA	0	103	1233	22	339.5	3.3
MICRACTINIUM	0	0	67	11	19.4	0.2
OOCYSTIS	8	179	0	3	47.6	0.5
PEDIASTRUM	0	0	33	6	9.7	0.1
POLYEDRIOPSIS	0	77	0	0	19.2	0.2
SCENEDESMUS	3	615	4300	219	1284.4	12.3
TETRAEDRON	0	51	0	0	12.8	0.1
TETRASTRUM	0	26	233	11	67.5	0.6
TREUBARIA	0	26	0	0	6.4	0.1
UNIDENTIFIED CHLOROPHYTA	33	4256	1133	108	1382.8	13.2
BACILLARIOPHYTA						
ACHNANTHES	6	0	0	6	2.8	<0.1
AMPHORA	3	0	0	3	1.4	<0.1
ASTERIONELLA	72	0	0	136	52.1	0.5
COCCONEIS	3	0	0	11	3.5	<0.1
CYCLOTELLA	236	2231	8767	306	2884.7	27.6
CYMBELLA	22	26	0	3	12.7	0.1
DIATOMA	6	0	0	0	1.4	<0.1
FRAGILARIA	6	0	0	0	1.4	<0.1
GOMPHONEMA	31	0	33	6	17.4	0.2
MELOSIRA	8	0	167	17	47.9	0.5
MERIDION	8	0	0	0	2.1	<0.1
NAVICULA	169	51	67	44	83.0	0.8
NITZSCHIA	106	51	133	139	107.3	1.0
RHOICOSPHENIA	8	0	0	0	2.1	<0.1
STEPHANODISCUS	411	2897	0	153	865.3	8.3
SURIRELLA	3	0	0	0	0.7	<0.1
SYNEDRA	22	26	0	14	15.4	0.1
THALASSIOSIRA	522	1282	0	150	488.6	4.7
CYANOPHYTA						
APHANIZOMENON	0	0	0	3	0.7	<0.1
CHROOCOCCUS	6	333	600	42	245.1	2.3
MERISMOPEDIA	0	0	2533	0	633.3	6.1
MICROCYSTIS	0	0	33	0	8.3	0.1
OSCILLATORIA	3	0	0	0	0.7	<0.1
CHRYSOPHYTA						
DINOBYRON	3	0	0	3	1.4	<0.1
MALLOMONAS	0	0	0	6	1.4	<0.1
TOTAL	1717	14820	23666	1575	10444.7	

Table 4.2-10

Density (units/ml) of phytoplankton in bimonthly samples (indicated by date and collection number) at Bell Bend on the Susquehanna River, 1985.

TAXON	12 APR AJG-85-011	14 JUN AJG-85-026	15 AUG AJG-85-070	7 OCT AJG-85-102	MEAN	% TOTAL
CHLOROPHYTA						
ACTINASTRUM	0	0	133	0	33.3	0.3
ANKISTRODESMUS	6	2564	1633	86	1072.3	10.0
CHLAMYDOMONAS	8	154	1167	6	333.6	3.1
COELASTRUM	0	0	567	0	141.7	1.3
CRUCIGENIA	0	26	200	31	64.0	0.6
DICTYOSPHAERIUM	0	77	1267	8	338.0	3.2
FRANCEIA	0	26	0	0	6.4	0.1
KIRCHNERIELLA	0	103	867	33	250.6	2.3
MICRACTINIUM	0	26	67	0	23.1	0.2
OOCYSTIS	3	0	0	0	0.7	<0.1
PEDIASTRUM	0	0	100	3	25.7	0.2
POLYEDRIOPSIS	0	26	0	0	6.4	0.1
SCENEDESMUS	0	923	3933	367	1305.8	12.2
SELENASTRUM	0	26	0	3	7.1	0.1
TETRAEDRON	0	128	133	0	65.4	0.6
TETRASTRUM	0	26	233	8	66.8	0.6
UNIDENTIFIED CHLOROPHYTA	47	4128	733	136	1261.2	11.8
BACILLARIOPHYTA						
ACHNANTHES	6	0	0	3	2.1	<0.1
AMPHORA	6	0	0	3	2.1	<0.1
ASTERIONELLA	58	0	0	100	39.6	0.4
COCCONEIS	6	0	0	11	4.2	<0.1
CYCLOTELLA	178	2923	8567	325	2998.1	28.0
CYMATOPLEURA	3	0	0	0	0.7	<0.1
CYMBELLA	14	0	0	3	4.2	<0.1
DIATOMA	6	0	0	0	1.4	<0.1
FRAGILARIA	3	0	0	0	0.7	<0.1
GOMPHONEMA	35	26	0	6	17.5	0.2
MELOSIRA	17	0	0	14	7.6	0.1
NAVICULA	150	51	33	53	71.9	0.7
NITZSCHIA	83	103	300	97	145.8	1.4
RHOICOSPHENIA	8	0	0	0	2.1	<0.1
STEPHANODISCUS	306	3769	0	161	1059.0	9.9
SYNEDRA	6	77	0	3	21.3	0.2
THALASSIOSIRA	394	1667	0	161	555.6	5.2
CYANOPHYTA						
CHROOCOCCUS	3	359	667	53	270.3	2.5
MERISMOPEDIA	0	0	2067	3	517.4	4.8
SCHIZOTHRIX	0	0	0	3	0.7	<0.1
CHRYSOPHYTA						
DINOBYRON	0	0	0	6	1.4	<0.1
PYRRHOPHYTA						
PERIDINIUM	3	0	0	0	0.7	<0.1
TOTAL	1350	17205	22666	1683	10726.2	

Species of phytoplankton composing 5% or more of the total units counted in at least one sample from SSES or Bell Bend on the Susquehanna River, 1985; pH affinity as rated by Lowe (Ref. 4.2-30): 1 = alkaliphilous, 2 = acidophilous, 3 = indifferent, and 4 = unknown.

Species	pH Affinity	SSES	Bell Bend
CHLOROPHYTA			
Ankistrodesmus falcatus		Jun, Aug, Oct	Jun, Aug
Dictyosphaerium pulchellum			Aug
Scenedesmus bicaudatus		Aug	Aug
S. quadricauda		Oct	Oct
BACILLARIOPHYTA			
Asterionella formosa	(1)	Oct	Oct
Cyclotella meneghiniana	(1)	Aug, Oct	Aug, Oct
C. pseudostelligera	(1,3)	Apr, Jun	Apr, Jun
Navicula tripunctata	(1)	Apr	Apr
Stephanodiscus invisitatus	(4)	Apr, Jun, Oct	Apr, Jun, Oct
Thalassiosira pseudonana	(3)	Apr, Jun, Oct	Apr, Jun, Oct
CYANOPHYTA			
Merismopedia tenissima		Aug	Aug

Table 4.2-12

Description and location of benthic macroinvertebrate sampling sites on the Susquehanna River, 1985.

Station	SSES		BELL BEND	
Site	I	II	I	III
Depth[a]	0.6	1.0	1.3	1.3
Substrate Type[b]	gravel-pebble	pebble-cobble	gravel-pebble with boulders[c]	gravel-pebble with boulders[c]
Location	850 m upriver from the center of the intake structure; 30 m from the west bank	850 m upriver from the center of the intake structure; 100 m from the west bank	710 m downriver from the center of the discharge diffuser; 40 m from the west bank	710 m downriver from the center of the discharge diffuser; 70 m from the west bank

[a] Site depth (m) when river surface elevation is 148.6 m above mean sea level (river discharge about 120 m^3/s) at the Susquehanna SES Biological Laboratory.

[b] Based on predominant particle size (Ref. 4.2-55).

[c] There tended to be accumulations of fine sediments downstream from boulders.

Table 4.2-13

Density (org/m²) and percent total of major groups of benthic macroinvertebrates collected in four dome samples at each station on the Susquehanna River in April and June, 1985.

SITE / TAXA	APR ORG/M^2	APR % TOTAL	JUN ORG/M^2	JUN % TOTAL	MEAN ORG/M^2	MEAN % TOTAL
SSES						
OLIGOCHAETA	10107	21.7	5991	9.7	8049	14.8
EPHEMEROPTERA	1161	2.5	3253	5.2	2207	4.1
HYDROPSYCHIDAE	12389	26.6	28343	45.7	20366	37.5
CHIRONOMIDAE	19799	42.6	19730	31.8	19764	36.4
OTHER	3058	6.6	4767	7.6	3913	7.2
TOTAL	46514		62084		54299	
BELL BEND						
OLIGOCHAETA	4310	18.0	2678	10.9	3494	14.4
EPHEMEROPTERA	971	4.1	1213	5.0	1092	4.5
HYDROPSYCHIDAE	1552	6.5	4356	17.8	2954	12.2
CHIRONOMIDAE	14366	60.1	12858	52.5	13612	56.3
OTHER	2707	11.3	3375	13.8	3041	12.6
TOTAL	23906		24480		24193	
COMBINED						
OLIGOCHAETA	7208	20.5	4334	10.0	5771	14.7
EPHEMEROPTERA	1066	3.0	2233	5.2	1649	4.2
HYDROPSYCHIDAE	6971	19.8	16349	37.8	11660	29.7
CHIRONOMIDAE	17081	48.5	16293	37.7	16687	42.5
OTHER	2884	8.2	4073	9.3	3479	8.9
TOTAL	35210		43282		39246	

Table 4.2-14

Benthic macroinvertebrates collected in dome samples at SSES (SS) and Bell Bend (BB) on the Susquehanna River, 1985.

