NONESUCH RIVER SALT MARSH
YEAR 5 POST-RESTORATION MONITORING
AND PROJECT SUMMARY REPORT

NONESUCH RIVER, SCARBOROUGH, MAINE

Prepared for:
Friends of Scarborough Marsh

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Portland, Maine 04103

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Prepared for:

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1.0 INTRODUCTION

The Scarborough Marsh Planning Team (SMPT) initiated salt marsh restoration activities at Nonesuch River, in the Scarborough Marsh Wildlife Management Area, Scarborough, Maine, in 2005 (Figure 1). SMPT comprises Friends of Scarborough Marsh (FSM), United States Fish and Wildlife Service (USFWS), Maine Department of Inland Fisheries and Wildlife (MEIF&W), and United States Department of Agriculture – Natural Resource Conservation Services (NRCS).

The Nonesuch River Salt Marsh Restoration Project (Project) restoration activities included the plugging of man-made ditches and the breaching of existing berms to restore hydrology and ecological function to the marsh, and control or prevention of the spread of the invasive plant species, common reed (*Phragmites australis*). To assist in this effort, Tetra Tech, Inc. (formerly Northern Ecological Associates, Inc.), was contracted by the SMPT in 2005 to conduct pre- and post-restoration monitoring of a 250-acre portion of the Scarborough Marsh along Nonesuch River. Monitoring activities were designed following the USFWS's *Salt Marsh Restoration Monitoring Plan for Ditch-Plugging Efforts in New England Marshes* (*Monitoring Plan*) (USFWS 2001).

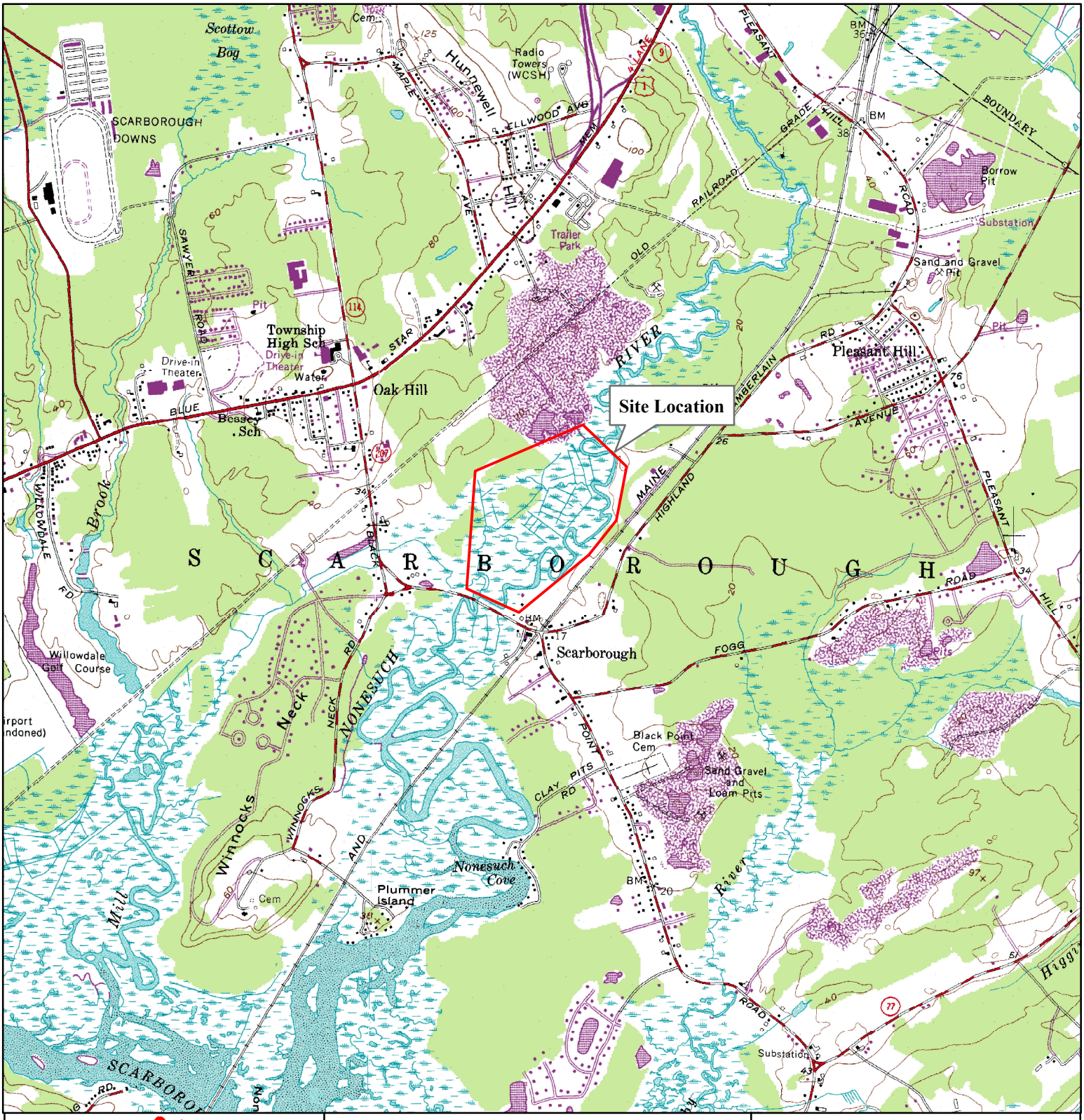
Ditch-plug construction and berm removal were completed in early 2006. The primary goal of the ditch-plugging and berm removal effort was to restore hydrologic functions to the Nonesuch River site, with the following intended outcomes:

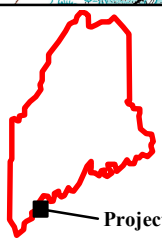
- Increasing the elevation of the groundwater table,
- Increasing the duration of flooding in temporary pannes, and
- Increasing the number of permanent pools.

By restoring hydrologic conditions, it was expected that native salt-marsh-dependent species (i.e., fish, invertebrates, waterbirds, shorebirds, wading birds, and waterfowl) would be reestablished and/or would increase in number. Monitoring efforts focused on the collection of qualitative and quantitative information on the chemical and physical characteristics of water on the marsh surface to include cover type mapping, site assessments, photographic documentation of site conditions, water quality and water level sampling, and vegetation monitoring.

Pre-restoration monitoring activities were conducted in August through October 2005, and the results of those activities are detailed in the 2005 Pre-Restoration Monitoring Draft Documentation and Data Report. Year 2 post-restoration monitoring activities were conducted during August through November 2007, and summaries of those activities and the data gathered thereby were presented in the 2007 Data and Documentation Report. Finally, Year 5 post-restoration monitoring was conducted between August and November 2010.

This Year 5 Post-Restoration Monitoring and Project Summary Report presents a comprehensive analysis of data collected during pre- and post-restoration monitoring activities for the Project. The report includes a brief discussion of monitoring methodology (Section 2.0), results and discussion (Section 3.0), and management implications and recommendations (Section 4.0). In addition, data gathered for Year 5 post-restoration monitoring is presented in the following





Source: MEGIS Ortho-rectified Digital Images 0.5 foot resolution, 2001.
* Digital data layers provided by U.S. Fish and Wildlife Service - Gulf of Maine Coastal Program.

SCALE

3,000 1,500 0 3,000 Feet

800 400 0 800 Meters

Figure 1. Site Location for Nonesuch River Salt Marsh Restoration Monitoring Project, Scarborough, Maine.

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Prepared By: TETRA TECH

Date: 12/05

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appendices: completed site assessment data forms (Appendix A), photographic documentation (Appendix B), water quality and water level data (Appendix C), vegetation monitoring data (Appendix D), field notes (Appendix E), and a list of wildlife species observed during monitoring activities (Appendix F). An electronic copy of data and information collected during all years of the monitoring effort are included on a CD located in the front cover of this report.

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2.0 METHODS

Monitoring was completed pre-restoration, and in Years 2 and 5 post-restoration. The goal of the periodic monitoring activities was to evaluate the success of restoration efforts to restore native vegetation, control the spread of *Phragmites*, and improve hydrologic conditions on the marsh. Monitoring methods were selected based on the *Monitoring Plan* (USFWS 2001), and following discussions with the SMPT. Any modifications to the methods to account for site- and Project-specific conditions are described below. Pre and post-restoration monitoring included updating the cover type map, completing a site evaluation including photographic documentation, collecting water level (i.e., tidal signal) data, measuring surface and subsurface water quality parameters, and vegetation monitoring. The following sections provide a summary of the field monitoring techniques and a brief discussion of the findings.

2.1 COVER TYPE MAPPING

The cover type map generated by the USFWS during pre-restoration monitoring activities for the Project area was updated to reflect the post-restoration cover type in 2007, as included in the Year 2 post-restoration monitoring report (NEA 2007), and during post-restoration monitoring activities in 2010 (Figure 2). Year 5 post-restoration updates to the cover type map included documenting the location and extent of the *Phragmites* communities in the Project area, and noting changes in community types post-restoration compared to the pre-restoration cover type map provided by USFWS, and changes included in the Year 2 post-restoration cover type map. The same two or three letter code format used for the pre-restoration cover map were utilized, and updates to the cover type map reflect the response of the dominant vegetative communities to restoration, particularly in the areas formerly dominated by *Phragmites*. It is important to note that because the scale of the project is so large, the detail of the cover type map is coarse-level, and it is possible that some community type changes documented post-restoration do not represent significant community changes, but that more detailed attention was given to a particular area compared to pre-restoration cover type mapping. Cover type map changes are discussed in Section 3.1.

2.2 SITE EVALUATION

Pre-restoration site conditions were established in 2005 by performing a site evaluation, which included completion of a site assessment data form and photographic documentation of pre-restoration site conditions (Appendices A and B, respectively, of the Pre-Restoration Monitoring Report). These site evaluation activities were repeated in 2007 and 2010 to complete Year 2 and Year 5 post-restoration monitoring requirements. The site evaluation was based on the procedures presented in the *Monitoring Plan* (USFWS 2001), and modified according to the restoration activities proposed for the Project.

