



SECTION 2: PROJECT METHODOLOGY

We have to remember that what we observe is not nature in itself but nature exposed to our method of questioning.

Werner Heisenberg

2.1 Review and Assessment of Existing Data

The GeoSyntec/BSC Group Team (GeoSyntec) held a project kick-off meeting with Town staff on August 29, 2002 to finalize the goals, methodologies and data management protocols for this project. At a second meeting on September 4, 2002, GeoSyntec coordinated with the Town to select twelve wetland replication sites for inclusion in the study.

The twelve sites were selected from the pool of 32 wetland replication projects that were constructed between the years of 1987 to 1998 and had been issued a Certificate of Compliance by the Franklin Conservation Commission. Conservation Commission files for each of the sites were reviewed, including site plans, Notice of Intent filings, Orders of Conditions, wetland replication specifications, and any other relevant available data (consultant reports, Town Assessor's maps, etc.). The following types of information were assessed in order to rank the wetland replication projects for inclusion in this study:



Wood Frog (*Rana sylvatica*)

- Year Approved/Constructed
- Project Size (square feet)
- Availability of replication construction specifications in permit information, including:
 - Grading specifications
 - Soils
 - Required plantings/planting locations
 - Seed mixture specifications
- Ease of field-locating replication area boundaries (nearby control points, etc.)
- Unique features (i.e. vernal pool, etc.)
- Availability of as-built plan *
- Availability of post-construction replication monitoring data *

* Note: None of the reviewed projects had these types of information available.



Based on review the above information, with an emphasis placed on the availability of detailed replication construction specifications, 9 of the 32 sites were eliminated from consideration for inclusion in the study. The remaining 23 sites were ranked from 1 to 4, with 4 indicating the highest ranking for inclusion in the study. The sites were then categorized into the following three age groups: (1) 0-5 years, (2) 5-10 years, and (3) over 10 years. The goal was to select the highest ranking sites representing each of these project age categories, while also ensuring that a wide range of project sizes were included in the study group.

Following selection of the 12 wetland replication sites to be included in this study, the Town provided GeoSyntec with copies of all site plans, permits, design specifications and other available information relevant to the replication areas. Site maps and approved replication plans for the 12 selected sites are included as an appendix to this document (provided under separate cover). GeoSyntec reviewed and assessed the specific features of each replication area prior to commencing field data collection. This information was be used as a reference during field data collection, to ensure that data collection activities were properly tailored to each specific site (i.e. documenting presence and survival of planted shrubs and trees in locations specified on a site plan, documenting presence of wetland soils as specified, etc.). This information was also used to assess the adequacy of each site's permit requirements and related design specifications in relation to the site's current wetland features.

It should be noted that none of the 12 selected sites (and none of the 32 sites in the original site selection pool) had post-construction monitoring data or as-built plans. In general, the distinction between the permit requirements/design specifications for the 12 sites fell into four categories:

- Replication location and size indicated on site plan
- Location and size, plus grading and soil specifications
- Location and size, grading and soil specifications, plus "suggested" plantings
- Detailed replication plan, including grading, soils and planting specifications



Great Blue Heron
(*Ardea herodias*)

2.2 Field Data Collection Methods

2.2.1 Wetland Field Data

GeoSyntec collected field data for the wetland replication areas on a digital Wetland Replication Data Form that was created specifically for this project. Each wetland was classified according to the National Wetland Inventory (NWI) classification hierarchy. Where appropriate, a dominant NWI class was assigned to the wetland and other NWI classes present were noted. The quantity and location of monitoring plots for each wetland replication area was determined based on its size and the variety of features it exhibits. In larger, more complex replication areas (i.e. multiple NWI classes, significant variations in dominant vegetation, etc.), an appropriate number of plots were selected so as to represent overall conditions for the entire replication. Each replication area and each monitoring plot was photo-documented with a digital camera to show overall conditions and each NWI class present.



In addition to general survey information (i.e. date, time, weather, etc.), the following site-specific information was collected and entered into the digital Data Form:

- **Vegetation:** Within each monitoring plot, GeoSyntec recorded the presence and dominance of plant species within the following four vegetation layers: Trees, Shrubs, Saplings/Lianas, and Herbs. The dominance of each species within these layers was estimated within the following four categories: Dominant (>50%), Abundant (26-50%), Common (5-25%) and Scarce (<5%).
- **Hydrologic Characteristics:** GeoSyntec recorded representative hydrologic features for each wetland plot. This included an assessment of the frequency and duration of surface saturation/flooding, and documentation of hydrologic indicators (i.e. silt deposition, water-stained leaves, depth to groundwater or soil saturation, etc).
- **Soils:** GeoSyntec recorded information from a soil profile within each monitoring plot. The soil profile was established to a minimum depth of 18 inches (unless bedrock/refusal was reached before this point). The depth of each soil horizon within the profile was recorded, as well as the matrix color (based on a Munsell Soil Color Chart), texture, redoximorphic features, and any other general observations.
- **Unique Vegetation and/or Invasive Species Notes:** GeoSyntec documented and field-located with a GPS unit the presence and relative abundance of any “unique” vegetation and non-native invasive species found in each wetland, as follows:
 - “Unique vegetation” was defined to include species that are (1) listed as rare, threatened or endangered in Massachusetts, as listed by the Massachusetts Natural Heritage and Endangered Species Program. “Invasive species” was defined to include the non-native invasive plants listed in “*A Guide to Invasive Plants in Massachusetts*”, published by the Massachusetts Division of Fisheries and Wildlife – Biodiversity Initiative.
- **Wetland Delineation:** GeoSyntec field-delineated the wetland boundaries of wetland replication areas according to the appropriate state and/or federal methodologies. Wetlands defined as Wetland Resource Areas under the Massachusetts Wetlands Protection Act (WPA) were mapped according to the state methodology. Wetlands not jurisdictional under the WPA were mapped according to the federal methodology. Wetland delineations were field-located with a mapping-grade GPS unit with sub-meter accuracy.