	SS	BB
Coelenterata		
Hydroida		
Hydridae		
Hydra sp.	X	X
Platyhelminthes		
Turbellaria		
Alloeocoela	X	X
Tricladida	X	X
Nemertinea		
Tetrastemmatidae		
Prostoma sp.	X	X
Nematoda	X	X
Entoprocta		
Urnatella gracilis	X	X
Annelida		
Oligochaeta		
Lumbricidae	X	
Naididae		
Nais behningi	X	X
N. bretscheri	X	X
N. communis	X	X
N. elinguis	X	
N. pardalis	X	
N. simplex	X	X
Nais spp.	X	X
Piguetiella michiganensis	X	X
Slavina appendiculata	X	X
Tubificidae		
Aulodrilus limnobius	X	
Bothrioneurum vejdovskyanum	X	X
Isochaetides freyi	X	
Limnodrilus hoffmeisteri	X	X
Quistadrilus multisetosus	X	X
Lumbriculidae		
Lumbriculus sp.	X	X
Stylodrilus heringianus	X	X
Hirudinea		
Glossiphoniidae		
Actinobdella inequiannulata		X
Erpobdellidae	X	
Arthropoda		
Crustacea		
Isopoda		
Asellus sp.	X	X
Amphipoda		
Crangonx sp.		X
Gammarus sp.	X	X
Decapoda		
Astacidae	X	X
Insecta		
Collembola		
Isotomidae		
Isotomurus palustris	X	X
Plecoptera		
Nemouridae	X	
Taeniopterygidae		
Strophopteryx fasciata	X	
Taeniopteryx sp.	X	X
Leuctridae		
Leuctra sp.	X	X
Perlidae		
Acroneuria abnormis	X	
A. lycorias	X	
Acroneuria spp.	X	X
Neoperla clymene	X	X
Neoperla sp.	X	X
Phasganophora capitata	X	X
Phasganophora sp.	X	X
Perlesta sp.	X	
Perlodidae	X	

	SS	BB
Ephemeroptera		
Ephemeridae		
Ephemera sp.		X
Hexagenia limbata	X	X
Hexagenia sp.	X	X
Polymitarcidae		
Ephoron sp.	X	X
Potamanthidae		
Potamanthus spp.	X	X
Caenidae		
Caenis sp.	X	X
Tricorythidae		
Tricorythodes albilineatus gr.	X	
Tricorythodes sp.	X	X
Ephemerellidae		
Drunella cornutella	X	X
D. walkeri	X	X
Drunella spp.	X	X
Ephemerella dorothea	X	X
E. excrucians		X
E. invaria	X	X
E. needhami	X	
E. septentrionalis	X	
Ephemerella spp.	X	X
Eurylophella bicolor	X	X
E. coxalis		X
E. lutulenta		X
Eurylophella spp.	X	X
Serratella deficiens	X	X
S. sordida	X	
Serratella spp.	X	X
Leptophlebiidae		
Paraleptophlebia adoptiva		X
Paraleptophlebia sp.		X
Baetidae		
Baetis macdunnoughi		X
B. nr. *propinquus*	X	
B. tricaudatus	X	
Baetis spp.	X	X
Heterocloeon curiosum	X	
Pseudocloeon carolina	X	
Pseudocloeon sp.	X	X
Siphlonuridae		
Isonychia sp.	X	X
Heptageniidae		
Epeorus sp.	X	X
Heptagenia spp.	X	X
Rhithrogena sp.	X	X
Stenacron interpunctatum	X	X
Stenacron spp.	X	X
Stenonema ithaca	X	X
S. mediopunctatum	X	X
S. modestum	X	X
S. pulchellum	X	X
S. terminatum	X	X
S. vicarium	X	X
Stenonema spp.	X	X
Odonata		
Anisoptera		
Gomphidae		X
Stylogomphus albistylus	X	
Zygoptera		
Coenagrionidae		
Argia sp.	X	X
Hemiptera		X
Veliidae		
Microvelia sp.	X	
Megaloptera		
Sialidae		
Sialis sp.	X	X
Corydalidae		
Chauliodes sp.	X	
Corydalus cornutus	X	
Corydalus sp.	X	X

Table 4.2-14 (cont.)

	SS	BB
Trichoptera		
Glossosomatidae		
Agapetus sp.	X	
Glossosoma sp.	X	
Protoptila sp.	X	
Philopotamidae		
Chimarra obscura	X	X
Chimarra sp.	X	X
Polycentropodidae		
Neureclipsis sp.	X	X
Polycentropus sp.	X	X
Hydropsychidae		
Cheumatopsyche spp.	X	X
Hydropsyche bifida gr.	X	X
H. hageni	X	
H. morosa	X	X
H. phalerata	X	X
H. simulans	X	
H. sparna	X	
H. valanis	X	
Hydropsyche spp.	X	X
Macrostemum carolina	X	
M. zebratum	X	X
Macrostemum spp.	X	X
Hydroptilidae		
Agraylea sp.	X	
Hydroptila sp.	X	X
Ochrotrichia sp.	X	
Phryganeidae		
Ptilostomis sp.	X	
Leptoceridae		
Ceraclea alagma	X	X
C. ancylus	X	X
C. flava	X	X
C. maculata	X	X
C. mentisa	X	X
C. neffi	X	X
C. nepha	X	X
C. tarsipunctata	X	X
Ceraclea sp. #1	X	X
Ceraclea spp.	X	X
Mystacides nr. *alafimbriata*		X
Mystacides spp.	X	X
Nectopsyche sp.	X	X
Oecetis avara	X	X
O. cinerascens	X	X
O. inconspicua	X	X
O. nocturna		X
Oecetis spp.	X	X
Lepidostomatidae		
Lepidostoma sp.	X	X
Lepidoptera	X	X
Noctuidae	X	
Coleoptera		
Gyrinidae	X	X
Dineutus sp.		X
Hydrophilidae	X	X
Berosus sp.	X	X
Psephenidae		
Psephenus herricki	X	
Psephenus sp.	X	X
Elmidae		
Dubiraphia vittata	X	X
Dubiraphia sp.	X	X
Macronychus sp.	X	
Optioservus trivittatus	X	
Optioservus sp.	X	X
Stenelmis bicarinata	X	X
S. mera	X	
Stenelmis spp.	X	X
Diptera		
Tipulidae	X	X
Antocha saxicola	X	X
Antocha sp.	X	X
Hexatoma sp.	X	
Psychodidae		X
Simuliidae	X	X
Simulium spp.	X	X

	SS	BB
Diptera (cont.)		
Tabanidae	X	X
Athericidae		
Atherix sp.	X	
Empididae	X	X
Hemerodromia spp.	X	X
Ceratopogonidae	X	X
Chironomidae		
Tanypodinae		
Ablabesmyia mallochi	X	X
A. ornata	X	X
A. peleensis	X	
A. rhamphe	X	X
Ablabesmyia spp.	X	X
Labrundinia sp.	X	X
Macropelopia sp.	X	
Nilotanypus sp.	X	X
Procladius sp.	X	X
Psectrotanypus sp.	X	
Thienemannimyia gr.	X	X
Chironominae		
Chironomus decorus gr.		X
Chironomus spp.	X	X
Cryptochironomus blarina	X	X
C. fulvus gr.	X	X
Cryptochironomus spp.	X	X
Demicryptochironomus sp.		X
Dicrotendipes neomodestus	X	X
Dicrotendipes spp.	X	X
Endochironomus nigricans	X	X
Endochironomus sp.	X	X
Glyptotendipes sp.	X	X
Harnischia gr.		X
Microtendipes sp.	X	X
Nilothauma sp.		X
Parachironomus abortivus	X	X
P. carinatus	X	X
P. frequens	X	X
Parachironomus spp.	X	X
Paralauterborniella elachista	X	
Phaenopsectra sp.	X	X
Polypedilum convictum	X	X
P. fallax gr.	X	X
P. illinoense	X	
P. nr. *scalaenum*	X	X
Polypedilum spp.	X	X
Rheotanytarsus distinctissimus gr.	X	X
R. exiguus gr.	X	X
Rheotanytarsus spp.	X	X
Stenochironomus sp.	X	
Stictochironomus sp.		X
Tanytarsus coffmani	X	
Tanytarsus spp.	X	X
Tribelos fusicornis	X	X
T. jucundus	X	X
Zavrelia gr.	X	X
Diamesinae		
Diamesa sp.		X
Pseudodiamesa sp.	X	
Sympotthastia sp.	X	X
Orthocladiinae		
Brillia sp.	X	
Cardiocladius sp.	X	
Corynoneura celeripes	X	X
C. taris	X	X
Corynoneura spp.	X	X
Cricotopus bicinctus	X	X
C. tremulus	X	X
Cricotopus spp.	X	X
Eukiefferiella coerulescens gr.	X	
Eukiefferiella spp.	X	X*
Heterotrissocladius gr.	X	X
Nanocladius spp.	X	X
Orthocladius sp.	X	X

Table 4.2-14 (cont.)

