Report on NJPDES Special Conditions

EVALUATION OF SPECIAL CONDITIONS CONTAINED IN SALEM NUCLEAR GENERATING STATION NJPDES PERMIT TO RESTORE WETLANDS, INSTALL FISH LADDERS AND INCREASE BIOLOGICAL ABUNDANCE WITHIN THE DELAWARE ESTUARY

The Public Service Electric and Gas Company (PSE&G) Salem Nuclear Generating Station located along the Delaware River Estuary at Artificial Island, River Mile (RM) 50 withdraws over three billion of gallons of water from the Estuary daily for cooling. Over three billion fish are killed each year due to impingement and entrainment at Salem's cooling water intake. The 1994 and the 2001 New Jersey Pollutant Discharge Elimination System (NJPDES) permits for Salem contained special conditions including a wetland restoration and enhancement program in and around the Delaware Estuary, the installation of fish ladders, and a baywide biological monitoring program. The purpose of the wetland restoration program and the installation of fish ladders is to enhance the production of fish in the Delaware Estuary in hopes of offsetting the loss of the billions fish that are killed by the cooling water intake system. This Fact Sheet provides a brief summary of the evaluation of the success of the special conditions by Carpenter Environmental Associates, Inc.

Wetland Restoration

PSE&G has undertaken restoration efforts at 3,723 acres of ***Phragmites*-dominated wetlands** in New Jersey, 4,398 acres of *Phragmites*-dominated wetlands in Delaware, and 4,398 acres of diked **salt hay farms** in New Jersey. The restoration program included applying herbicides, prescribed burning, and mowing to *Phragmites*-dominated marshes and opening former salt hays farms to tidal inundation.

Phragmites Dominated Sites

- At the *Phragmites* dominated sites, the *Phragmites* eradication program has reduced *Phragmites* coverage. Most sites have reached or exceeded PSE&G's interim goal of 45 % coverage by Spartina and other "desirable marsh vegetation". However, the sustainability of the Phragmites reduction appears to be dependent on annual herbicide treatment. The true success of the *Phragmites* control program cannot be determined until herbicide treatment has been discontinued. In addition, at the Alloways site the interim goal was met through the removal of approximately 1,000 acres of *Phragmites* dominated wetlands from the restoration program—an action which then skewed the perceived results by removing from the program a problematic site.

- The restoration of the *Phragmites* dominated sites was expected to increase fish utilization of those areas. This has not been demonstrated by the data to present. Monitoring at Alloway Creek includes several sites (a) dominated by *Phragmites*, (b) dominated by *Spartina* or (c) under treatment for

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Phragmites removal ("*Treated*" sites). The 2000 monitoring showed that within the Alloway Creek study area, fish abundance was similar at all three types of sites. In 2002, fish abundance at the *Phragmites* dominated site at Alloway Creek was approximately twice as great than that seen at *Spartina* dominated site and the treated site at Alloway Creek. Reproduction of mummichog and Atlantic silverside was seen in the *Phragmites* dominated sites both prior to and following the treatment of *Phragmites* and growth patterns were seen to be similar for mummichog and Atlantic silverside both pre and post treatment as well. Studies also indicate that mummichog use *Phragmites* as a food source in *Phragmites* dominated sites. These results indicate that *Phragmites* eradication has not demonstrated an increased utilization of the site by fish and/or increased fish production.

Salt Hay Farms

- Tidal flow has successfully returned to the New Jersey salt hay farms. Not all sites have attained percent coverage goals for *Spartina* coverage but *Spartina* and other desirable species do dominate the three sites. The restored salt hay farms that were originally dominated by *Spartina* have reached the set goal of marsh coverage after repeated herbicide applications (Dennis Township and Maurice River) but the one farm that was dominated by *Phragmites* (Commercial Township) has not yet reached the interim goal of 45% *Spartina* coverage and doesn't come close to the vegetative coverage of the reference marsh at Moores Beach.
- Young of the year fish assemblages were similar between the restored salt marshes and the reference marshes including size composition, seasonal patterns of occurrence and species composition. Predator species such as striped bass and white fish were also found to be utilizing the restored salt hay farm marshes, with a higher diversity of species and a higher density of predator fish as compared to the reference marshes. Forage studies indicated that food habits of the fish were similar between the restored salt marshes and the reference marshes.

Fish Ladders

The fish ladder program included installation of fish ladders at eight sites. Stocking of the sites was conducted to facilitate future usage of the sites by returning offspring.

- Four of the eight ladders (McColley Pond, Coursey Pond, McGinnis Pond, and Moores Lake) are working well with large numbers of adult fish utilizing the fish ladders with limited stocking. The fish ladders at Sunset Lake and Silver Lake are also supporting adult fish passage. Although fish passage was observed at Garrison Lake in 2000, very little usage of that fish ladder has been seen in 2001 and 2002. The fish ladder at Coopers Lake does not appear to be supporting fish passage based upon the low numbers of fish observed utilizing that site since construction was complete. Evidence of spawning was seen in all sites except Garrison Lake. It does not appear that the stocking efforts have been successful in establishing the return of offspring to the fish ladder sites. Three of the four sites with large numbers of fish utilizing the ladders received limited stocking, indicating that the fish utilizing the fish ladders are most likely pioneers, rather than either returning stocked fish or offspring of stocked fish. The sites that have received the largest numbers of stocked fish continue to show limited use of the fish ladders by adults.

Baywide Abundance

Data available shows no increase in baywide abundance values of the representative important species or Atlantic silverside since PSEG completed the marsh restoration and fish ladder installations. Striped bass data is difficult to interpret as the abundance numbers in the Delaware are apparently linked to abundance in Chesapeake Bay. Overall, it appears that striped bass have increased, although this increase is not statistically significant. Weakfish and white perch declined in numbers after 1997, although the decline was not statistically significant. A decline was also seen for spot, bay anchovy, Atlantic silverside (1994-2001), and American shad, with the decline being statistically significant for American shad when comparing 1991-1994 data to 1997-2001 data. Increases have been seen in blueback herring, although these increases are not statistically significant.

THIS FACT SHEET IS BASED ON THE REPORT “EVALUATION OF SPECIAL CONDITONS CONTAINED IN SALEM NUCLEAR GENERATING STATION NJPDES PERMIT TO RESTORE WETLANDS, INSTALL FISH LADDERS, AND INCREASE BIOLOGICAL ABUNDANCE WITHIN THE DELAWARE ESTUARY” PREPARED BY CARPENTER ENVIRONMENTAL ASSOCIATES, INC. FOR DELAWARE RIVERKEEPER NETWORK, DECEMBER 2003.