Glossy Buckthorn
(*Rhamnus frangula*)

2.2.2 Data Collection for Evaluation of Wetland Replication Compliance

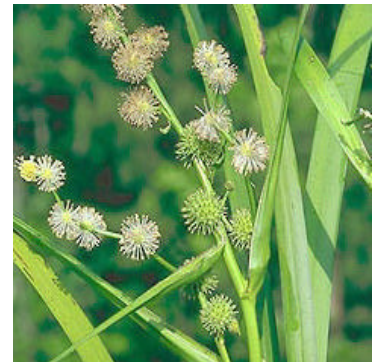
Some of the field data collected as described above in Section 2.2.1 was used to evaluate if the wetland replication area was constructed in substantial compliance with the approved wetland replication plan. This evaluation included the following:



Wetland Delineation: The wetland delineations conducted for each replication area were used for comparison to the replication design plans approved as part of the Order of Conditions issued for the site. This comparison allowed GeoSyntec to determine if the replication area was sized and sited according to the approved plan.

Soils Information: Many of the replication areas the study included design specifications with regard to soils. For example, a common requirement was for wetland soils from impacted areas to be stockpiled and then replaced in the replication area. Soil profiles (conducted as described above) were compared to the site's permitted design specifications to determine if current site conditions are consistent with the grading and soil-related construction specifications.

Species Composition: Some of the replication sites had design requirements related to planting of specific wetland herbaceous, shrub, and tree species. Vegetation information collected at each site (as described above) was used to assess the current presence of such species on the site. Where specific planting locations were provided in the plans (usually for tree/shrub plantings), these locations were assessed for the presence/survival of the planting.



Bur-reed
(*Sparganium americanum*)

It should be noted that some replication plans included a “suggested” planting plan rather than “required” plan. At these sites, the presence or absence of species could not be used to assess compliance with design specifications.

It should also be noted that the vegetation community within a replicated wetland may change dramatically over time, regardless of the seed mix or plantings used at the time of construction. Such variations in plant dominance can often be related to the spread of aggressively colonizing species (including invasive species such as Purple Loosestrife) from adjacent wetland areas. As such, the species within a replication area may provide evidence that a planting plan was followed according to permit specifications, but cannot conclusively indicate that specifications were not followed.

2.2.3 GPS/GIS Data Collection

GeoSyntec developed a wetland assessment MS-Access database to store all field data collected. This database allowed GeoSyntec staff to conduct real-time maintenance of field data and related assessment information. An integrated mapping-grade Global Positioning System (GPS) connected to a ruggedized “pocket” computer loaded with orthophotography and existing GIS data layers were used to collect and record wetland information. Field data was entered into the hand-held computer using customized forms from the JetStream™ software package, a field data collection software that integrates both spatial (GIS) and relational tabular data. In addition to greatly improving quality assurance through the elimination of transcription of paper forms and digitization of paper maps, the digital forms were designed to limit responses so that all information collected conforms to the standard protocols established.

The wetland replication field surveys involved assignment of a GPS unit to the field crew along with a pocket computer and digital camera. The GPS unit was used to field-locate wetland boundaries,



monitoring plot locations, and the locations of unique species and invasive species infestations. The GPS unit was also used to locate fixed control points in the vicinity of each wetland, such as the edges of roads and the corners of buildings. The pocket computer was pre-loaded with database tables and field data forms to allow field staff to record attribute data for each wetland, as well as GIS coverages for field editing and quality assurance review. The GPS unit was operated with settings that ensure sub-meter accuracy for each recorded point.

In addition to collecting digital information on each wetland replication area, GeoSyntec also created hard copy and digital maps of each wetland replication. These maps were created presenting the GPS data as an overlay on digital orthophotos obtained from the Massachusetts Geographic Information System (MassGIS).

2.2.4 Wetland Functions and Values Assessment

GeoSyntec assessed the functions and values of each wetland replication area according to the methodology developed by the US Army Corps of Engineers (ACOE) and published in a booklet titled *“Wetland Functions and Values – A Descriptive Approach”* (see excerpts in Appendix B). This methodology was developed to provide a comprehensive approach for characterizing wetland resources, as required by the Section 404 permitting process. The methodology is equally useful in assessing the functions and values of wetlands as described in the Massachusetts Wetlands Protection Act and for baseline data collection, planning, and assessment purposes.

As stated in the *“Wetland Functions and Values – A Descriptive Approach”* workbook, the ACOE methodology is designed to be “an approach which includes a qualitative description of the physical characteristics of the wetlands, identifies the functions and values exhibited, and most importantly, the basis for the conclusions using “best professional judgment.” Field data and a variety of other types of available data (i.e. GIS datalayers, NRCS soil maps, etc.) are used for evaluation and qualitative assessment of the following functions and values for each wetland replication area:

- Groundwater Recharge/Discharge
- Floodflow Alteration (Storage and Desynchronization)
- Fish and Shellfish Habitat
- Sediment/Toxicant/Pathogen Retention
- Nutrient Removal/Retention/Transformation
- Production Export (Nutrient)
- Sediment/Shoreline Stabilization
- Wildlife Habitat
- Recreation (Consumptive vs. Non-consumptive)
- Educational/Scientific Value
- Uniqueness/Heritage
- Visual Quality/Aesthetics
- Threatened or Endangered Species Habitat



Muskrat
(*Ondatra zibethica*)

The assessment of each wetland replication was based on a review of specific considerations and qualifiers for each of the functions and values listed above (see attached lists of Considerations/Qualifiers in Appendix B).