	SS	BB
Orthocladiinae (cont.)		
Parametriocnemus sp.	X	X
Rheocricotopus spp.	X	X
Synorthocladius sp.	X	X
Thienemanniella spp.	X	X
Tvetenia bavarica gr.	X	X
T. discoloripes gr.	X	X
Tvetenia spp.	X	X
Mollusca		
Gastropoda		
Physidae		
Physa sp.	X	X
Lymnaeidae		
Lymnaea sp.	X	X
Planorbidae		
Gyraulus sp.	X	X
Helisoma anceps	X	
Helisoma sp.	X	X
Ancylidae		
Ferrissia sp.	X	X
Pleuroceridae		
Goniobasis virginica	X	
Pelecypoda		
Sphaeriidae		
Pisidium casertanum	X	X
Pisidium sp.	X	X
Sphaerium transversum	X	X
Sphaerium spp.	X	X
Unionidae		X

Table 4.2-15

Mean density (org/m^2) and percent total of benthic macroinvertebrates collected in four dome samples at each site on the Susquehanna River, 1985.

STATION	SSES		PERCENT	BELL BEND		PERCENT
SITE	I	II	TOTAL	I	III	TOTAL
TAXON						
ALLOEOCOELA	124	8	0.1	32	31	0.1
TRICLADIDA	2	147	0.1	11	20	<0.1
PROSTOMA SP.	152	63	0.2	49	54	0.2
NEMATODA	1150	673	1.7	1548	1244	5.8
NAIDIDAE	10748	4925	14.4	4207	1653	12.1
SLAVINA APPENDICULATA	0	0	0.0	0	0	0.0
TUBIFICIDAE	118	299	0.4	739	333	2.2
LIMNODRILUS HOFFMEISTERI	0	0	0.0	18	0	<0.1
LUMBRICULIDAE	0	8	<0.1	32	5	<0.1
GAMMARIDAE	0	0	0.0	8	2	<0.1
ASTACIDAE	0	0	0.0	5	0	<0.1
PLECOPTERA	2	6	<0.1	0	14	<0.1
PERLIDAE	6	0	<0.1	14	0	<0.1
ACRONEURIA SPP.	0	2	<0.1	0	0	0.0
NEOPERLA SP.	0	0	0.0	9	15	<0.1
PHASGANOPHORA SP.	11	17	<0.1	0	0	0.0
PARAGNETINA MEDIA	2	0	<0.1	0	0	0.0
HEXAGENIA SP.	0	0	0.0	2	0	<0.1
EPHORON SP.	934	305	1.1	75	112	0.4
POTAMANTHUS SPP.	831	727	1.4	347	828	2.4
CAENIS SP.	863	219	1.0	175	166	0.7
EPHEMERELLIDAE	9	0	<0.1	6	0	<0.1
DRUNELLA SPP.	2	2	<0.1	0	0	0.0
EPHEMERELLA SPP.	0	2	<0.1	0	0	0.0
SERRATELLA SPP.	5	5	<0.1	0	0	0.0
SERRATELLA DEFICIENS	2	0	<0.1	0	0	0.0
BAETIDAE	2	0	<0.1	0	0	0.0
ISONYCHIA SP.	25	86	0.1	11	0	<0.1
HEPTAGENIIDAE	115	189	0.3	106	118	0.5
RHITHROGENA SP.	0	0	0.0	3	0	<0.1
STENACRON SPP.	2	0	<0.1	3	0	<0.1
STENONEMA SPP.	6	0	<0.1	6	6	<0.1
STENONEMA ITHACA	2	0	<0.1	0	0	0.0
STENONEMA PULCHELLUM	17	64	<0.1	57	94	0.3
STENONEMA TERMINATUM	2	2	<0.1	17	54	0.1
ODONATA	0	0	0.0	3	2	<0.1
GOMPHIDAE	2	0	<0.1	2	0	<0.1
COENAGRIONIDAE	0	2	<0.1	6	0	<0.1
SIALIS SP.	20	6	<0.1	26	8	<0.1
CHAULIODES SP.	2	0	<0.1	0	0	0.0
CORYDALUS SP.	2	3	<0.1	0	0	0.0
TRICHOPTERA (PUPAE)	14	28	<0.1	40	14	0.1
GLOSSOSOMA SP.	0	2	<0.1	0	0	0.0
CHIMARRA SP.	15	2	<0.1	0	2	<0.1
POLYCENTROPODIDAE	5	5	<0.1	3	2	<0.1
NEURECLIPSIS SP.	11	5	<0.1	14	0	<0.1
POLYCENTROPUS SP.	2	0	<0.1	3	6	<0.1
HYDROPSYCHIDAE	81	48	0.1	0	0	0.0
CHEUMATOPSYCHE SPP.	16543	19540	33.2	3692	2017	11.8
HYDROPSYCHE SPP.	11	12	<0.1	2	0	<0.1
HYDROPSYCHE BIFIDA GR.	15	11	<0.1	0	0	0.0
HYDROPSYCHE MOROSA	186	167	0.3	0	0	0.0
HYDROPSYCHE PHALERATA	1988	2106	3.8	141	57	0.4
MACROSTEMUM SPP.	9	17	<0.1	0	0	0.0

Table 4.2-15 (cont.)

STATION	SSES		PERCENT	BELL BEND		PERCENT
SITE	I	II	TOTAL	I	III	TOTAL
TAXON						
LEPTOCERIDAE	26	6	<0.1	20	46	0.1
CERACLEA SPP.	6	12	<0.1	23	14	<0.1
CERACLEA ANCYLUS	0	0	0.0	3	0	<0.1
CERACLEA FLAVA	0	0	0.0	5	0	<0.1
CERACLEA MACULATA	9	18	<0.1	37	5	<0.1
CERACLEA MENTIEA	3	20	<0.1	0	0	0.0
CERACLEA NEFFI	0	2	<0.1	0	0	0.0
NYSTACIDES SPP.	0	0	0.0	0	2	<0.1
NECTOPSYCHE SP.	75	112	0.2	115	32	0.3
OECETIS SPP.	34	6	<0.1	127	64	0.4
OECETIS AVARA	6	0	<0.1	2	0	<0.1
OECETIS CINERASCENS	6	2	<0.1	18	14	<0.1
BEROSUS SP.	2	0	<0.1	2	0	<0.1
PSEPHENUS SP.	2	0	<0.1	0	0	0.0
DUBIRAPHIA SP.	31	3	<0.1	21	15	<0.1
DUBIRAPHIA SP.(ADULTS)	3	5	<0.1	0	0	0.0
OPTIOSERVUS SP.	40	28	<0.1	8	2	<0.1
STENELMIS SP.	1709	1049	2.5	307	433	1.5
STENELMIS SP.(ADULTS)	8	37	<0.1	8	14	<0.1
SIMULIIDAE	6	46	<0.1	6	0	<0.1
ATHERIX SP.	2	0	<0.1	0	0	0.0
EMPIDIDAE (PUPAE)	2	2	<0.1	0	0	0.0
HEMERODROMIA SP.	370	229	0.6	64	40	0.2
CERATOPOGONIDAE	0	0	0.0	21	14	<0.1
CHIRONOMIDAE (PUPAE)	360	287	0.6	431	0	0.9
ABLABESMYIA MALLOCHI	0	0	0.0	35	72	0.2
THIENEMANNIMYIA GR.	2658	2517	4.8	1258	1942	6.6
CHIRONOMINAE	35	35	<0.1	0	71	0.1
CHIRONOMUS SPP.	0	0	0.0	107	0	0.2
CRYPTOCHIRONOMUS SPP.	35	35	<0.1	575	107	1.4
DICROTENDIPES SPP.	252	143	0.4	719	250	2.0
ENDOCHIRONOMUS NIGRICANS	144	252	0.4	178	178	0.7
GLYPTOTENDIPES SP.	72	0	<0.1	107	0	0.2
MICROTENDIPES SP.	2587	2911	5.1	5428	3055	17.5
PARACHIRONOMUS SPP.	252	35	0.3	35	0	<0.1
POLYPEDILUM CONVICTUM	2445	3129	5.1	1006	215	2.5
POLYPEDILUM FALLAX GR.	35	0	<0.1	0	0	0.0
POLYPEDILUM NR. SCALAENUM	252	216	0.4	107	143	0.5
RHEOTANYTARSUS SPP.	5357	5069	9.6	1367	1258	5.4
TANYTARSUS SPP.	35	35	<0.1	106	0	0.2
ZAVRELIA GR.	322	0	0.3	287	647	1.9
ORTHOCLADIINAE	0	35	<0.1	0	35	<0.1
CARDIOCLADIUS SP.	107	72	0.2	0	0	0.0
CORYNONEURA SPP.	0	0	0.0	35	0	<0.1
CRICOTOPUS SPP.	862	1798	2.4	718	468	2.5
CRICOTOPUS BICINCTUS	1581	1437	2.8	287	755	2.2
EUKIEFFERIELLA SPP.	413	215	0.6	35	215	0.5
NANOCLADIUS SPP.	431	431	0.8	3163	1474	9.6
ORTHOCLADIUS SP.	35	0	<0.1	0	0	0.0
SYNORTHOCLADIUS SP.	71	0	<0.1	107	0	0.2
THIENEMANNIELLA SPP.	0	0	0.0	0	72	0.1
TVETENIA DISCOLORIPES GR.	934	1581	2.3	143	35	0.4
PHYSA SP.	0	0	0.0	0	3	<0.1
LYMNAEA SP.	2	0	<0.1	0	3	<0.1
FERRISSIA SP.	18	37	<0.1	11	71	0.2
PISIDIUM SP.	41	77	0.1	97	410	1.0
SPHAERIUM SPP.	689	563	1.2	287	538	1.7

