Biofilter Wetland at Harrow Run
Water Quality Evaluation of Pollutant Removal Efficiency
from a Tailwater Recovery System

Objective and Scope

In November of 2004, a biofilter wetland was installed to treat nutrient-rich runoff from a tailwater recovery system. This tailwater recovery system was originally installed to take advantage of water reuse at a private nursery operation in Deerfield, NJ. Water use was cut by one-third with the reuse system installed; however, monitoring data collected in 2002 showed that high nutrient overflow to a second pond that discharges to Harrow Run was impacting water quality. In the past few years, the large amount of sediment runoff from the nursery operation and bank erosion from this second pond has lead to significant siltation. Changes in the bottom topography and the surface water level of this second pond have resulted in an ideal location for the creation of a biofilter wetland. The biofilter wetland was installed to treat the overflow from the tailwater recovery system, improve water quality in Harrow Run, and enhance the landscape and habitat with native vegetation.

The biofilter wetland is approximately 7,500 square feet and has been planted with more than 3,000 species of native, freshwater wetland and pond type vegetation. The effectiveness of this biofilter wetland is critical to discovering if additional measures are needed to further control nutrients from this location. Also, the data collected as part of this water quality evaluation can add to the water quality monitoring data that was collected prior to the installation of the biofilter wetland to address any improvements and/or impairments to the water quality in Harrow Run.

Data Usage

The data collected will be used to examine the effectiveness of a biofilter wetland as a treatment solution for nutrient-rich runoff. The data will add to the knowledge-base of BMP effectiveness. Furthermore, this data can be included in an assessment of water quality in Harrow Run, a lower tributary to the Upper Cohansey River.

Monitoring Network Design and Rationale

Sampling Locations: Attachment A provides a detailed map outlining the nursery location and Harrow Run. There will be three sampling locations, which are also included on Figure 1. Location 1 can be found at the outflow of the upper pond to the lower pond (39°29′57″ N, 75°15′11″ W). Location 2 is just upstream of the lower pond’s discharge to Harrow Run (39°29′55″ N, 75°15′10″ W). Location 3 is immediately downstream of the lower pond’s discharge to the Harrow Run (39°29′55″ N, 75°15′11″ W).

Temporal and Spatial Aspects: Surface water quality samples will be collected from Locations 1-3 once every two weeks from March 2005 through November 2005 for a total of 16 sampling events. Samples will be taken on a regular basis, independent of wet or dry weather, and weather information from a local weather station will be incorporated into the data analysis. A single grab sample will be collected at the outlet weir of the upper pond for Location 1. Surface water sampling at Locations 2 and 3 will be conducted so that the samples are representative of the cross section of the stream. A single grab sample will be collected at Locations 2 and 3 if the stream width is six feet or less. Should the stream width be greater than six feet during any of the sampling events, three subsurface grab samples will be collected at equidistant points across the stream. These grab samples then will be composited in a larger volume container from which the desired volume will be transferred to the sample bottles. A dedicated large volume container will be assigned to each sample location. Prior to each sampling event, the large volume containers will be decontaminated using the following procedures: 1) distilled/deionized water rinse, 2) non-phosphate detergent wash, 3) distilled/deionized water rinse, 4) air dry, and 5) distilled/deionized water rinse.

In addition, wet weather samples will be collected from Locations 1-3 on the day following a storm. Due to the controlled overflow from the upper pond to the lower pond, storm events do not immediately impact the upper pond leading to overflow; therefore, next day sampling will be conducted at Locations 1-3 to gage the overall effect of the storm event. Only one sample each from Locations 1-3 will be collected per wet weather event. Four wet weather sampling events will be conducted at an interval of approximately one event every two months. The procedures and protocols discussed above will continue to be followed as part of this wet weather data collection.

Basis for Sampling Locations: Surface water quality sampling will be conducted to assess the nutrient and sediment load entering the lower pond (Location 1) and the effect of the lower pond's discharge on the water quality of Harrow Run at an upstream location (Location 2) and a downstream location (Location 3).

Monitoring Parameters

Surface water quality sample collection, as well as *in situ* measurements of pH, temperature, dissolved oxygen, stream width, stream depth, and stream velocity, will be conducted by the Rutgers Cooperative Research & Extension Water Resources Program. Stream width, stream depth, and stream velocity will be measured in accordance with the methods outlined in Attachment B. Samples will be analyzed for ammonia-nitrogen, nitrate-nitrogen, total Kjeldahl nitrogen, total phosphorus, dissolved orthophosphate phosphorus, and total suspended solids by QC Laboratories (NJDEP Certified Laboratory #PA166).

Schedule*

Task	Date
Submit quality assurance work plan	March 2005
Conduct surface water quality sampling	March 2005 – November 2005
Submit data and summary report to NJDEP and the National Fish and Wildlife Foundation (NFWF)	February 2006

* All scheduling is subject to the natural occurrence of appropriate stream flow conditions (i.e., non-flooding conditions).

