

11. Monitoring and Evaluation

As discussed in Section 5.3.2, NJDEP assessed the impairment of the Neshanic River and its tributaries based on surface water quality monitoring at the USGS Reaville Gage Station near the stream-road crossing between the Reaville Road and the main Neshanic River denoted as N1 as well as AMNET monitoring at biological monitoring stations AN0330, AN0331, AN0332 and AN0333 as represented by FN1, SN1, TN3 and N1, respectively (see Figure 5.6). In order to understand the causes and sources of water pollution in the watershed, this project expanded the surface water quality monitoring to include seven monitoring stations in the watershed (see in Figure 5.6). Additional water quality monitoring was done at stations FN1, SN1, TN3, TN3a, UNT1 and UNT2. The project conducted another round of biological monitoring at all four biological monitoring stations. As discussed in Section 5.6.2, the project documented the stream conditions at seven monitoring stations using the Rosgen Stream Classification System and the channel conditions in 15 locations across the watershed following the Schumm's five-stage channel evolution model. In addition, the project organized and trained volunteers to assess the physical and biological conditions of instream and riparian areas of the 40 stream reaches located at the road-stream crossings using SVAP. The resulting monitoring data were used in setting the water pollutant reduction targets and establishing a reliable baseline for evaluating water quality changes after implementing the BMP projects in this Plan.

Monitoring is a necessary step in assessing water quality improvements resulting from the installation and implementation of the various BMPs in this Plan. Long-term monitoring of water quality and stream conditions is generally expensive and funding for such monitoring is limited and hard to find. It is not realistic to expect the same intensive monitoring conducted in the project to be continued in the long run.

Two criteria can be used to evaluate whether watershed restoration efforts are successful. The first criterion relates to changes in land use management practices. Three issues relevant to the first criterion are: (1) how much and where are the proposed BMP projects implemented in the watershed? (2) are stakeholders aware of the impacts of their land use and management decisions on water resources? and (3) do stakeholders continue to practice environmentally friendly BMPs even after initial BMP funding ends? The second criterion deals with the outcomes observed in streams and their riparian areas. Two issues relevant to the second criterion are: (1) do the water quality and biological conditions in the streams improve over time? and (2) are stream channels being stabilized? Based on these two criteria, the following monitoring programs should be implemented to evaluate the success of the watershed restoration efforts in the watershed:

11.1. BMP Documentation Database

Water quality improvement in streams must be achieved by implementing various BMPs in different areas of the watershed. An important monitoring effort is to document the efforts in educating the stakeholders and implementing both structural and nonstructural BMPs in the watershed. The documentation should include, but not be limited to:

- Educational materials being developed by municipalities and relevant agencies and organizations to educate stakeholders on NPS control and stormwater management in the watershed;

- Ordinances and rules related to water resource protection being developed and implemented by municipalities;
- Local implementation of federal, state and county regulations pertaining to water resource protection;
- Location, scale and expected effects of BMPs funded and implemented in the watershed. For each BMP implementation, there should be documentation of the expected water quality improvement. Water quality impacts can be estimated using quantitative models and tools, such as STEPL models and others. Onsite monitoring during and after BMP implementation should be conducted and documented.

11.2. Water Quality Monitoring

It is expected that the NJDEP and USGS will continue their streamflow and water quality monitoring work at the USGS Reaville Gage Station (i.e., monitoring station N1). The NJDEP and USGS should compare their routine monitoring procedures to the dry weather monitoring plan specified in the Neshanic River Watershed Quality Assurance Project Plan and make necessary adjustments in their monitoring plan to improve water quality assessment in the watershed. The water quality parameters that should be monitored include NH₃-N, NO₃-N, NO₂-N, TK), TP, dissolved orthophosphate phosphorus, TSS and *E. coli*. Annual water quality and bacteria sampling results should be sufficient for assessing changes in water quality in streams in the Neshanic River Watershed. Although the drainage area to the Reaville Gage Station only contains the upper portion of the Neshanic River Watershed, monitoring results would indicate how water quality can be improved through active land use management in the watershed.

11.3. Biological Monitoring

The NJDEP should continue biological monitoring at biological monitoring stations AN0330, AN0331, AN0332 and AN0333 as represented by monitoring stations FN1, SN1, TN3 and N1 in this project. Biological monitoring at selected biological monitoring stations is usually conducted once every five years. This frequency of monitoring should be sufficient to determine whether improvements in water quality and watershed hydrology eventually translate into improvements in biological conditions in the streams in the Neshanic River Watershed.

11.4. Stream Visual Assessment

Stream visual assessment uses visual inspection of the physical and biological characteristics of instream and riparian segments of stream reaches to assess the health of the stream, identify pollutant sources and identify potential management measures to reduce pollutant sources. Local watershed and environmental organizations should continue to use stream visual assessment as an educational tool for encouraging community volunteers to document changes in stream and riparian area conditions.

The NJDEP (August 2007) has developed a protocol for stream visual assessments that must be utilized for any 319 grant, namely the Visual Assessment Project Plan (VAPP). This project did not utilize this protocol because it was not available at the time the 319 grant contract

was finalized. Instead, the SVAP developed by NRCS and modified by Rutgers University Cooperative Extension was used in this grant project. Since the VAPP is available, it should be used by the local watershed and environmental organizations in their stream visual assessment activities.