Table 4.2-16

Mean and maximum flow of the Susquehanna River from 1 January to the beginning of the April sampling period, 1978-82 and 1985.

Year	Dates	Mean Flow (m^3/s)	Maximum Flow (m^3/s)
1985	1 Jan-15 Apr	451	1,581 (14 Mar)
1982	1 Jan-25 Apr	632	1,735 (27 Mar)
1981	1 Jan-12 Apr	517	2,768 (22 Feb)
1980	1 Jan-20 Apr	523	2,556 (23 Mar)
1979	1 Jan-22 Apr	911	5,916 (7 Mar)
1978	1 Jan-16 Apr	930	3,057 (23 Mar)

Table 4.2-17

Dry weight (g/m^2) and percent total of major groups of benthic macroinvertebrates collected in two dome samples at each station on the Susquehanna River in April, June, August, and October 1985.

SITE / TAXA	APR G/M²	APR % TOTAL	JUN G/M²	JUN % TOTAL	AUG G/M²	AUG % TOTAL	OCT G/M²	OCT % TOTAL	MEAN G/M²	MEAN % TOTAL
SSES										
EPHEMEROPTERA	0.2	2.3	1.4	27.4	0.2	7.1	0.2	11.0	0.5	11.2
TRICHOPTERA	6.7	88.2	2.9	57.0	2.2	67.9	1.5	64.3	3.3	72.9
DIPTERA	0.2	2.1	<0.1	1.8	0.3	8.9	<0.1	0.4	0.1	3.0
MOLLUSCA	0.3	3.5	0.2	4.9	0.4	12.8	0.4	17.5	0.3	7.3
OTHER	0.3	3.9	0.4	8.9	0.1	3.3	0.2	6.8	0.3	5.6
TOTAL	7.6		5.0		3.2		2.3		4.5	
BELL BEND										
EPHEMEROPTERA	0.2	7.4	1.2	65.3	0.2	17.6	0.4	47.5	0.5	27.9
TRICHOPTERA	0.7	21.1	0.3	18.8	0.2	12.7	<0.1	10.4	0.3	17.8
DIPTERA	2.1	63.8	0.1	8.1	0.6	46.3	<0.1	3.1	0.7	40.2
MOLLUSCA	<0.1	1.5	<0.1	2.7	0.1	10.6	0.1	15.8	<0.1	5.1
OTHER	0.2	6.2	<0.1	5.1	0.2	12.8	0.2	23.2	0.2	9.0
TOTAL	3.3		1.8		1.4		0.8		1.8	
COMBINED										
EPHEMEROPTERA	0.2	3.9	1.3	37.4	0.2	10.3	0.3	20.3	0.5	16.0
TRICHOPTERA	3.7	67.8	1.6	47.0	1.2	51.2	0.8	50.5	1.8	57.1
DIPTERA	1.1	20.9	0.1	3.5	0.5	20.3	<0.1	1.1	0.4	13.7
MOLLUSCA	0.2	2.9	0.1	4.3	0.3	12.2	0.3	17.1	0.2	6.7
OTHER	0.3	4.5	0.3	7.8	0.1	6.0	0.2	11.0	0.2	6.5
TOTAL	5.5		3.4		2.3		1.5		3.2	

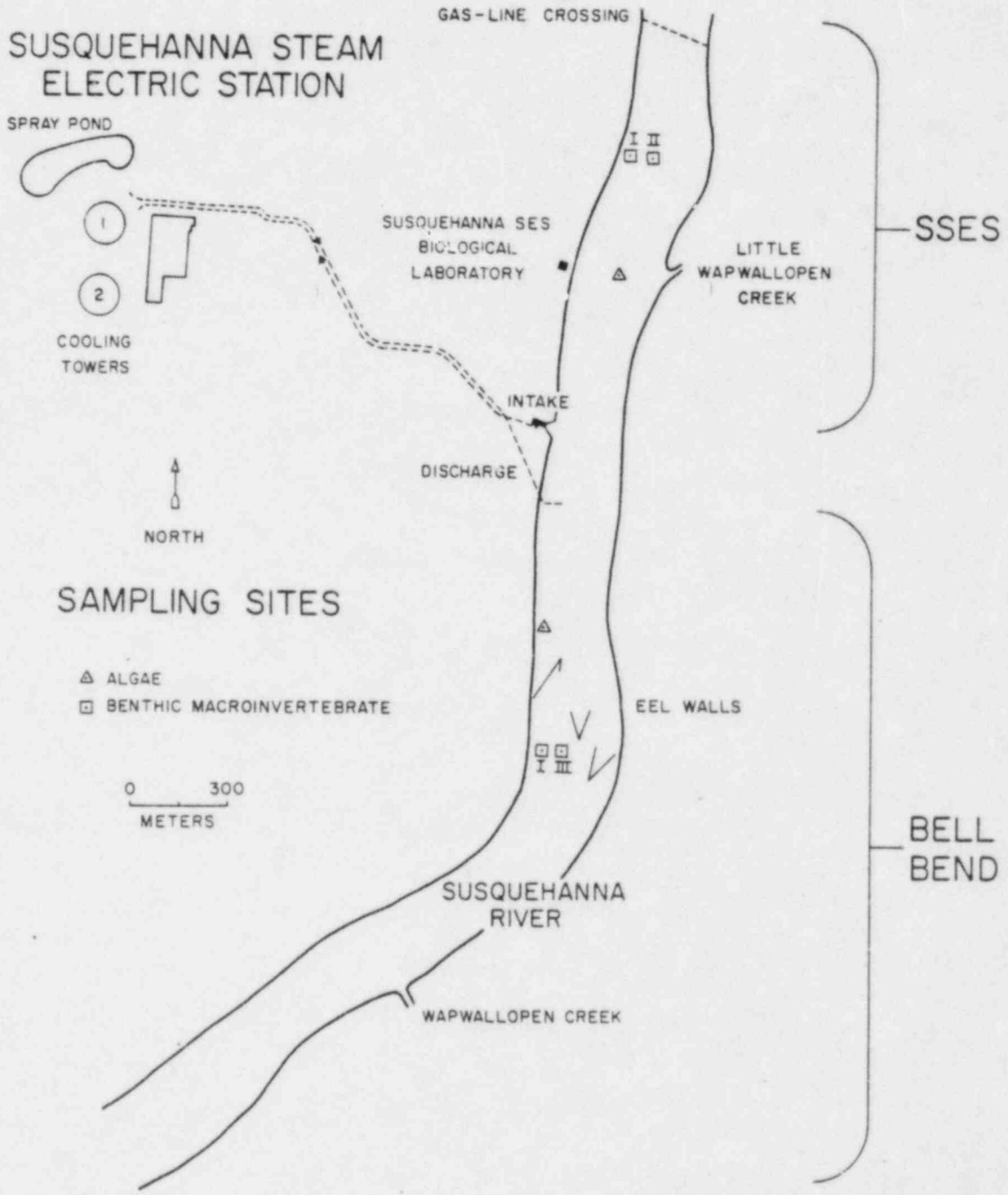

Fig. 4.2-1

Algae and benthic macroinvertebrate sampling sites at SSES and Bell Bend on the Susquehanna River, 1985.