500 250 0 500 Feet

LEGEND

- Ditch Plug*
- Berm Ditch Line*
- Former *Phragmites australis* Polygon*
- Project Boundary

Vegetation Legend*

Ds	*Distichlis spicata* (spikegrass)	Sa	*Schoenoplectus acutus* (hardstem bulrush)
Jg	*Juncus gerardii* (blackgrass)	Sas	*Spartina alterniflora* (short)
P	*Phragmites australis*	Sat	*Spartina alterniflora* (tall)
Pa	*Potentilla anserina* (silverweed)	Sc	*Spartina cynosuroides*
Pm	*Plantago maritima*	Sp	*Spartina patens*
S	*Scirpus sp.* (saltmarsh bulrush)	Ta	*Typha angustifolia* (narrowleaved cattail)
Sv	*Scirpus validus*	Tl	*Typha latifolia* (broadleaved cattail)

Source: MEGIS Ortho-rectified Digital Images 0.5 foot resolution, 2001.
* Digital data layers provided by U.S. Fish and Wildlife Service - Gulf of Maine Coastal Program.

Figure 2. Cover Types for Nonesuch River Salt Marsh Restoration Monitoring Project, Scarborough, Maine.

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Date: 12/07

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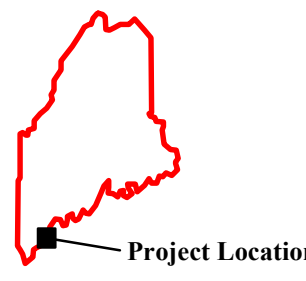
2.2.1 SITE ASSESSMENT

The 2010 site assessment was conducted on November 7 and November 12, 2010, to qualitatively assess the overall Year 5 post-restoration site conditions. The assessment included notation and/or observation of existing weather conditions and tidal cycle, condition of the breached berm areas, observation of ditch plugs and altered tidal creeks, presence of undesirable and desirable species, presence of wildlife species, observation of recreational activities, and evidence of site disturbance. Site assessment results are discussed in Section 3.2. See Appendix A for the complete site assessment data form, photographs, and a marked-up figure.

2.2.2 Photographic Documentation

Photographic stations were established in 2005 to visually document pre-restoration marsh surface conditions and the location and size of existing undesirable communities (*e.g., Phragmites*) at the site. Photographic stations were set up at four locations across the site, focusing on the *Phragmites* communities. The locations of fixed photo stations were recorded using a GPS unit and transferred into a GIS for overlay onto the photographic and sampling station location map (Figure 3). These photographic stations were revisited in 2007 and 2010, and photographs similar to the photo series acquired in 2005 were taken. Between four and nine photographs were taken at each photo station during low tide (during neap 1st quarter); 22 photographs were taken in total. Photo stations were located by finding the marked wooden stakes that had been labeled with a unique photo station identifier in 2005. The Year 5 photographs were taken on November 12, 2010. To replicate the previous photographic series (taken in 2005 and 2007), the photographer took each photograph at the same approximate compass direction and location as the original photograph taken during pre-restoration surveys conducted in 2005. In addition, the date and time, and a brief description of key features in the photograph were noted. The photographic documentation comparisons are discussed in Section 3.2. The 2010 photo station photographic records are presented in Appendix B.



Source: MEGIS Ortho-rectified Digital Images 0.5 foot resolution, 2001.
* Digital data layers provided by U.S. Fish and Wildlife Service - Gulf of Maine Coastal Program.

SCALE

500 250 0 500

Feet

LEGEND

- Ditch Plug*
- Berm Ditch Line*
- Photo Station
- Water Monitoring Station
- Transect
- *Phragmites australis* Quadrat
- Vegetation Quadrat
- Former *Phragmites australis* Polygon*
- Project Boundary

Figure 3. Photographic and Sampling Station Locations for Nonesuch River Salt Marsh Restoration Monitoring Project, Scarborough, Maine.

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Date: 12/05

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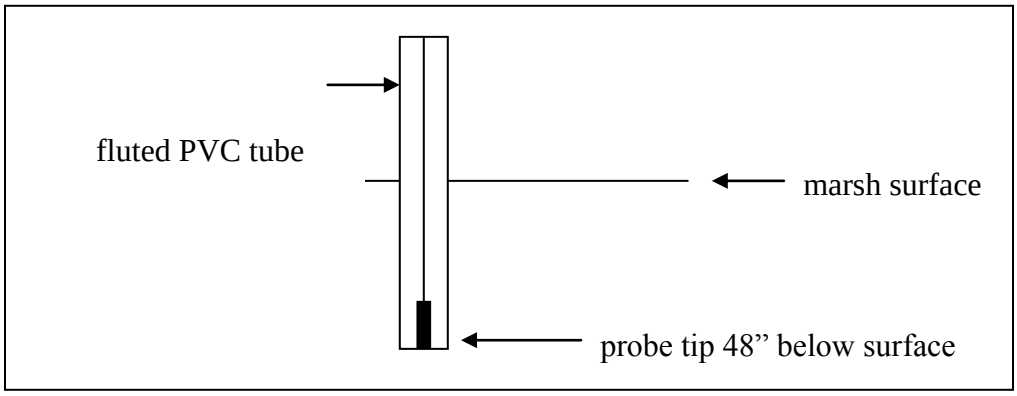
2.3 WATER LEVEL SAMPLING

Tidal signal (i.e., surface water depth) and groundwater level were assessed to determine the depth of flooding and duration of inundation of the marsh surface during the tidal cycle. Tidal signal and groundwater level were measured simultaneously using Global Water Model WL15 pressure transducer/data loggers (Global 2001). Data loggers were placed so that the pressure-sensitive probe tip was located at approximately 48 inches below the marsh surface within a fluted PVC tube to record data on ground and surface water level and duration of inundation as shown in Figure 4.

Figure 4. Water Level Sampling Data Recorder Set-up.



Water level sampling station locations were selected in 2005 in order to characterize marsh and surface water hydrological conditions at strategic locations across the marsh (Figure 3). Sampling station locations were recorded using a GPS unit and transferred into GIS for overlay onto the photographic and sampling station location map (Figure 3). Based on site conditions and proposed restoration activities, four sampling stations were established:

Station Number	Location
1	In an open marsh, pool/panne complex near berm breach site B2
2	Adjacent to north end of berm breach site B7
3	In an open marsh area, river side of restoration work (control)
4	Northern end of the Project area, landward of north end of berm breach site B14

Data loggers were deployed at the previously set-up water monitoring stations on August 27, 2010. Stations 3 and 4 collected data continuously over a 5-week period, to determine water level depth and duration of inundation on the marsh surface. Water level recorders at Stations 1 and 2 malfunctioned during the sampling period and therefore had to be re-installed September 27, 2010. Station 1 and 2 water level recorders collected data for approximately 7 weeks until November 12, 2010. Water level sampling results are discussed in Section 3.3. Figures summarizing the water level data are included in Appendix C. Collection dates for each station are presented below.

Station	Collection Dates
1	9/27–11/12/10
2	9/27–11/12/10
3	8/16–9/20/10
4	8/16–9/20/10

2.4 WATER QUALITY

Water quality data (i.e., dissolved oxygen, temperature, and salinity) were collected on six separate field visits over a 5-week sampling period from August 16 to September 20, 2010. Sampling events were scheduled to capture the low tide water quality during a 4-hour period surrounding low tide (i.e., 2 hours before and 2 hours after), during spring and neap tide cycles. Ideally, water quality sampling should occur during the growing season (May–August). However, due to the Project schedule for 2005, and the desire to repeat sampling during the same timeframe, sampling was conducted during September and October 2007 and August and September 2010.

During 2005, water quality sampling stations were set-up within a 5-meter radius of the four water level recording stations discussed in Section 2.3 (Figure 3). The 6-inch piezometer has slats cut from 0 to 6 inches below the marsh surface, and the 18-inch piezometer has slats cut from 12 to 18 inches below the marsh surface, to allow free movement of groundwater into the piezometer. These water quality sampling stations were revisited in 2007 and 2010, and a YSI Model 85 handheld oxygen, conductivity, salinity, and temperature system (YSI Incorporated 1996) was used to take readings at the established sampling locations. Water quality readings were measured in the 6-inch and 18-inch deep piezometer, and from a nearby pool, if available. To ensure data quality, three replicates were taken from each piezometer or pool at each sampling location. Water quality results are discussed in Section 3.4. All water quality sampling data were pooled and entered into tables and graphs that summarize the information (Appendix C).

2.5 VEGETATION MONITORING

Vegetation monitoring was conducted following the protocol outlined in the Global Programme of Action Coalition for the Gulf of Maine (GPAC) report, *Regional Standards to Identify and Evaluate Tidal Wetland Restoration in the Gulf of Maine* (GPAC 1999). During 2005, the site was divided into 10 segments of equal width along the north-south axis, and transect locations were randomly located within each segment. The location of the first quadrat was randomly selected within the low marsh zone, and subsequent quadrats were located at approximately 33 1/3-meter intervals along each transect, at a compass bearing of 270 degrees. Four additional quadrats were established in the *Phragmites* areas, to ensure adequate representation of *Phragmites* for future analysis (Figure 3). To allow for easier relocation of the vegetation plot sites during post-restoration monitoring, a wooden stake was placed at each of these vegetation monitoring stations, and GPS location data were collected with a handheld unit. Pre-restoration vegetation monitoring was conducted on October 6 and 7, 2005. Year 2 post-restoration

vegetation monitoring was conducted on October 6, 7, and 16, 2007. Year 5 post-restoration vegetation monitoring was conducted on October 3 and 13, 2010, and each station that was established in 2005 was relocated with the use of a handheld GPS unit, and by visually searching for the wooden stake that had been placed in 2005 (and replaced as necessary in 2007). Once located, a one-square-meter (1 m^2) quadrat was placed at the stake location, and the following activities were performed within each quadrat:

- All plant species were identified;
- A visual estimate of percent cover was generated, including percent bare ground, using a variation of the Braun-Blanquet cover classes (<1%, 1–5%, 6–25%, 26–50%, 51–75%, >75%); and
- For species of concern, the height of the three tallest individuals was measured and a determination of stem density (number of shoots/ m^2) was made.

