

## **6. CONCLUSIONS AND RECOMMENDATIONS**

The evaluation of 90 select freshwater wetland mitigation sites around the State of New Jersey indicates that between 1988 and 1999 wetland mitigation practices have not been effective in meeting NJDEP's NEPPS goals for increasing wetland quantity and quality in New Jersey. Less than one out of every two acres of proposed mitigation resulted in achieving a freshwater wetland. These findings are generally consistent with a study conducted by the National Research Council (NRC 2001). Mitigation projects most likely to be successful in terms of quantity of wetlands achieved were emergent and open water wetland creation and restoration projects that rely on stream diversion as the major source of hydrology. The mitigation sites included in this study were selected, in part, based upon the quality and availability of mitigation plans and specifications. It is reasonable to assume, therefore, that if an evaluation of all remaining mitigation sites (that had been approved prior to NJDEP's more recent implementation of performance-based mitigation plans) were conducted, the findings would result in a further reduction of indicator scores. However, it should be noted that some high quality wetlands of all proposed mitigation types were observed during the course of this study. For example, see Photo 3 (forested and scrub/shrub communities), Photo 4 (emergent community), and Photo 5 (State open water and emergent communities). These successful projects provide evidence that high quality wetland creation is possible given the level of knowledge currently available.

Presented below are conclusions and recommendations of this study regarding planning and design; implementation, oversight, and training; data management; tracking and research; and avoiding and minimizing impacts to wetland resources. In general, many of these findings are comparable to those presented in the National Research Council's national study mentioned above.

### **Planning and Design**

One of the major difficulties encountered during this study involved the lack of clearly defined mitigation plans and specifications that could be readily and consistently measured. This issue

**Mitigation Site ID = 130**  
**Wetland Achieved = 126.39%**  
**Concurrence Score = 76.18**  
**WMQA Index = 0.74**  
**Size (acres) = 0.72**  
**Wetland Type (acres)**  
  
**Compensation Ratio (x:1)**

| Proposed | Achieved |
|----------|----------|
| 1.00     | 1.26     |



Photo 3: Created Wetland Trending Toward Forested Community

Although forested wetlands are difficult to create, a reliable source of hydrology and good soil conditions were the most common factors among successful mitigation sites.

|                                 |               |          |          |
|---------------------------------|---------------|----------|----------|
| <b>Mitigation Site ID =</b>     | <b>105</b>    |          |          |
| <b>Wetland Achieved =</b>       | <b>91.30%</b> |          |          |
| <b>Concurrence Score =</b>      | <b>96.32</b>  |          |          |
| WMQA Index =                    | 0.56          |          |          |
| <b>Size (acres) =</b>           | <b>0.92</b>   |          |          |
| <b>Wetland Type (acres)</b>     |               |          |          |
|                                 | Impacted      | Proposed | Achieved |
| Forest                          |               |          |          |
| Shrub                           |               |          |          |
| Emergent                        | 0.92          | 0.92     | 0.84     |
| Open Water                      |               |          |          |
| <b>Compensation Ratio (x:1)</b> |               |          |          |
|                                 | Proposed      | Achieved |          |
|                                 | 1.00          | 0.91     |          |



Photo 4: Created Emergent Wetland

Emergent wetlands generally achieved the highest Wetland Achieved and Concurrence scores.

**Mitigation Site ID = 059**

**Wetland Achieved = 100.82%**

**Concurrence Score = 65.85**

**WMQA Index = 0.56**

**Size (acres) = 12.2**

**Wetland Type (acres)**

|            | Impacted | Proposed | Achieved |
|------------|----------|----------|----------|
| Forest     |          |          |          |
| Shrub      |          |          |          |
| emergent   |          | 9.20     | 0.62     |
| Open Water |          | 3.00     | 11.69    |

**Compensation Ratio (x:1)**

| Proposed | Achieved |
|----------|----------|
| 1.00     | 1.01     |



Photo 5: Created Wetland Containing Predominantly Open Water

This created wetland is comprised of mostly open water with an emergent wetland fringe.

may have been addressed in the recently adopted revisions to New Jersey's Freshwater Wetland Protection Act Rules that specifically outline the requirements to submit a wetland mitigation proposal. These efforts should continue, and the standard application guidance should be linked to standardized success criteria and monitoring report requirements that should be applied consistently where possible.