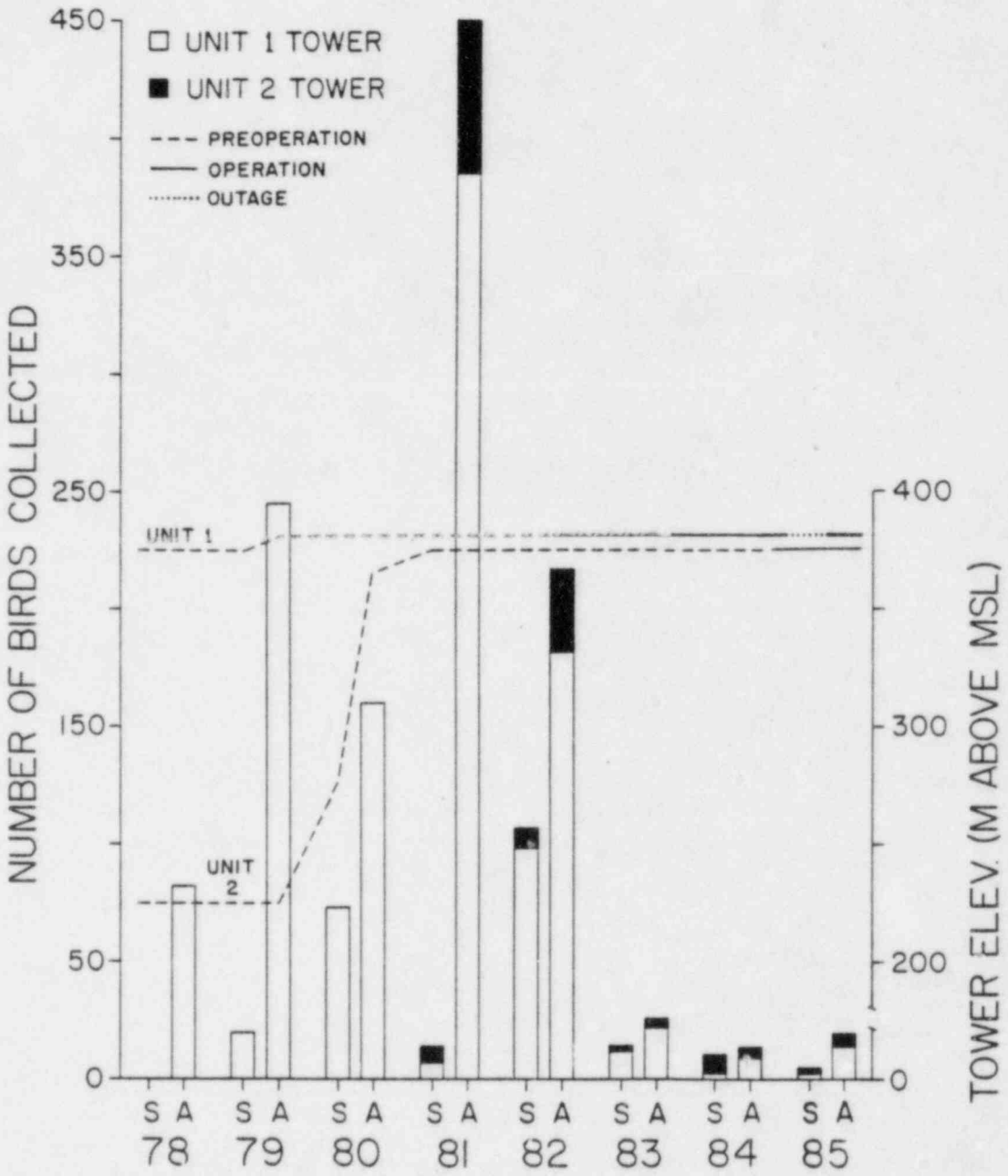

Fig. 4.2-2

Total number of impacted birds collected at the Unit 1 and 2 cooling towers of the Susquehanna SES during spring and autumn migrations from 1978 through 1985 with the elevation of each tower during the same period. No data were collected at the Unit 1 tower before autumn 1978 and at the Unit 2 tower before spring 1981.

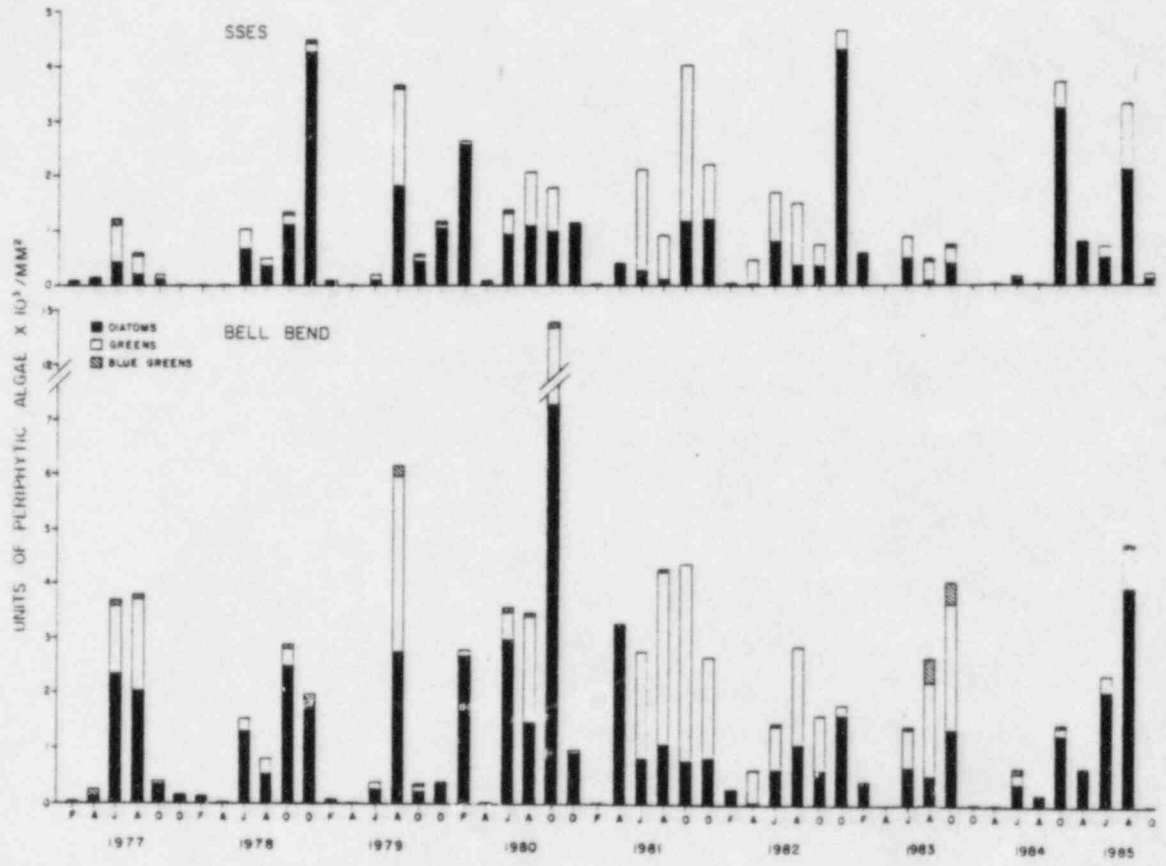

Fig. 4.2-.

Standing crop of periphytic algae (units/mm^2) on cumulative acrylic plates at SSES and Bell Bend on the Susquehanna River, 1977-85.