Vegetation monitoring results are discussed in Section 3.5 and tables summarizing vegetation monitoring results are presented in Section 3.5 and Appendix D.

2.6 ADDITIONAL INFORMATION

Anecdotal observations were recorded during completion of all field sampling activities. A copy of all field notes collected during field sampling activities is provided in Appendix E. Additionally, Appendix F contains a list of wildlife species observed during pre- and post-restoration field sampling activities.

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3.0 RESULTS AND DISCUSSION

3.1 COVER TYPE MAPPING

Based on a review of the pre- and post-restoration cover type maps, and consideration of observations during field activities, vegetation monitoring, and the annual site assessment, the most noticeable cover type changes were observed in the areas formerly dominated by *Phragmites*. The *Phragmites* community has been replaced with a more diverse community comprising a combination of bulrush (*Schoenoplectus* and *Scirpus*), cattail (*Typha*), and cordgrass (*Spartina*), spike grass or saltgrass (*Distichlis spicata*), and rush (*Juncus*) species. Narrow-leaved cattail (*Typha angustifolia*) is present in all of the former *Phragmites* areas, occupying up to approximately 80% cover in one area.

Phragmites had returned to each of the five areas by Year 5 post-restoration, but at substantially reduced levels compared to pre-restoration conditions. During pre-restoration monitoring, the *Phragmites* areas were dominated by *Phragmites*, with *Phragmites* litter constituting much of the remaining ground cover. Minor components of saltgrass, Baltic rush (*Juncus balticus*), New York aster (*Aster novi-belgii*), bulrush, salt meadow grass (*Spartina patens*), and cattail also were interspersed within the *Phragmites* areas.

The total aerial coverage of narrow-leaved cattail appears to have increased compared to pre-restoration conditions. *Typha* now occupies portions of the areas formerly dominated by *Phragmites* and the former berm areas.

The coarse level of the mapping makes more detailed analysis difficult, however additional information on changes to species composition are included in Section 3.5 Vegetation Monitoring.

3.2 SITE EVALUATION

Site evaluations were used to subjectively compare observations of pre-restoration conditions with subsequent post-restoration conditions on the marsh surface. Site evaluations were documented in the form of a site assessment and photographic documentation (Appendix A).

3.2.1 Site Assessment

Site assessment observations, comparing pre-restoration and post-restoration conditions are summarized below. Photographs that accompany the site assessment are referenced in the site assessment in Appendix A.

- Based on visual observations of ditch plug and berm removal areas, and the marsh in the vicinity of these areas, it appears that marsh restoration activities have contributed to overall increased cover of desirable species, decreased the cover of undesirable species,

increased desirable permanent pool habitat for fish when comparing pre-restoration conditions to post-restoration conditions.

- In general, the majority of ditch plugs are in excellent condition, have revegetated with desirable species, are stable, and are holding water in permanent pools. A couple of the ditch plugs have been partially compromised, and show some evidence of erosion. In several cases, the actual location of the ditch plug is no longer discernable from the natural marsh. Several of the ditch plugs have *Phragmites* present, including some sites in the vicinity of *Phragmites* Area 2, and in areas distant from the former *Phragmites* areas.
- Excavated pools, both newly created pools and those created within former existing channels following ditch plug activities, appear to be retaining water, support fish populations, and have stable edges that have revegetated with desirable species. Excavated pools at Year 5 post-restoration are no longer discernable from pre-existing pools.
- The higher elevation berms formerly provided opportunity for shrubs to grow in the middle of the salt marsh, and obstructed surface water movement across the marsh. The removal of the berms created areas of varying depths, including pannes, pools, and high marsh. Several of the pools created by the removal of berms are deep enough to provide fish habitat even at Year 5 post-restoration. Revegetation in these former berm areas includes desirable salt marsh species and narrow-leaved cattail, a perennial herbaceous species that prefers brackish locations.
- The five *Phragmites* areas are now predominantly composed of a combination of desirable salt marsh species, including bulrush (*Schoenoplectus* and *Scirpus*), cordgrass (*Spartina*), saltgrass (*Distichlis spicata*), and rush (*Juncus*) species. Narrow-leaved cattail is present in all of the former *Phragmites* areas, occupying up to 80% cover. *Phragmites* is present in each of the five areas, but at substantially reduced levels compared to pre-restoration.
- The total aerial coverage of *Typha* has likely increased compared to pre-restoration conditions, where *Typha* now occupies areas formerly dominated by *Phragmites*, and former berm areas. However, narrow-leaved cattail is a brackish marsh species and is a frequent inhabitant of salt marshes at the upper reaches of the tidal range. This species was abundant in the Project area prior to implementation of restoration activities, including in the areas surrounding the former *Phragmites* areas, so its presence is not surprising.
- In general, desirable species throughout the Project area appear healthy and vigorous, and there is no obvious loss of aerial coverage or density as a result of restoration activities. Shrubs that formerly were present on berms throughout the marsh are no longer present, except along the edges of the marsh, where topographic conditions are conducive to shrub development.

3.2.2 Photographic Documentation

When compared to pre-restoration photographs, the photos (Photos #1-1, 1-2, 1-3, 2-1, 2-2, 2-3, 2-9, 3-1, 3-4, 3-5, 4-1, 4-2, 4-3, and 4-4) of the formerly *Phragmites*-dominated areas show that the cover of *Phragmites* and presence of homogenous stands have been reduced substantially in

Year 5 post-restoration, although regrowth of *Phragmites* is occurring in some areas. It appears that the vegetative community on the marsh is recovering well, and has repopulated with desirable salt marsh species, including bulrush, cordgrass, saltgrass, rush, and cattail species, as seen in the photos and noted in Section 3.2.1 Site Assessment.

3.3 WATER LEVEL SAMPLING

Water level data were collected pre-restoration, and during Years 2 and 5 post-restoration, to determine flooding depth and duration at the marsh surface, and evaluate the changes in water levels that may be attributed to restoration activities. Data collected at the Water Sampling Stations during pre- and post-restoration monitoring activities appear to indicate an increase in water table level in Year 5 post-restoration at three of the four monitoring stations (Stations #1–3), and a decrease in the magnitude of water level change at one of the monitoring stations (Station #4) (Appendix C).

Water level data at Station #1, which is located furthest from the Nonesuch River (Figure 3), suggest that the base water table level during the lowest tides was higher in year 5 post-restoration than it was pre-restoration. The magnitude of change in the water levels pre-restoration was greater than was observed either period post-restoration. This appears to indicate that groundwater levels remain elevated throughout the duration of the tidal cycle when compared to pre-restoration conditions. This is especially clear during the neap tide portion of the tidal cycle when groundwater levels were observed during pre-restoration monitoring to drop substantially.

Water level data at Station #2, which is located in proximity to one of the berm removal areas (B7), suggest that the base water table level was higher at this station in year 5 post-restoration than it was pre-restoration. The data for Station #2 appear to show a substantial increase in the base water level at the station, and the groundwater levels remain elevated throughout the duration of the tidal cycle when compared to pre-restoration conditions.

Water level data at Station #3, which is located near to the Nonesuch River outside of the berm or ditched area, suggest that the base water table level was higher in year 5 post-restoration than it was pre-restoration. The data for Station #3 appear to indicate the base water table level during Year 5 post-restoration monitoring was higher than during either of the previous sampling periods. The location of this station outside of the presumed area of direct influence of restoration activities makes these results somewhat perplexing, and some potential explanation and considerations are explored in subsequent paragraphs.

Water level data at Station #4, which is located at the north end of the Project area, appear to show a substantial decrease in the magnitude of water level change post-restoration compared to pre-restoration. However, considering the location of this station at the farthest point from the source of tidal influence, the results from the pre-restoration monitoring are perplexing. A water level of 2 ft or more at the water monitoring station would require the influx of an enormous amount of water to the system, and water levels of this magnitude were not reflected at the other water monitoring stations during the same time period, which may indicate an error in the

calibration of the water level recorder during pre-restoration monitoring. As a result, direct comparisons of the water levels at this station may not be worthwhile.

The array of water level change from pre-restoration to post-restoration when comparing station to station reflects the response of the marsh in different areas, and zones of influence. Year to year, and month to month variability in the magnitude of the tides (i.e., how high the high tides are and how low the low tides are), and from the influences of evapotranspiration, precipitation, and storm surges, also affected groundwater levels during the monitoring periods. The station locations were selected to try to capture the effects of restoration activities at four distinct locations on the marsh, including areas within and outside of the zone of direct influence of restoration activities; the microtopographic differences between sites may not be apparent when establishing the stations, and may result in slight differences in the expression of tidal signal at one location compared to another, although the relative change would be comparable. Additionally, an attempt is made to collect water level monitoring data during similar tidal conditions between monitoring years; however year to year variability in the tidal range may contribute to some of the variability in the data from monitoring period to monitoring period. Also, shifts in the water level monitoring set-up may occur during winter freeze-thaw cycles, or resulting from ice sheer or ice rafts that may form on the marsh over winter. An attempt was made at the beginning of each monitoring season to readjust the water level monitoring set up if necessary, and recalibrate the height that the probe sits below the ground surface. However, in reality these adjustments are not 100% accurate, and may contribute to some variation in the accuracy of water level measurements and our ability to make direct comparisons from year to year.

Overall, the water level data appear to indicate the an increase in ground water level throughout the tidal cycle at three of the stations, resulting in increased duration and extent of flooding in many areas of the marsh following restoration activities, with some year to year and station to station variability depending on station location and tidal conditions. The changes to the hydrologic conditions are not clearly understood at all stations; however the overall hydrologic changes appear to be consistent with the results expected from restoration activities.

3.4 WATER QUALITY

Water quality data were collected pre-restoration, and during Years 2 and 5 post-restoration to evaluate whether restoration activities resulted in a change in water quality at a gross level. Recognizing that water quality data can be highly variable, especially when few samples are collected, these data were collected primarily to determine whether water quality was within a suitable range for establishment and survival of nekton and desirable salt marsh vegetation, and to ensure that water quality remained within a suitable range following restoration activities.