Mitigation was not always conducted in suitable locations. Mitigation was also often divided into very small parcels of wetland creation. These small, isolated mitigation areas often did not become wetlands as planned, or, if wetlands were created, they were of low quality. Mitigation should always be located in an area that has a reliable, predictable hydrologic source. A hydrologic or water budget that includes a demonstration that the identified hydrologic source is reliable and adequate should be a requirement for all mitigation proposals. Inadequate hydrology was a major contributing factor to low Wetland Area Achieved indicator scores (see Photo 6).

All mitigation plans should include provisions for regular inspections, maintenance, and, if needed, mid-course corrections. For example, grading may have to be corrected to accommodate field conditions and the wetland may require regular maintenance after the implementation phase to control invasive vegetation. Performance standards implemented through a series of site inspections and standardized monitoring requirements are needed to ensure that corrective action, if needed, can and will be implemented.

Mitigation plans and monitoring report requirements should include a statement of the mitigation goals in each report, including wetland acreage and type, and should clearly indicate to what extent these goals can or have been met. Very few monitoring reports reviewed for this study contained such information. Consistent application of these requirements would facilitate compliance efforts and would greatly increase NJDEP's ability to measure the success of such efforts in achievement of programmatic and/or NEPPS goals. The setting of clear, realistic goals prior to the implementation of a mitigation project may also increase chances of success (Ehrenfeld, 2000; Keddy, 1999).

**Mitigation Site ID = 051**  
**Wetland Achieved = 0.00%**  
**Concurrence Score = 65.83**  
**WMQA Index = n/a**  
**Size (acres) = 13.01**

**Wetland Type (acres)**

|            | Impacted | Proposed | Achieved |
|------------|----------|----------|----------|
| Forest     | 2.84     | 10.61    |          |
| Shrub      | 2.93     | 1.20     |          |
| Emergent   | 2.77     | 1.20     |          |
| Open Water |          |          |          |

**Compensation Ratio (x:1)**

| Proposed | Achieved |
|----------|----------|
| 1.52     | 0.00     |



Photo 6: Proposed Creation Site with Inadequate Hydrology to Support a Wetland

Although this mitigation site was generally consistent with approved plans in terms of design, the site failed to achieve wetlands due to inadequate hydrology. Inadequate hydrology was a major contributing factor to low Wetland Achieved scores.



Given the low level forested wetland creation success, NJDEP should focus special attention on the mitigation plan review and follow-up work required for this mitigation type. It appears that the low level of forested wetland creation was due at least in part to lack of sufficiently detailed hydrologic and planting specifications in mitigation plans, the failure of contractors to plant trees in accordance with specifications, and high mortality of trees due to herbivory and/or poor stock. In general, higher standards of performance should be applied to forested wetland creation projects.

Mitigation wetlands that were stormwater-driven scored relatively low in terms of wetland quality and had relatively high levels of nuisance and invasive plant species. NJDEP should continue to discourage stormwater as a source of water for mitigation wetlands.

Only 47.5% of approved mitigation area was constructed in accordance with NJDEP approvals. Although this score represents a qualitative assessment, ongoing efforts to refine and apply standardized design requirements will only be beneficial if coupled with compliance monitoring and regulatory oversight.

Given the low level of success found during this study, it is clear that NJDEP should continue to require and strengthen financial assurance for mitigation projects. The financial assurance should be in an amount sufficient for the NJDEP to hire an independent contractor to complete and maintain the mitigation project should the mitigator default.