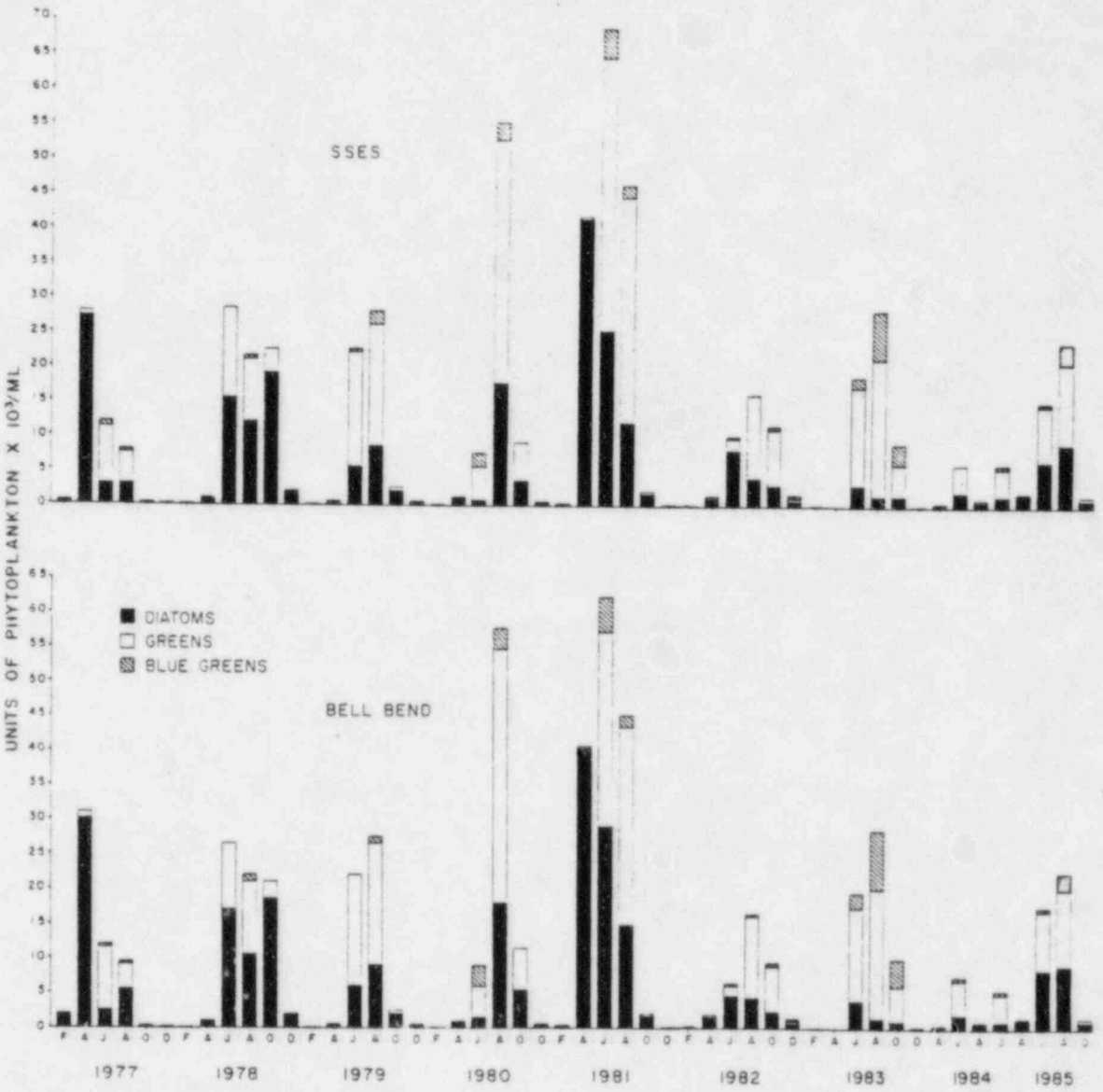

Fig. 4.2-4

Standing crop of phytoplankton (units/ml) at SSES and Bell Bend on the Susquehanna River, 1977-85.

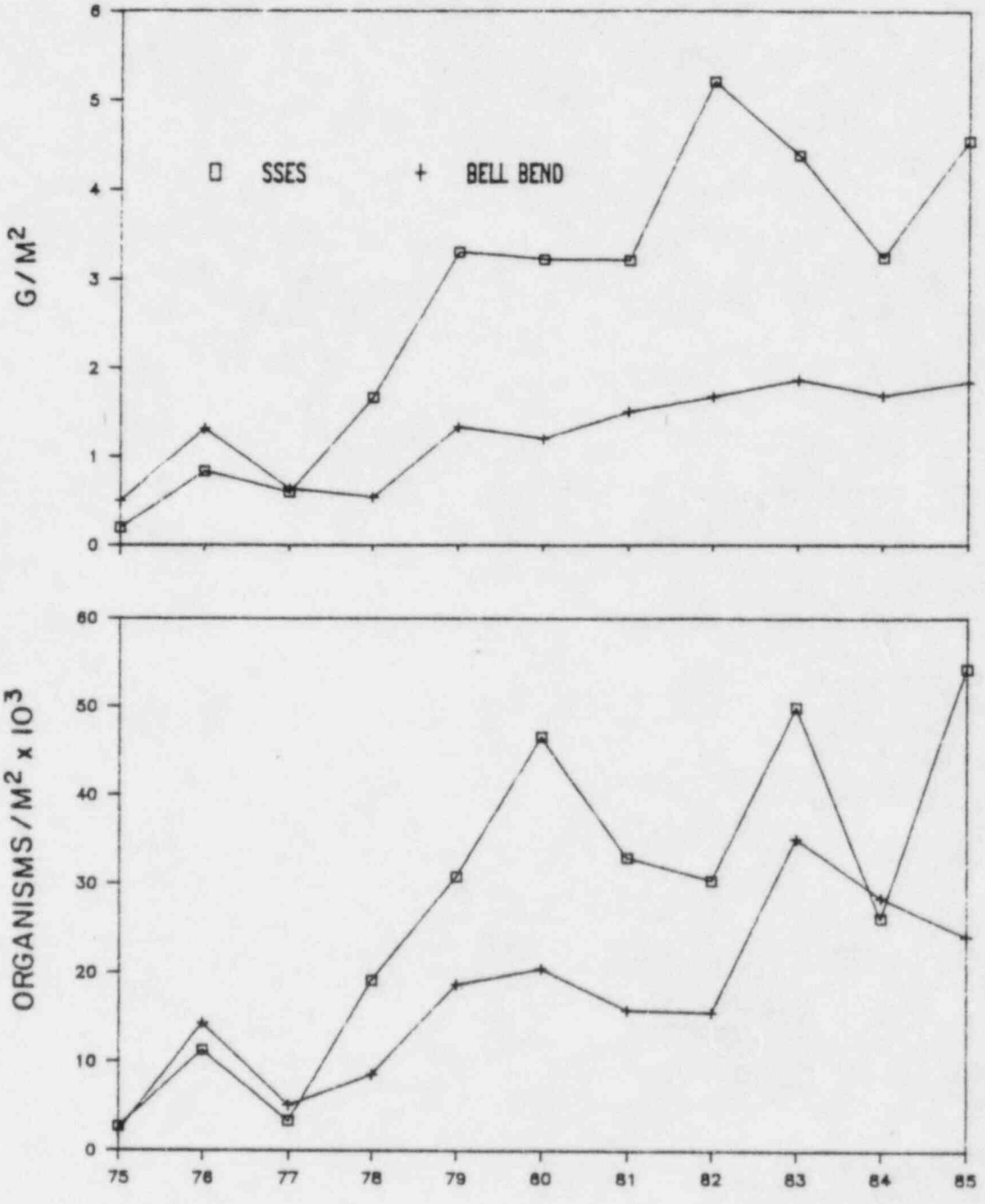

Fig. 4.2-5

Annual mean biomass (g/m^2) and density (org/m^2) of benthic macroinvertebrates at SSES and Bell Bend on the Susquehanna River, 1975-85. At Bell Bend, only site I was collected from 1975-77.