Water quality data were collected on six separate field visits, pre-restoration, and during Years 1, 2, and 5 post-restoration, at all four monitoring stations. Although water quality data vary greatly between site locations and sampling events, recorded levels of dissolved oxygen, salinity, and temperatures remain within ranges suitable for nekton and salt marsh vegetation development and survival. These data are discussed in more detail in the sections below. Water

quality data collected during Year 5 post-restoration monitoring were pooled and presented in figures, included in Appendix C and in Tables 1–4 below.

3.4.1 Dissolved Oxygen

Tables 1–4 presents the dissolved oxygen (DO) data collected during all years of the study. Minimum, maximum, and mean dissolved oxygen levels, are presented for pre-restoration, and Years 1, 2, and 5 post-restoration. Data for Year 5 post-restoration are also presented in more detail in figure format in Appendix C.

For the Year 5 post-restoration monitoring event dissolved oxygen levels were measured as percent saturation in the 18-inch and the 6-inch monitoring wells and in the adjacent pools at each station. Overall, the dissolved oxygen levels were variable between years; however a large increase from the average pre-restoration level (1.67 %) in the 18 inch well at Station 2 to the 5 year post restoration DO level (4.88%). The 6 inch well at Stations 2 also had a similar increase from the pre-restoration conditions with an increase in average DO percentage from 3.65% to 5.93% in 2010. Between 2005 and 2010, the average pool DO percentage dropped nearly in half from 54.13% to 28.62 %. Each DO average at Station 1 decreased since 2005, with greatest decrease in the pool, which dropped from an average of 59.3% to 23.2% in 2010. Station 3 also had a significantly lower average DO levels in 2010 compared to 2005. The 6- in well dropped by 0.5%, while the 18- in well dropped by 0.5%. The pool at Station 3 was dry throughout the Year 5 post-restoration sampling season. The average DO percent saturation also significantly dropped at the pool at Station 4 in 2010 (15.4%) from 2005 (55.8%).

Based on this information, dissolved oxygen concentrations in the pools adjacent to monitoring stations were generally within the acceptable survival range for fish and aquatic organisms. Dissolved oxygen concentrations were much lower in water monitoring wells in comparison to pools, most likely as a result of oxidations-reduction (redox) reactions in the soils due to the flooded conditions. Comparable salt marsh studies have shown that similar variations in dissolved oxygen concentrations can occur daily and seasonally, with extreme fluctuations occurring diurnally in the late summer months (Portnoy 1991, Smith and Able 2003). In summary, post restorations dissolved oxygen levels within the water monitoring wells were acceptable for growth and maintenance of salt marsh vegetation and pool dissolved oxygen levels were acceptable for fish and aquatic organism survival.

3.4.2 Salinity

Salinity levels were recorded in the 18-inch and 6-inch monitoring wells and in pools adjacent to wells at each station, and Tables 1–4 presents the minimum, maximum, and mean salinity levels, measured in parts per trillion (ppt), for pre-restoration, and Years 1, 3, and 5 post-restoration monitoring events. Data for Year 5 post-restoration are also presented in more detail in figure format in Appendix C.

Mean salinity levels were variable among all stations and years. At Station 1, both sampling wells had lower average DO levels in 2010 than pre-restoration levels; the DO levels at the 18-

in and 6- in sampling wells both dropped by approximately 3ppt. However the mean pool salinity steadily rose from 2005, with an approximate 2 ppt increase from pre-restoration levels to Year 1 post restoration levels and rose to an additional 5.5 ppt during Year 2 Post- restoration.

Significant increases in average salinity at Station 2 were recorded at the 6- in sampling well and the pool, with increases of approximately 6 ppt and 13 ppt respectively. Salinities varied at Station 3, but the mean salinity at the 6-in sampling well rose approximately 2 ppt in 2010.

The station to station and year to year variability was likely influenced by local precipitation levels, with larger storm events resulting in lower average salinity levels, as well as the influence of recent tides. Overall the range in salinity levels observed for the study were within the normal range expected, and were well within the acceptable range necessary for survival of desirable species of nekton and salt marsh vegetation.

3.4.3 Temperature

Temperatures were recorded in the 18-inch and 6-inch monitoring wells and in pools adjacent to wells at each station, and Tables 1–4 present the minimum, maximum, and mean temperatures, measured in degrees Celsius (^{o}C), collected for pre-restoration, and Years 1, 2, and 5 post-restoration. Data for Year 5 post-restoration are also presented in more detail in figure format in Appendix C.

Mean temperatures were variable for all years of the study and were generally highest in the pools. At Station 1 the average temperature in all three sampling sites rose each year post-restoration, with the mean pool temperature rising almost 4 degrees since 2005. The mean pool temperature at Station 2 rose over 5 degrees from pre-restoration conditions to the Year 5 Post-Restoration conditions.

Water temperatures are expected to vary during the day, depending on the surrounding air and ground temperatures. Peak spawning for fish that are found in salt marsh pools such as mummichogs, typically spawn in May and June, whereas fish are less active during the fall or winter months and tend to burrow into the mud until springtime (USFWS 1985, Smith and Able 2003). Despite noted temperature variability, all pre- and post-restoration temperatures are within an acceptable range for fish survival during the period of sampling.

Table 1. Mean Water Quality, Salinity and Ground Water Data Collected at Water Quality Station 1 at the Nonesuch River Salt Marsh.

Parameters	Pre-Restoration			Year 2 Post-Restoration			Year 5 Post-Restoration		
Dissolved Oxygen (% saturation)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	1.9	1.0	4.3	1.7	0.0	11.2	1.4	.2	2.8
6”	4.7	0.7	19.0	0.3	0.0	1.4	2.6	0.2	4.2
Pool	89.0	56.4	157.9	142.7	101.5	167.7	23.2	0.1	34.0
Salinity (ppt)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	15.81	15.4	16.3	14.39	14.1	14.6	12.0	10.2	12.7
6”	20.42	18.9	21.3	14.20	13.8	14.8	16.8	15.4	18.3
Pool	15.7	12.4	18.4	15.1	14.4	16.2	18.1	14.4	20.6
Temperature (C)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	17.27	15.7	18.3	18.03	16.9	20.7	19.0	16.7	21.4
6”	17.89	16.8	19.8	18.51	17.2	21.0	20.2	18.2	22.3
Pool	27.1	24.6	30.4	26.9	18.9	29.8	22.4	20.0	27.5
Pool Depth (inches)									
Pool				1.8	1.0	3.0	3.1	1.0	5.0

Source: NEA 2005, and 2007. NR = Not Recorded

Table 2. Mean Water Quality, Salinity and Ground Water Data Collected at Water Quality Station 2 at the Nonesuch River Salt Marsh.

Parameters	Pre-Restoration			Year 2 Post-Restoration			Year 5 Post-Restoration		
Dissolved Oxygen (% saturation)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	1.7	0.8	3.7	1.8	0.0	9.1	4.9	0.8	12.4
6”	3.7	0.4	11.4	0.4	0.1	1.0	5.9	2.0	16.3
Pool	108.3	91.5	129.5	131.1	56.7	209.7	28.6	11.3	40.6
Salinity (ppt)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	12.9	12.7	13.2	11.9	11.6	12.3	10.3	9.4	12.6
6”	13.3	12.9	14.3	12.6	11.9	13.6	19.3	16.2	22.0
Pool	15.4	13.8	18.1	13.3	11.7	14.8	20.6	14.3	24.6
Temperature (C)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	16.9	16.6	17.4	16.6	15.6	18.3	17.7	15.4	21.4
6”	17.3	16.6	18.2	17.2	16.0	18.9	18.5	16.3	22.0
Pool	26.9	23.7	32.1	22.9	20.9	24.7	20.4	15.8	27.5
Pool Depth (inches)									
Pool				0.6	1.0	1.5	2.1	0.5	4.0

Source: NEA 2005, and 2007. NR = Not Recorded

Table 3. Mean Water Quality, Salinity and Ground Water Data Collected at Water Quality Station 3 at the Nonesuch River Salt Marsh.

Parameters	Pre-Restoration			Year 2 Post-Restoration			Year 5 Post-Restoration		
Dissolved Oxygen (% saturation)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	1.9	1.2	2.5	5.0	0.0	28.6	1.4	0.6	2.4
6”	8.2	1.5	22.6	0.4	0.0	1.9	3.8	3.0	5.3
Pool	149.4	149.4	149.4	NR	NR	NR	NR	NR	NR
Salinity (ppt)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	9.1	9.0	9.4	3.7	2.5	5.2	4.0	2.4	9.8
6”	8.3	6.5	10.6	9.9	9.4	10.9	14.3	11.8	22.2
Pool	8.0	8.0	8.0	NR	NR	NR	NR	NR	NR
Temperature (C)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	17.7	16.6	18.2	16.6	15.8	18.9	17.9	15.4	19.5
6”	18.2	16.8	19.3	16.7	15.4	18.7	18.7	16.7	20.9
Pool	23.3	23.3	23.3	NR	NR	NR	NR	NR	NR
Pool Depth (inches)									
Pool	1.8	1.8	1.8	NR	NR	NR	NR	NR	NR

Notes: Pool data for Water Quality Station 3 were based on pre-restoration monitoring only; this pool was dry at all times surveyed during post-restoration monitoring.

Source: NEA 2005, and 2007. NR = Not Recorded

Table 4. Mean Water Quality, Salinity and Ground Water Data Collected at Water Quality Station 4 at the Nonesuch River Salt Marsh.

Parameters	Pre-Restoration			Year 2 Post-Restoration			Year 5 Post-Restoration		
Dissolved Oxygen (% saturation)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	2.3	0.6	5.1	0.5	0.1	0.8	1.7	0.5	3.7
6”	3.4	1.0	9.4	0.7	0	2.8	3.5	1.2	6.9
Pool	55.9	33.3	75.2	84.6	41.0	160.0	15.4	3.8	73.9
Salinity (ppt)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	12.4	11.6	12.8	10.4	9.5	10.6	7.5	6.7	8.2
6”	7.7	6.6	8.1	6.6	6.1	7.0	10.7	5.1	13.1
Pool	8.7	7.1	10.6	7.6	6.6	16.2	14.2	9.5	19.8
Temperature (C)									
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
18”	15.0	13.9	15.8	14.4	13.3	16.1	16.7	15.4	17.8
6”	15.4	14.0	17.3	15.1	13.9	16.6	17.6	16.1	20.1
Pool	22.8	16.8	29.3	24.1	18.3	29.6	21.0	16.8	25.6
Pool Depth (inches)									
Pool				0.5	0.0	1.5	3.2	2.0	5.0

Source: NEA 2005, and 2007. NR = Not Recorded

3.5 VEGETATION MONITORING

Based on a review of the pre- and post-restoration vegetation monitoring data, there are several interesting trends that were observed that indicate a transition of the vegetation communities in the Project area from *Phragmites*-dominated communities, and towards more desirable salt marsh communities. Vegetation monitoring results are considered (1) in terms of the presence of invasive species, predominantly *Phragmites;* (2) based on an evaluation of vegetation presence/absence by strata (i.e., herbaceous, shrub, vine) over time; and (3) based on broad changes in percent cover by the likelihood of species' occurrence in a wetland or upland over time.