ATTACHMENT A

Map of Harrow Run, Biofilter Wetland, and Sampling Locations

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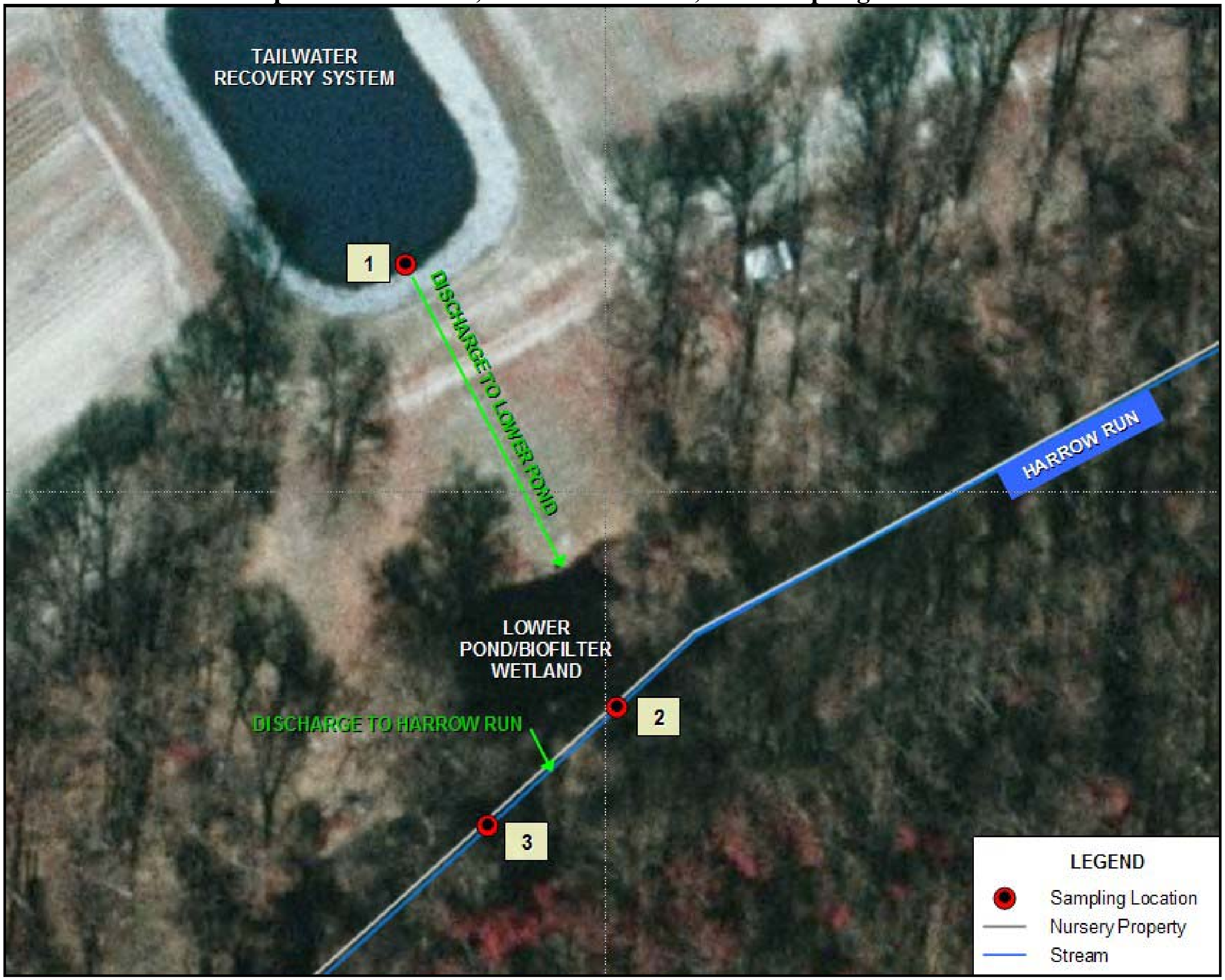

ATTACHMENT B

Stream Flow Measurement Procedure

Stream Flow Measurement Procedure

Stream width, depth, velocity, and flow determinations will be made in conformance with the following procedures:

1. A measuring tape is extended across the stream, from bank to bank, perpendicular to flow. Meter calibration is checked.

2. Using a Marsh-McBirney, Inc. Model 2000 Flo-Mate Portable Water Flow meter, velocity and depth measurements are made at points along the tape. Normally depth is measured using a rod calibrated in tenths of a foot. In shallow streams, a yardstick may be used to measure depth. Velocities are measured at approximately 0.6 depth (from the surface) where depths are less than 2.5 feet and at 0.2 and 0.8 depth (from the surface) in areas where the depth exceeds 2.5 feet.

3. The stream cross section is divided into segments with depth and velocity measurements made at equal intervals along the cross section. The number of measurements will vary with site conditions and uniformity of stream cross section. Each cross section is divided into equal parts depending upon the total width and uniformity of the section. At a minimum, velocities are taken at quarter points for very narrow sections. In general, velocity and depth measurements are taken every one to five feet. A minimum of ten velocity locations is used whenever possible. The velocity is determined by direct readout from the Marsh-McBirney meter set for 5 second velocity averaging.

4. Using the field data collected, total flow, average velocity, and average depth can be computed. Individual partial cross-sectional areas are computed for each depth and velocity measurement. The mean velocity of flow in each partial area is computed and multiplied by the partial cross-sectional area to produce an incremental flow. Incremental flows are summed to calculate the total flow. The average velocity for the stream can be computed by dividing the total flow by the sum of the partial cross-sectional areas. The average depth for the stream can be computed by dividing the sum of the partial cross-sectional areas by the total width of the stream. The accuracy of this method depends upon a number of factors, which include the uniformity of the steam