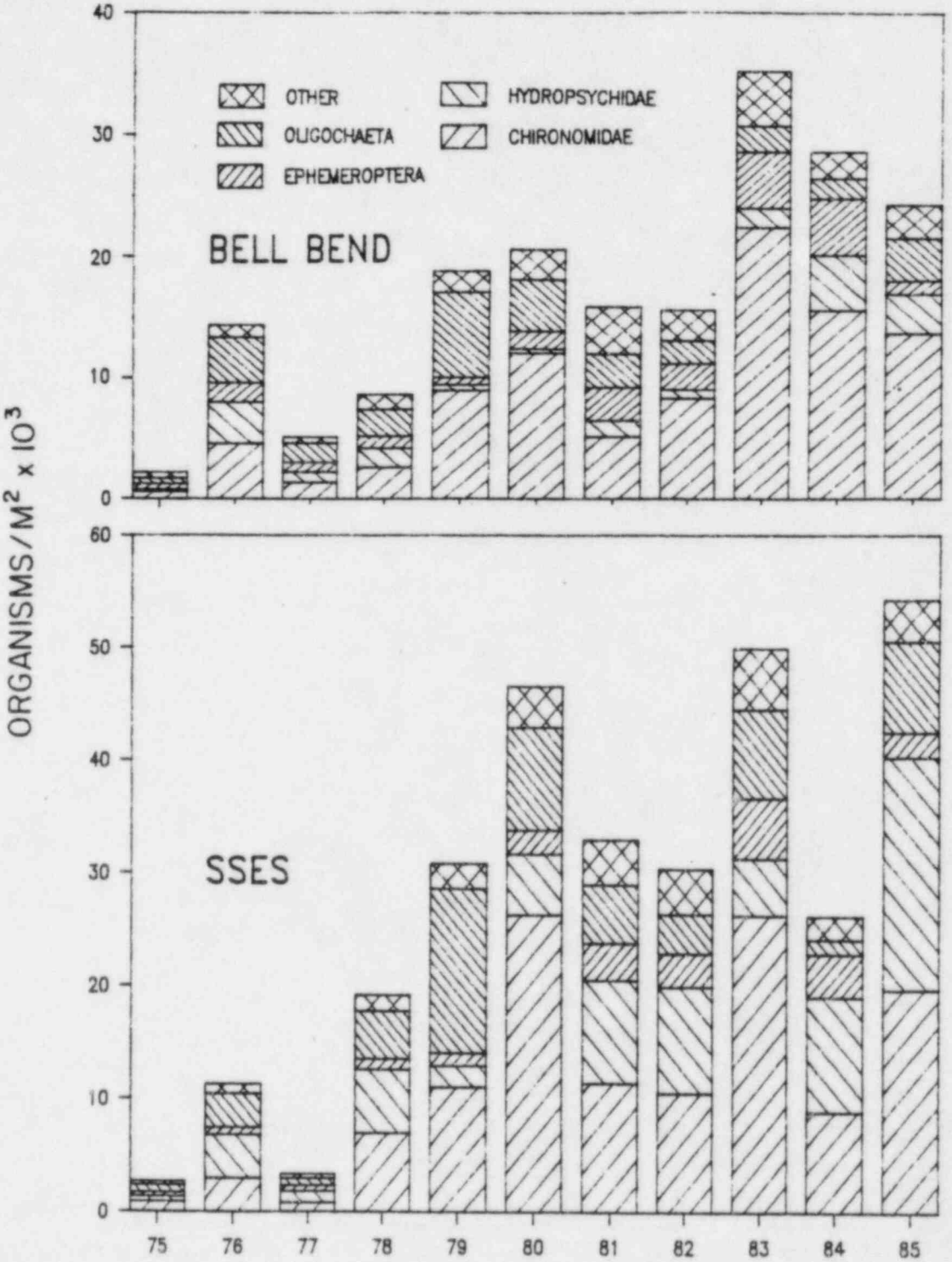

Fig. 4.2-6

Annual mean density (org/m^2) of benthic macroinvertebrates at SSES and Bell Bend on the Susquehanna River, 1975-85. At Bell Bend, only site I was collected from 1975-77.

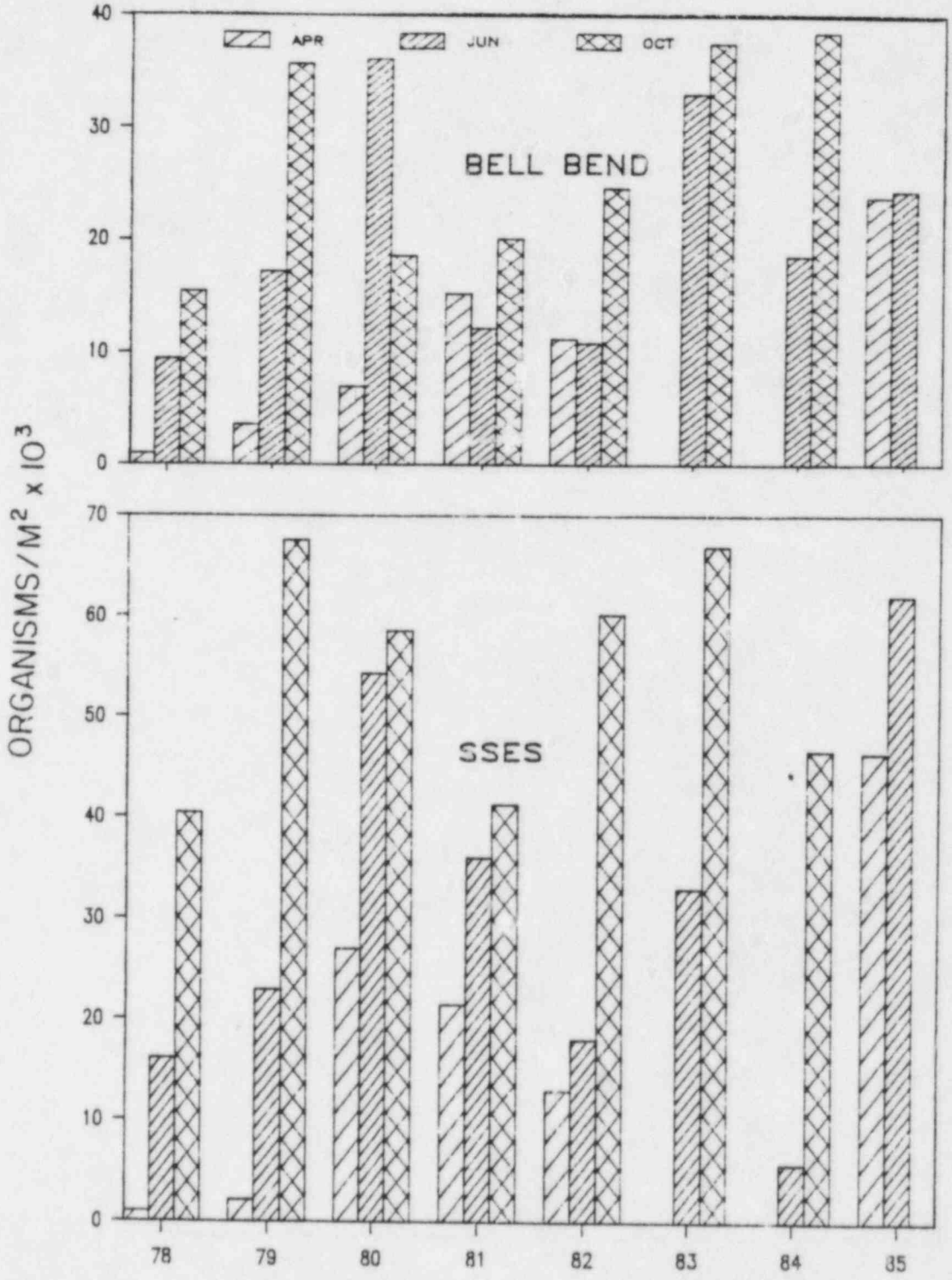

Fig. 4.2-7

Mean density of benthic macroinvertebrates (org/m²) at SSES and Bell Bend on the Susquehanna River, 1978-85.