3.5.1 Invasive Species

During the pre-restoration vegetation monitoring, the five *Phragmites* areas were dominated by *Phragmites* (approximately 50% to greater than 75% cover), with *Phragmites* litter constituting the remaining ground cover (5–50% cover). Minor components (1% to more than 6%) of saltgrass, Baltic rush, New York aster, bulrush, salt meadow grass, and cattail also were interspersed within the *Phragmites* areas. During Year 2 post-restoration monitoring, no *Phragmites* was observed in any of the vegetation plots. During Year 5 vegetation monitoring, *Phragmites* was observed in only one of the established vegetation monitoring plots (i.e., plot Phrag 1), located at the western end of the Project area near Photo Station 4. Vegetation monitoring plot data indicate a substantial reduction in the presence and cover of *Phragmites* in the Project area in Year 5 post-restoration compared to pre-restoration.

In one of the *Phragmites* plots (i.e., plot Phrag 1), purple loosestrife (*Lythrum salicaria*) was identified during Year 5 post-restoration monitoring, with 1–5% cover. Purple loosestrife was not observed in and other vegetation monitoring plot during any of the vegetation monitoring pre- or post-restoration.

Based on vegetation monitoring plot data, the overall presence of invasive species in the Project area was substantially reduced post-restoration compared to pre-restoration. It's possible that disturbance associated with restoration activities created an opportunity for purple loosestrife to become established in the Project area. However, by Year 5 post-restoration the native vegetation community was well established, and it is hoped that purple loosestrife will not become a dominant species in the community. The area near plot Phrag 1 appears to have a substantially higher water table compared to pre-restoration conditions, and the success of the ditch plugging in the vicinity may be resulting in ponding of fresh water in this area, creating conditions that are conducive to purple loosestrife establishment.

The presence of *Phragmites* observed in the vegetation monitoring plots does not support the observations made during the annual site assessment that *Phragmites* has returned to each of the five *Phragmites* areas, since *Phragmites* was only found in one of the vegetation monitoring plots during Year 5 post-restoration monitoring activities. However, findings are consistent with

observations made during the annual site assessment that the overall percent cover of *Phragmites* at Year 5 post-restoration is substantially reduced compared to pre-restoration conditions.

3.5.2 Changes in Species Presence/Absence

Vegetation monitoring data reveal some interesting trends related to the change in species presence or absence comparing pre-restoration vegetation monitoring data with Year 5 post-restoration data.

- Three species that are commonly associated with salt or brackish marshes were observed for the first time during the Year 5 post-restoration monitoring:
  - *Eleocharis parvula* dwarf spike-rush
  - *Juncus canadensis* Canada rush
  - *Triglochin maritimum* common arrowgrass
- Several species that are more frequently associated with freshwater wetland systems and had been observed during previous vegetation monitoring activities were not observed during the Year 5 post-restoration monitoring:
  - *Leersia oryzoides* rice cutgrass
  - *Lycopus virginicus* Virginia water horehound
  - *Oenothera fruticosa* narrowleaf evening primrose
  - *Polygonum punctatum* dotted smartweed
  - *Rumex crispus* sour dock
  - *Trifolium species* clover species
  - *Vicia cracca* bird vetch
- Shrubs that were observed during pre-restoration vegetation monitoring were not observed during Year 5 post-restoration vegetation monitoring:
  - *Polygonum ramossisimum* bushy knotweed
  - *Rosa palustris* swamp rose
- One vine species that was present during pre-restoration and Year 2 post-restoration, was not observed during Year 5 post-restoration monitoring:
  - *Calystegia sepium* hedge bindweed
- The other vine species was observed during all three monitoring periods, but the overall percent cover decreased post-restoration compared to pre-restoration:
  - *Cuscuta gronovii* common dodder
- The overall presence of several species that are commonly associated with low or high salt marsh or brackish marsh were observed to increase from pre-restoration vegetation monitoring to Year 5 post-restoration monitoring:
  - *Schoenoplectus acutus* hardstem bulrush
  - *Scirpus pungens* common three-square
  - *Scirpus robustus* salt marsh bulrush
  - *Spartina alterniflora* smooth cordgrass
  - *Spartina patens* salt meadow grass
  - *Typha angustifolia* narrow-leaved cattail

Overall the changes observed in species presence or absence associated with the vegetation monitoring are consistent with other monitoring findings, which indicate a trend towards development of a more desirable salt marsh community as a result of wetland restoration activities.

3.5.3 Changes in Percent Cover By Indicator Status Over Time

To evaluate and compare vegetation cover change over time (i.e., pre-restoration 2005, Year 2 post-restoration 2007, and Year 5 post-restoration 2010), the cover class was replaced with the median cover class value for each cover class (Table 5). The Braun-Blanquet Cover Classes represents the range of percent cover within which each species was determined to be present. Once the cover class values were replaced with the median value for each cover class, the total percent cover for each species was summed across all vegetation monitoring plots in order to determine the approximate total percent cover for each species. Species were grouped by strata (i.e., herbaceous, shrub, vine) and wetland indicator status. Wetland indicator status is used to designate a plant species' preference for occurrence in a wetland or upland (Table 6). These data were tallied by indicator status so that basic trends could be identified, which are summarized in Table 7 and shown in Appendix D.

Table 5. Median Cover Class Values.

Braun-Blanquet Cover Class	Percent Cover	Median Cover Class Value
t	<1	0.5
1	1 to 5	3
2	6 to 25	15.5
3	26 to 50	38
4	51 to 75	63
5	>75	88

Table 6. Wetland Indicator Status Categories.

Indicator Code	Indicator Status	Designation	Comment
OBL	Obligate Wetland	Hydrophyte	Almost always occur in wetlands
FACW	Facultative Wetland	Hydrophyte	Usually occur in wetlands, but may occur in non-wetlands
FAC	Facultative	Hydrophyte	Occur in wetlands and non-wetlands
FACU	Facultative Upland	Nonhydrophyte	Usually occur in non-wetlands, but may occur in wetlands
UPL	Obligate Upland	Nonhydrophyte	Almost never occur in wetlands
NL	Not Listed	Likely Nonhydrophyte	Status not yet determined, but not known to occur in wetlands

Source: USDA NRCS 2014

Table 7. Summary of Vegetation Cover across all Vegetation Monitoring Plots at the Nonesuch River Salt Marsh..

Year by Strata	Indicator Status				
	NL	FACU	FAC	FACW	OBL
Herbaceous					
2005	0	80	0	4743	1737
2007	3.5	50	3	3196.5	1599
2010	0	15.5	0	4891	3680
Shrub					
2005			3		15.5
2007			3		0
2010			0		0
Vine					
2005	33		31.5		
2007	4		16		
2010	17		0		

Note: Vegetation cover class was substituted with the mean value of each class, and summed across all vegetation monitoring plots.

The results of this assessment of changes in total percent cover by indicator status reveal some interesting trends. Vegetation monitoring observations indicated that nonhydrophytic herbaceous species (i.e., FACU) decreased in total percent cover from pre-restoration to Year 5 post-restoration, whereas obligate hydrophytic herbaceous species (i.e., OBL) increased in total percent cover during the same period. Vegetation monitoring results also indicated a decrease in total percent cover for both shrub and vine species across each of the wetland indicator status categories observed when comparing conditions over time.

Overall the changes in total percent cover by indicator status are consistent with other monitoring findings, which indicate a trend towards development of a more desirable salt marsh community as a result of wetland restoration activities.

4.0 MANAGEMENT IMPLICATIONS AND RECOMMENDATIONS

4.1 MANAGEMENT IMPLICATIONS

The results of pre- and post-restoration monitoring activities at Nonesuch Salt Marsh indicate the following:

- It appears that marsh restoration activities have contributed to overall increased cover of desirable species, decreased the cover of undesirable species, increased desirable permanent pool habitat for fish when comparing pre-restoration conditions to post-restoration conditions.
- The *Phragmites* community has been replaced with a more diverse community comprising a combination of bulrush, cattail, and cordgrass, spike grass or saltgrass, and rush species.
- *Phragmites* had returned to each of the five areas by Year 5 post-restoration, but at substantially reduced levels compared to pre-restoration conditions.
- The total aerial coverage of narrow-leaved cattail appears to have increased compared to pre-restoration conditions, and now occupies portions of the areas formerly dominated by *Phragmites* and the former berm areas; however, narrow-leaved cattail is a brackish marsh species and was abundant in the Project area prior to implementation of restoration activities, including in the areas surrounding the former *Phragmites* areas.
- The majority of ditch plugs are in excellent condition, have revegetated with desirable species, are stable, and are holding water in permanent pools, and in several cases the location of the ditch plug is no longer discernable from the natural marsh.
- Excavated pools, both newly created pools and those created within former existing channels following ditch plug activities, appear to be retaining water, support fish populations, have stable edges that have revegetated with desirable species, and are no longer discernable from pre-existing pools.
- The water level data appear to indicate the an increase in ground water level throughout the tidal cycle at three of the stations, resulting in increased duration and extent of flooding in many areas of the marsh following restoration activities, with some year to year and station to station variability depending on station location and tidal conditions; the changes to the hydrologic conditions are not clearly understood at all stations; however the overall hydrologic changes appear to be consistent with Project expectations.
- Post-restoration water quality parameters (i.e., dissolved oxygen, salinity, and temperature) were within the acceptable range necessary for survival of desirable species of nekton and salt marsh vegetation.
- The changes in vegetation species presence or absence and the changes in total percent cover by indicator status indicate a trend towards development of a more desirable salt marsh community compared with pre-restoration conditions.