Lastly, in light of the general findings of this study, and in particular the failure of the majority of proposed forested wetland creation sites, the Department may want to consider an increase in the regulatory mitigation ratio for specific types of wetlands, especially forested wetlands, to reach programmatic and NEPPS goals.

### **Implementation, Oversight and Training**

Many of the problems encountered in successful mitigation implementation could be corrected with increased follow-up conducted early in the implementation phase of the mitigation project. During the course of this study, we found that the most ecologically successful sites were

generally those that had received follow-up work in the form of maintenance, replanting, or improvements to grading or water control structures in accordance with recommendations made by NJDEP and other regulatory agencies after initial compliance inspections revealed problems. These observations are consistent with mitigation studies in other states (e.g. Redmond, 1992). An increase in compliance inspections, possibly coupled with increased construction oversight by experienced wetland ecologists would likely increase all indicators evaluated in this study. At a minimum, NJDEP should consider conducting two site inspections during construction of each mitigation site including immediately after initial grading, and again after planting is implemented.

NJDEP should develop requirements for increased oversight of mitigation construction by qualified wetland ecologists. It was found during field inspections that even for sites that were well-planned and included clear construction and planting specifications, mitigation often was not in compliance with permit requirements and did not achieve the amount or type of wetlands required. Field oversight during implementation could increase compliance with mitigation plans and result in substantial increases in mitigation success. Requiring the applicant to retain a trained and experienced wetland ecologist as an environmental supervisor for mitigation projects could provide the necessary oversight while reducing the burden on NJDEP staff resources.

As standardized design and monitoring requirements are developed, increased technical support and training should be provided to the Land Use Regulation staff. This will increase the likelihood that improved standards for mitigation plans and documents will lead to successful mitigation and effective enforcement.

### **Data Management, Tracking and Research**

An integral part of any effort to implement successful compliance efforts is the continued implementation of an up-to-date, well-maintained system for tracking, filing, and retaining monitoring reports and other administrative documents. Effective compliance/enforcement is not possible without such records of what is required for each plan, including records of the dates monitoring reports are due, results of past field visits, etc. During the course of this study we found that in many cases, mitigation files contained little or no monitoring or reporting



information. NJDEP should consider posting tracking forms and other relevant information regarding mitigation sites on the Internet. Public input may assist in on-going monitoring efforts.

Continued research efforts should be encouraged by NJDEP. Wetland mitigation, especially for freshwater systems, is still a relatively new field in which many basic assumptions have not been rigorously tested over time (Simenstad and Thom, 1996). However, ongoing research is being conducted within the State of New Jersey and nationwide to provide information regarding our basic assumptions regarding the organization and function of wetland systems. This information should be made available to Land Use Regulation staff on a regular basis so that permitting decisions can be made with up-to-date information. Monitoring data could be made available to key decision makers using the GIS capabilities of this study. Ample flexibility should be provided within rules and policy to integrate new information as it becomes available.

In order to measure the effectiveness of any changes in the mitigation program, NJDEP should continue to collect indicator data regarding implementation of the mitigation program. Requirements could be included in approved mitigation plans for the permittee to be responsible for the collection of information compatible with that collected for this study. This would facilitate continued input of information to the database and tracking of results of the mitigation program. The database and GIS integration developed for this study provide a template for addition of further information. Continued tracking of the indicators for more recently approved and implemented projects is essential to gauge the effectiveness of changes in mitigation plan review and approval procedures that are currently being implemented by NJDEP's Land Use Regulation Program.

### **Minimizing Impacts to Wetland Resources**

Given the low levels of compliance and success of mitigation sites included in this study, the primary focus of the NJDEP Land Use Regulation Program should continue to be on avoiding or minimizing impacts to wetlands. This can be accomplished through the permit review process including a rigorous review of alternatives in an effort to reduce the amount of permitted wetland losses.

Although standardization, consistency and accountability are important, the ecological systems that are being impacted by development and the steps needed to mitigate for these impacts are sufficiently complicated. Existing wetland mitigation engineering and science currently falls short of adequately replacing comparable wetland area or ecological value.

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