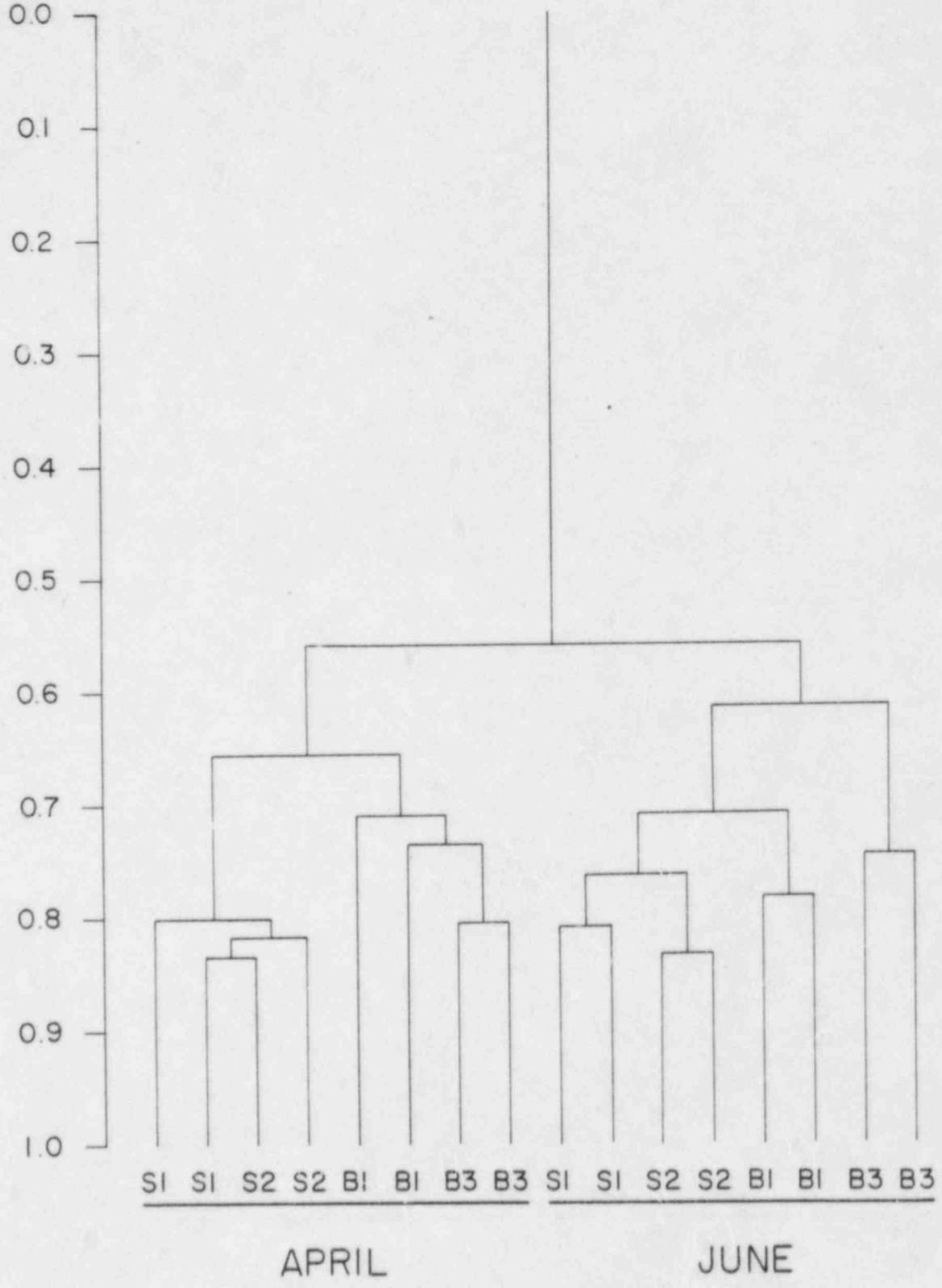

Fig. 4.2-8

Dendrogram of the cluster analysis of Bray-Curtis similarity matrices for 1985 benthic macroinvertebrate data at SSES I (S1), SSES II (S2), Bell Bend I (B1), and Bell Bend III (B3) on the Susquehanna River in April and June 1985.

5.0 ADMINISTRATIVE PROCEDURES

5.1 REVIEW AND AUDIT

The Licensee has established procedures for an independent group to review and audit compliance with the EPP. Audits of EPP compliance are conducted by the Nuclear Quality Assurance Department with support from the Environmental Management Department.

The Manager-Nuclear Support is responsible for off-site environmental matters and for providing any related support concerning licensing. The Superintendent of Plant-Susquehanna is responsible for on-site environmental matters. The Manager-Nuclear Quality Assurance with support from the Supervisor-Environmental Planning/Auditing is responsible for verifying compliance with the EPP. Figure 5.1-1, Auditing Organizational Chart, lists the various groups utilized in environmental reviewing and auditing of the Susquehanna SES environmental monitoring programs.

5.2 RECORDS RETENTION

Records and logs relative to the environmental aspects of plant operation and audit activities are retained in the Susquehanna Records Management System. This system provides for a convenient review and inspection of environmental documents which shall be made available to the NRC upon request.

Records of modifications to the plant structures, systems and components determined to potentially affect the continued protection of the environment shall be retained for the life of the plant. All other records, data and logs relating to the environmental programs and monitoring shall be retained for at least five years or, where applicable, in accordance with the requirements of other agencies.

5.3 CHANGES IN ENVIRONMENTAL PROTECTION PLAN

There were no requests for changes in the EPP during 1985.

5.4 PLANT REPORTING REQUIREMENTS

5.4.1 ROUTINE REPORTS

This Annual Environmental Operating Report was prepared to meet routine reporting requirements of the EPP for 1985. It provides summaries and analyses of environmental protection activities required in Subsection 4.2 of the EPP for the reporting period. Included in Subsection 4.2 of this report are environmental comparisons with nonradiological preoperational studies, and an assessment of observed impacts of plant operation on the environment. During 1985, there were no significant effects or evidence of trends towards irreversible damage to the environment.

5.4.2 NONROUTINE REPORTS

All nonroutine events that were reportable during 1985 were reported to either federal, state or local agencies in accordance with their reporting requirements in lieu of requirements of Subsection 5.4.2 of the EPP The NRC was provided with a copy of these reports.

FIGURE 5.1-1

AUDITING ORGANIZATION CHART

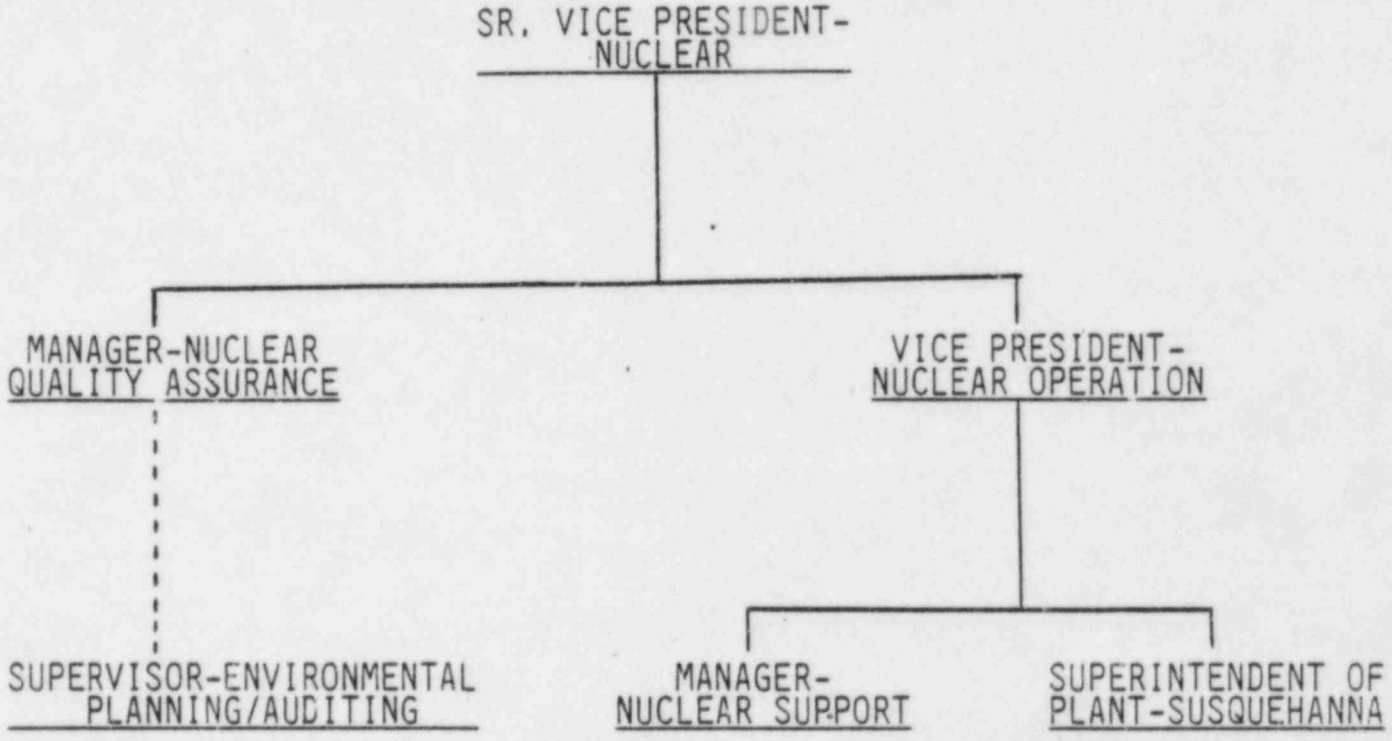

EXHIBIT 1

- Shad Impingement Survey

Ecology III, Inc.

ENVIRONMENTAL CONSULTING SERVICES

R.D. #1 — Berwick, PA 18603
(717) 542-2191

SUSQUEHANNA SES BIOLOGICAL LABORATORY

27 January 1986

Mr. Richard St. Pierre
U.S. Fish & Wildlife Service
Box 1673
Harrisburg, PA 17105-1673

Dear Dick:

Pursuant to our conversation on 19 December 1985, juvenile American shad were not collected during a survey of the river water intake at the Susquehanna Steam Electric Station from 6 September through 11 October 1985. During this period, Ecology III personnel used sampling baskets (1/2-inch mesh) to filter both traveling screen and trash bar wash water at the intake. The baskets were checked once each day, Monday through Friday (washes from Saturday and Sunday were included with the Monday collections). Excessive debris from high river flow caused by Hurricane Gloria tore the netting and broke the frames of both baskets on 28 September 1985. They were repaired and sampling was reinitiated at 0900 hours on 30 September.

Leaf litter and small numbers of at least 11 species of common river fishes were collected throughout the survey, but, as stated previously, no juvenile American shad were taken.

If you have any questions or comments, please contact me at your convenience.

Respectfully yours,

Theodore V. Jacobsen,
Project Director

TVJ/msh

cc: J. S. Fields (PP&L)
T. W. Robbins (NES)

EXHIBIT 2

- Sound Level Measurements Near Susquehanna Steam Electric Station Site 1985