4.2 MANAGEMENT RECOMMENDATIONS

Recommendations for continued management of the Nonesuch River site, based on site assessments, data collection, and other incidental observations, include the following:

- Monitor areas where growth of *Phragmites australis* is occurring. If communities of *Phragmites* continue to expand out onto the marsh, treatment could be considered to control further spread of *Phragmites* in the Project area.

Overall, the salt marsh restoration appears to have successfully plugged man-made ditches and breached or removed previously existing berms to restore hydrologic functions to the Nonesuch River site. These activities have resulted in an increase in the elevation of the groundwater table, an increase in the frequency and duration of flooding in temporary pannes, and an increase in the amount of permanent pool habitat post-restoration compared to pre-restoration in many areas of the Project area. However, *Phragmites* growth on the marsh persists, and continued monitoring of the *Phragmites* community is advised.

5.0 REFERENCES

Environmental Systems Research Institute, Inc. (ESRI). 1982. ArcInfo Geographic Information Systems Software, Version 8.0. Redlands, CA: ESRI, Inc.

Environmental Systems Research Institute, Inc. (ESRI). 1996. ArcView Geographic Information Systems Software, Version 3.2. Redlands, CA: ESRI, Inc.

Global Programme of Action Coalition for the Gulf of Maine (GPAC). 1999. *Regional Standards to Identify and Evaluate Tidal Wetland Restoration in the Gulf of Maine.* Wells National Estuarine Research Reserve, Wells, Maine.

Global Water Instrumentation, Inc. 2001. Global Water Model WL15 Pressure Transducer/Data Loggers, Gold River, CA.

Northern Ecological Associates (NEA). 2005. Nonesuch River Salt Marsh Post-Restoration Monitoring Draft Data and Documentation Report. Prepared by Tetra Tech (formerly Northern Ecological Associates, Inc.), for the Friends of Scarborough Marsh, December 2005.

_____. 2007. Nonesuch River Salt Marsh Post-Restoration Monitoring Draft Data and Documentation Report. Prepared by Tetra Tech (formerly Northern Ecological Associates, Inc.), for the Friends of Scarborough Marsh, December 2007.

Portnoy, J.W. 1991. Summer Oxygen Depletion in a Diked New England Estuary. Estuaries. Vol. 14: 122-129.

Smith, K.J. and K.W. Able. 2003. Dissolved Oxygen Dynamics in Salt Marsh Pools and its Potential Impacts on Fish Assemblages. Marine Ecology Progress Series. VOL. 258:223-232.

United States Department of Agriculture Natural Resources Conservation Service (USDA NRCS). 2014. Plants Database – Wetland Indicator Status. Available at: http://plants.usda.gov/wetinfo.html

United States Fish and Wildlife Service (USFWS) 1985.Species Profiles. Life History and Environmental Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic)-Mummichog and Striped Killifish. USFWS Biological Report 82 (11) United States Army Corp of Engineers, TR EL-82-4. 23.

United States Fish and Wildlife Service (USFWS). 2001. Salt Marsh Restoration Monitoring Plan for Ditch-Plugging Efforts in New England Marshes. Prepared by Tetra Tech, Inc. (formerly Northern Ecological Associates, Inc.), Portland, ME, for USFWS, Falmouth, ME. July 2001.

YSI, Incorporated. 1996. YSI Model 85 Handheld Oxygen, Conductivity, Salinity, and Temperature System. Yellow Springs, OH.

APPENDIX A

2010
Completed Site Assessment Data Forms

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Nonesuch River Restoration Monitoring Site Assessment

Site Name:	**Date:**	**Time:**	**Time of last high tide:**
Evaluator(s):		**Tide:** High Mid Low **and** incoming outgoing	
Cloud Cover(%): 0, 1 – 25, 25–50, 50–57, > 75%		**Precipitation:** none, drizzle, steady rain	
Temperature (ºF):	**Wind: calm intermittent breeze steady breeze gusting**		
Rain events within past 3-days (avg. over 72 hours): none <25 %, 25-50%, 51-75%, >75			

REF #	**ACCEPTABLE CONDITIONS**	**UN-ACCEPTABLE CONDITIONS**
1) Ditch Plugs:		
	_____ Desirable species present	_____ Desirable species absent; undesirable species present
	_____ Plant health/vigor good	_____ Plants in poor health, showing signs of stress
	_____ No obvious loss of aerial coverage or density	_____ Obvious loss of aerial coverage, plant density
	_____ No evidence of water flows, leaks	_____ Evidence of water flows, leaks
2) Excavated Pools/Altered Tidal Creeks:		
	_____ Pools retaining adequate water	_____ In-sufficient water retained in pools
	_____ Water quality adequate	_____ Water quality poor (*i.e.*, anaerobic conditions)
	_____ Presence of nekton	_____ Evidence of nekton die-off
	_____ Presence of macro-invertebrates	_____ Evidence of macro-invertebrate die-off
	_____ Mosquito larvae none - few	_____ Mosquito larvae common - many
	_____ Pool edges intact, stable	_____ Pool edges sloughing, undercut, unstable
	_____ Typical aquatic veg. species present	_____ Devoid of aquatic veg. or invasive species present
3) Berm/Breach Areas:		
	_____ Desirable species present	_____ Desirable species absent; undesirable species present
	_____ Plant health/vigor good	_____ Plants in poor health, showing signs of stress
	_____ Evidence of restored surface water movement	_____ No evidence of restored surface water movement
4) Undesirable Species: (*Phragmites, Typha, Lythrum, Polygonum cuspidatum, and shrubs on high marsh surface)*		
	_____ No undesirable species present	_____ Undesirable species found on site
	_____ Undesirable species coverage not increasing	_____ Undesirable species coverage increasing
* Identify the location of undesirable species on the cover type map		
5) Desirable Species: (*Spartina, Juncus, Distichlis, Salicornia, Scirpus, Solidago, Ruppia) note others when encountered*		
	_____ Plant health, vigor good	_____ Plants in poor health, showing signs of stress
	_____ No obvious loss of aerial coverage or density	_____ Obvious loss of aerial coverage, plant density
	_____ Shrubs, if present, are declining in health	_____ Shrubs, if present, are healthy or increasing in % cover

Observations (identify if any of the following observations are made)

Ref. #	**Species Group**	**√ if None**	**Note Species, Activity, Number, Habitat Use, etc**. (identify approximate location on cover type map)
7	Passerines or passerine nests		
8	Wading birds or wading bird nests		
9	Water birds or water bird nests		
10	Raptors or raptor nests		
11	Small mammals		
12	Large mammals		
13	Amphibians		
14	Reptiles		
15	Recreational activities		
16	Site disturbance		
17	Mosquito adult/larvae in pools		
18	Macro-invertebrates in pools		
19	Fish in pools		

Site Assessment (additional comments)

Be sure to record the location of features exhibiting un-acceptable conditions on the cover type map

Ref. #	Comments
1	Ditch Plugs — See specific notes on each ditch plug examined during site assessment. In general ditch plugs were revegetating with desirable species, plant health/vigor was good, and there were no significant leaks or signs of erosion around the ditch plugs. Some minor stress was evident on some ditch plugs, as noted below.
DP 1	Increase to 100% cover, hard to differentiate DP from surrounding, not sure where DP material came from, no obvious pool, no obvious ditch that needed plugging, no erosion. DISP, SC sp., TYAN, and SCPE.
DP 2	Increase to 100% cover, deep pool with lots of water behind, some fish, channels all lined with SC sp.
DP 3	Same as DP 4, 100% cover.
DP 4	Excellent condition, 100% veg. cover, narrow pool created in former channel, no erosion or leaks observed. DISP, SC sp., SPPA, small amount *Typha*
DP 5	Excellent condition, 95% cover, hard to tell where original marsh ends and DP begins, created pool is deep enough for fish, holding water, no erosion observed. SC sp., SPCY, DISP, SPPA
DP 6	Good condition, 85% cover, DISP, SC sp., TYAN, minor erosion, holding water to west and where B6 excavation occurred, fish present.
DP 7	Not sure of plug location; no clear ditch behind the location as noted on map. See area of DISP, *Scirpus* sp., that may be plug- in good condition and dense (100%) cover, but no channel behind.
DP 8	Not clear where, no apparent plugged channel. SC sp., *Solidago*, SCPE, Phragmites present
DP 9	DISP, *Scirpus*, *Typha*. Good condition, some accumulated organic debris behind plug, fish. Three Phragmites stems present. (Photo)
DP11	*Scirpus*, *Aster*, DISP, increase to 100% cover, good condition, no pool observed behind but soil was saturated, high water table, no erosion, height ok.
DP12	DISP, *Scirpus* sp., good condition, 100% cover, holding water, minor erosion and north side, pool/ponded water behind, feeding TYAN area. 10-15 Phrag stems. (Photo)
DP13	SC/*Schoenoplectus* species, good cover, seems stable, no issues. Nice pool.
DP14	Not clear where DP is, or if present at all, small channel but no associated pool.
DP15	Excellent condition, 100% veg. with DISP, SPPA, SPCY, SC sp., *Aster*, TYAN, TYLA, holding water, no erosion or leaks observed. No longer distinguishable where DP was.
DP16	Same as DP15, could not differentiate DP from natural.
DP18	Holding water, no erosion, slightly high but not too high, *Typha*, DISP, SPCY, *Aster*, Rye grass sp., quackgrass, and *Rosa*. 100% cover, pool behind is deep enough for fish.
DP19	TYAN, SCVA, DISP 100% cover, great condition, hard to tell from surrounding marsh, holding water behind, no signs of erosion. (Photo)
DP20	Good condition. Revegetate with SC sp., *Typha*, *Solidago*. Nice deep pool with fish.
DP21	Excellent, increase to 100% cover, similar to most with DISP, SC sp., *Typha* sp., and SPCY. A little *Phrag* present. (Photo with B12)
DP22	Excellent condition. SC sp.
DP23	TYLA, SCRO, DISP, SC sp., 100% cover, exposed plywood-3 pieces and some evidence of erosion. Holding a lot of water in pool behind, fish present, need to pound plywood in further. (Photos (3))

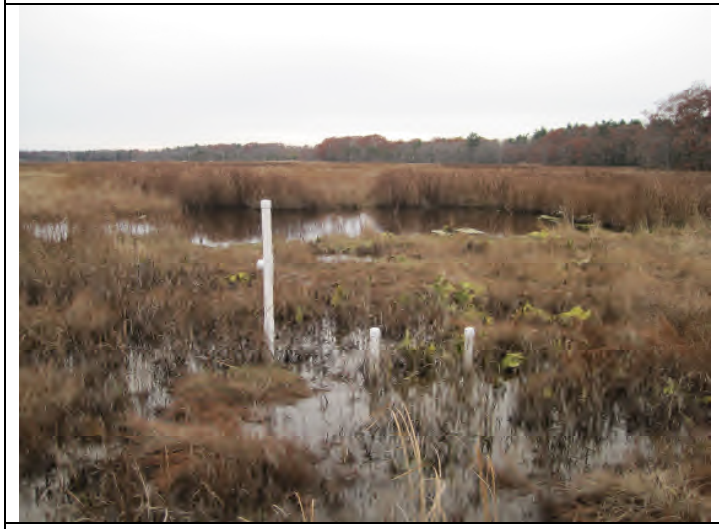
Ref. #	Comments
DP 24	DP has partially failed. Plywood exposed in two places, holding some soil between them but water is draining around them. (Photos (3)) DISP, SC sp, SPPE, *Solidago*
DP 25	In good shape, holding water, no leaks, no exposed plywood, elevation is ok, no erosion. 100% cover. Revegetating with DISP, SC sp., *Schoenoplectus*, *Solidago*
DP 26	Plywood exposed in two places. DP has been partially compromised. (Photos (3)) 75% cover, SC sp., DISP, SCRO, SPPE, *Phragmites* present.
DP 27	Good. Holding water, no erosion, no plywood visible, elevation is ok. Deep permanent fish habitat; lots of fish! 100% cover, DISP, SPPA, DISP
DP 28	Holding water in deep created pool, increase to 100% veg. cover. Fish present. DISP, SC sp., SPPE, *Phragmites* present. (Photo)
DP 29	Holding water in deep created pool, slightly high elevation. Increase to 100% cover. *Phragmites* present on DP. (Photo) Fish in pool. SPPA, *Juncus*, *Typha*, DISP
DP 30	Holding water, increase to 100% vegetation cover, deep pool created. Elevation ok. (Photo) DISP, SC sp., *Phragmites* stems on DP.
2	Excavated Pools — majority of pools excavated in creation of ditch plugs appeared to be retaining water and of a depth appropriate to support fish. Water quality appeared to be adequate, and edges were intact. Desirable salt marsh vegetation is present.
3	Berm/Breach Areas — See specific notes on each berm/breach location examined during site assessment. In general, berm breach areas were now created pools, and shallower areas had revegetated with desirable salt marsh species. Plant health was good, and surface water would no longer be impeded by these areas.
B 1	A couple inches of water, SC sp.
B 2	Large pool created near WLR1, deep enough for fish (Photo) *Phragmites* areas north of WLR1.
B 3	Pool created with fish, deeper parts present, depth variable, SC sp.
B 4	Unclear whether material was removed, no pool created, some bare ground which may be indicative of removal. SCRO/*Schoenoplectus*
B 5	Same as B 4, unclear location, adjacent channel now holds permanent water due to DP 6
B 6	SC sp.
B 7	Created pool, deep enough to sustain fish, open water has lots of fish, near WLR2 (south) (Photo) TYAN
B 8	Same as B7, nice, fish. TYAN
B 9	Typha.
B10	Grades from "Island" -w/shrubs to open water with *Typha*, open water, fish present. Lots of *Typha*
B11	Created pool fed by DP15 and DP16, TYAN.
B12	Permanent pool habitat created and fed by DP21 and DP22, fish present. (Photo with DP21)
B13	Not as deep a created pool but consistent with surrounding area of shallow pools ad hummocks, supports fish. TYAN.
B14	Created pool, TYAN, *Scirpus* adjacent, fish present.
B15	Lots of pooled water/high water table, revegetated with native vegetation.

Ref. #	Comments
4	Undesirable Species — See specific notes on each *Phragmites* area examined during site assessment. TYAN is present throughout the site, interspersed with other communities, including *Scirpus*, *Spartina*, *Distichlis*, and *Juncus*-dominated communities. The total aerial coverage of *Typha* has likely increased compared to pre-restoration conditions, where *Typha* now occupies areas formerly dominated by *Phragmites*, however TYAN is a brackish marsh species and is a frequent inhabitant of salt marshes at the upper reaches of the tidal range.
Phrag 1	At north end of site. Diverse regrowth of DISP, *Scirpus*, TYAN, some (<10%) PHAU, dead standing broken, open, *Phrag* may continue to spread. Minor regrowth especially present along edges of channel. Stunted, but will likely increase in height and density, especially on old berms and higher elevation areas.
Phrag 2	TYAN coming up and some minor phrag regrowth; more water than pre-restoration probably due to DP12. Some SPPA at edges, TYAN is approximately 80% cover. Also SPPE and SC sp.
Phrag 3	A few stems of *Phragmites* have regrown, revegetated with TYAN, DISP, SPPA. Water table is much higher at/above surface up to a few inches at all times observed. Channel within holding deep water for fish. 80-90% cover; *Phragmites* is still sparse.
Phrag 4	Phragmites is not dense, maybe 5-10% cover with DISP, *Atriplex*, *Scirpus*, aster, co-dominant. Revegetate with *Typha* and native species, but >40-50 stems immature PHAU present. (Photo) looking west.
Phrag 5	Minor *Phragmites* regrowth, DISP, SCVA. Open water in channels, TYAN growing up. See also B15.
5	Desirable Species — Plant health/vigor of desirable salt marsh species is good, and there has not been an obvious loss of aerial coverage or density.

TETRA TECH, Inc.

Site Assessment Photographs

Client:	Friends of Scarborough Marsh		**Project:**	Nonesuch River
Photographer:	Sarah Watts			
Location:	Scarborough, ME		**Date:**	11/07/10 & 11/12/10



Berm 2 and Water Level Recorder 1

Ditch Plug 24 (1)

Ditch Plug 24 (2)

Ditch Plug 24 (3)

TETRA TECH, Inc.

Site Assessment Photographs

Client:	Friends of Scarborough Marsh		**Project:**	Nonesuch River
Photographer:	Sarah Watts			
Location:	Scarborough, ME		**Date:**	11/07/10 & 11/12/10

Ditch Plug 26 (1)

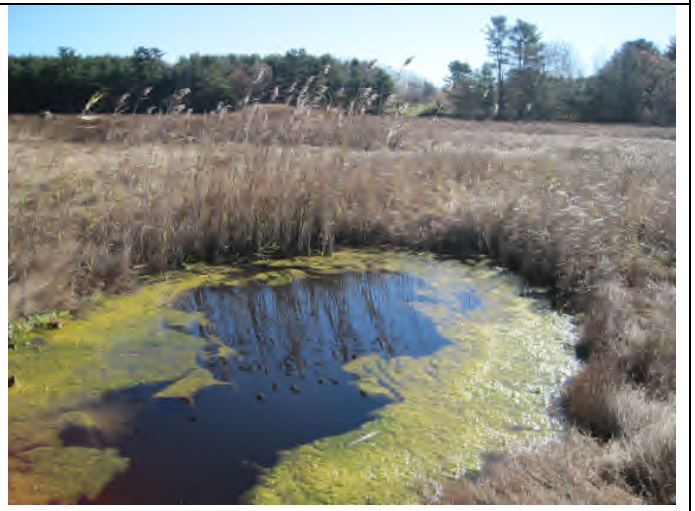
Ditch Plug 26 (2)

Ditch Plug 26 (3)

Ditch Plug 28

TETRA TECH, Inc.				
Site Assessment Photographs				
Client:	Friends of Scarborough Marsh		**Project:**	Nonesuch River
Photographer:	Sarah Watts			
Location:	Scarborough, ME		**Date:**	11/07/10 & 11/12/10

Ditch Plug 29



Ditch Plug 30

Phragmites Area 4 (looking west)

Ditch Plug 9

TETRA TECH, Inc.				
Site Assessment Photographs				
Client:	Friends of Scarborough Marsh		**Project:**	Nonesuch River
Photographer:	Sarah Watts			
Location:	Scarborough, ME		**Date:**	11/07/10 & 11/12/10

Ditch Plug 12

Berm 7

Berm 14 and Ditch Plug 21

Ditch Plug 19

TETRA TECH, Inc.				
Site Assessment Photographs				
Client:	Friends of Scarborough Marsh		**Project:**	Nonesuch River
Photographer:	Sarah Watts			
Location:	Scarborough, ME		**Date:**	11/07/10 & 11/12/10

Ditch Plug 23 (1)

Ditch Plug 23 (2)

Ditch Plug 23 (3)

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APPENDIX B

2010
Photographic Documentation

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TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Year 5 Post-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 1-1
Direction: 120

Comments:
Start of panoramic photo series at Photo Station #1. Station is setup just outside of removed *Phragmites* patch, adjacent to water monitoring station #4.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 1-2
Direction: 70

Comments:
Panoramic series from Photo Station #1. Picture of *Phragmites* removal area in the background.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 1-3
Direction: 20

Comments:
Panoramic series from Photo Station #1. Picture of *Phragmites* removal area in the background.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 1-4
Direction: 330

Comments:
End of panoramic series from Photo Station #1. End of the *Phragmites* removal area to the right of center near water monitoring station #4.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-1
Direction: 50

Comments:
Start of panoramic photo series from Photo Station #2 at low tide during neap 1st quarter. *Phragmites* removal area in the distance.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-2
Direction: 10

Comments:
Panoramic series from Photo Station #2 at low tide during neap 1st quarter. *Phragmites* removal area to the left of center.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-3
Direction: 330

Comments:
Panoramic series from Photo Station #2 at low tide during neap 1st quarter. *Phragmites* removal area to right of center and in distance at left.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-4
Direction: 290

Comments:
Panoramic series from Photo Station #2 at low tide during neap 1st quarter. Water monitoring station #1. *Phragmites* removal area to right of water monitoring station, in distance.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-5
Direction: 250

Comments:
Panoramic series from Photo Station #2 at low tide during neap 1st quarter.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-6
Direction: 210

Comments:
Panoramic series from Photo Station #2 at low tide during neap 1st quarter.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-7
Direction: 170

Comments:
Panoramic series from Photo Station #2 at low tide during neap 1st quarter.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-8
Direction: 130

Comments:
Panoramic series from Photo Station #2 at low tide during neap 1st quarter.

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 2-9
Direction: 90

Comments:
End of panoramic series from Photo Station #2. *Phragmites* removal area in distance to the left of center.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 3-1
Direction: 260

Comments:
Start of panoramic series from Photo Station #3 at low tide during neap 1st quarter. *Phragmites* removal area, at center.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 3-2
Direction: 210

Comments:
Panoramic series from Photo Station #3 at low tide during neap 1st quarter.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 3-3
Direction: 160

Comments:
Panoramic series from Photo Station #3 at low tide during neap 1st quarter.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 3-4
Direction: 110

Comments:
Panoramic series from Photo Station #3 at low tide during neap 1st quarter. *Phragmites* removal area in distance to right of center.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 3-5
Direction: 180

Comments:
End of panoramic series from Photo Station #3. *Phragmites* removal area in distance.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service & Friends of Scarborough Marsh
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 4-1
Direction: 110

Comments:
Start of panoramic series from Photo Station #4 at low tide during neap 1st quarter. Small *Phragmites* removal area at center.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 4-2
Direction: 150

Comments:
Panoramic series from Photo Station #4 during low tide during neap 1st quarter. *Phragmites* removal area at center.

TETRA TECH, INC.

PHOTOGRAPHIC RECORD
Pre-Restoration Monitoring

Company: U.S. Fish and Wildlife Service
Project: Nonesuch River Salt Marsh Restoration

Photographer: S. Watts
Date: 11-12-10
Photo No.: 4-3
Direction: 190

Comments:
Panoramic series from Photo Station #4 at low tide during neap 1st quarter. *Phragmites* removal area to left and at center-right.

Photographer: S. Watts
Date: 11-12-10
Photo No.: 4-4
Direction: 230

Comments:
End of panoramic series from Photo Station #4. *Phragmites* removal area left of center.

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APPENDIX C

2010
Water Sampling Data

- **Tidal Signal Data (water level recorder data)**
- **Water Quality Data**

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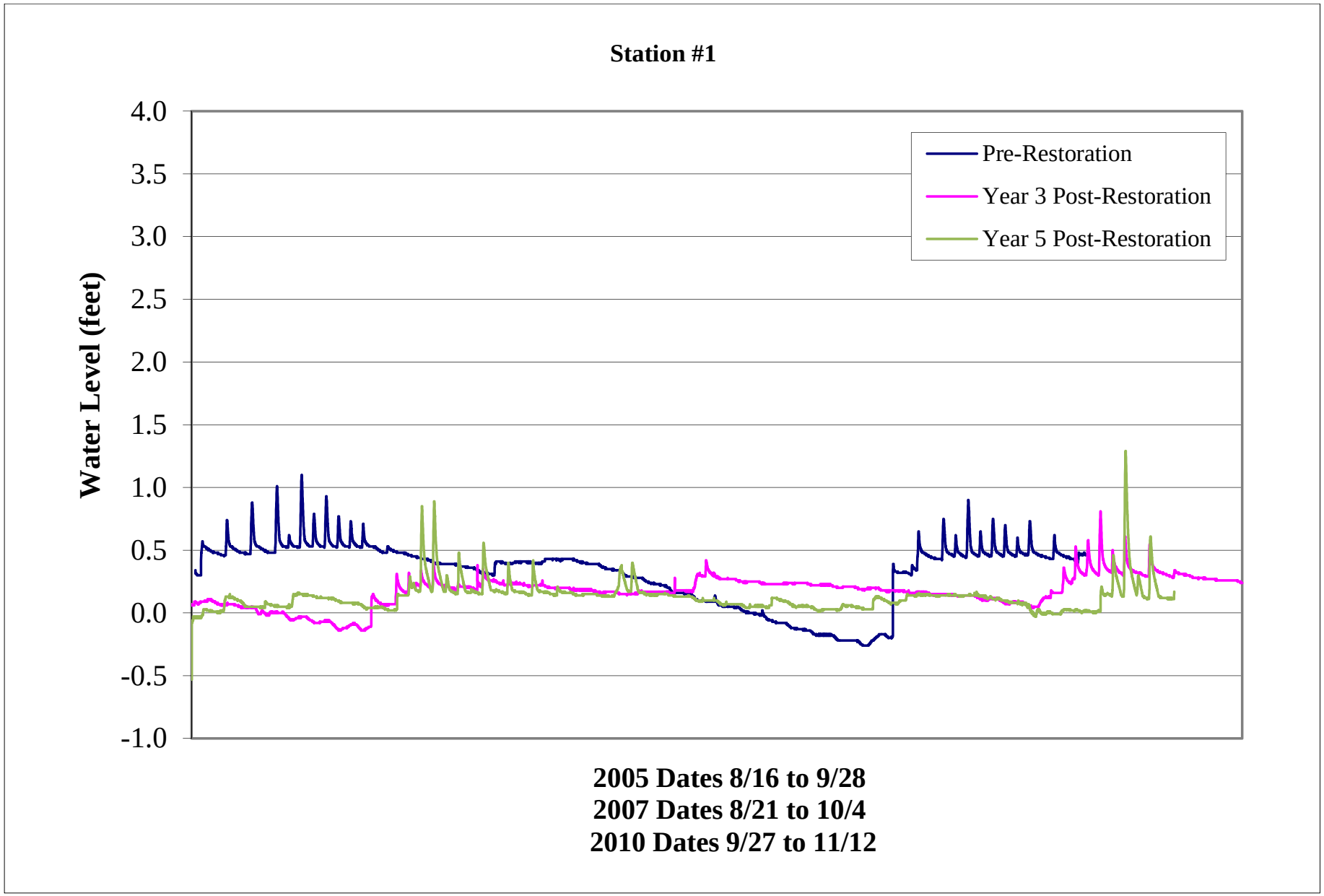
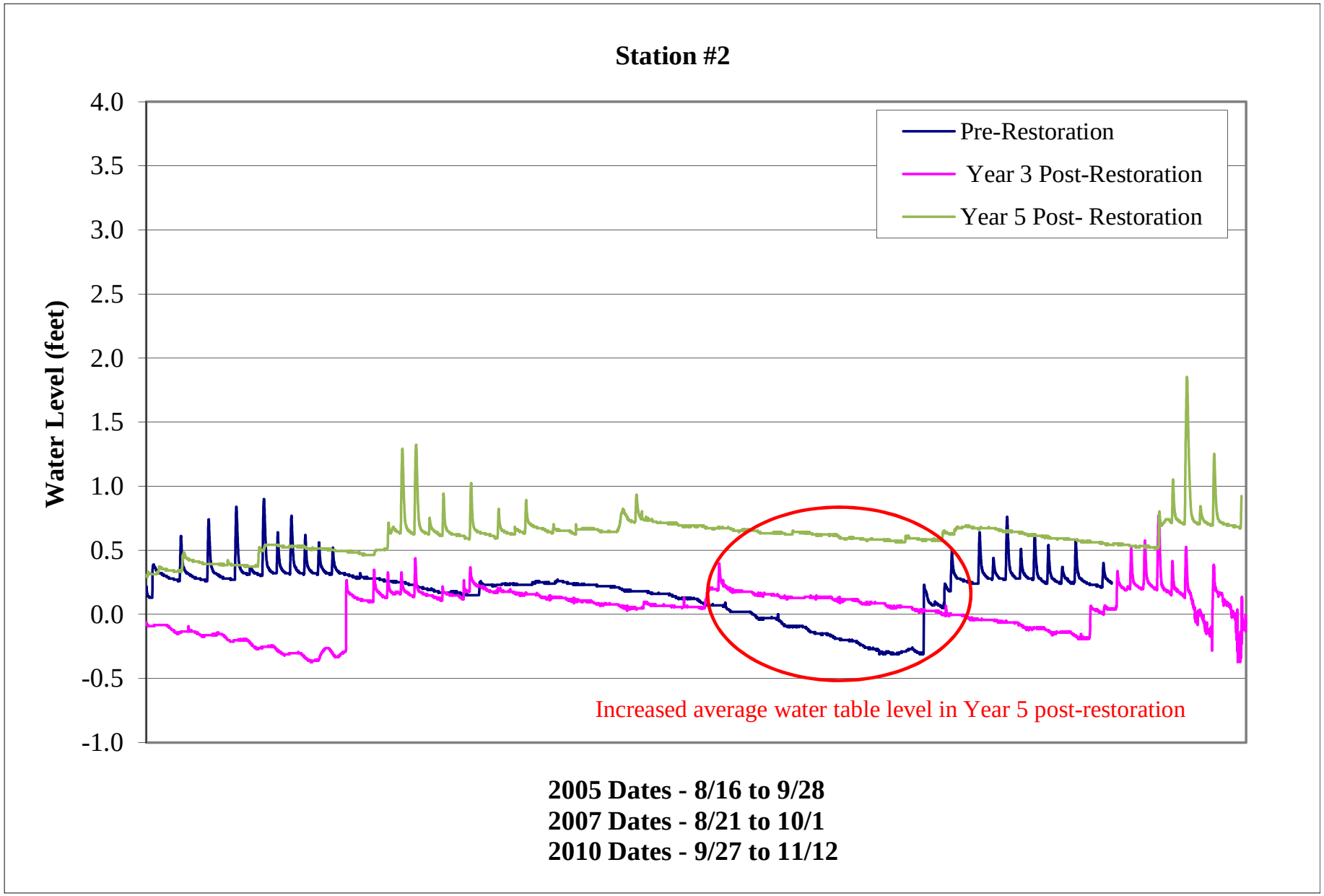
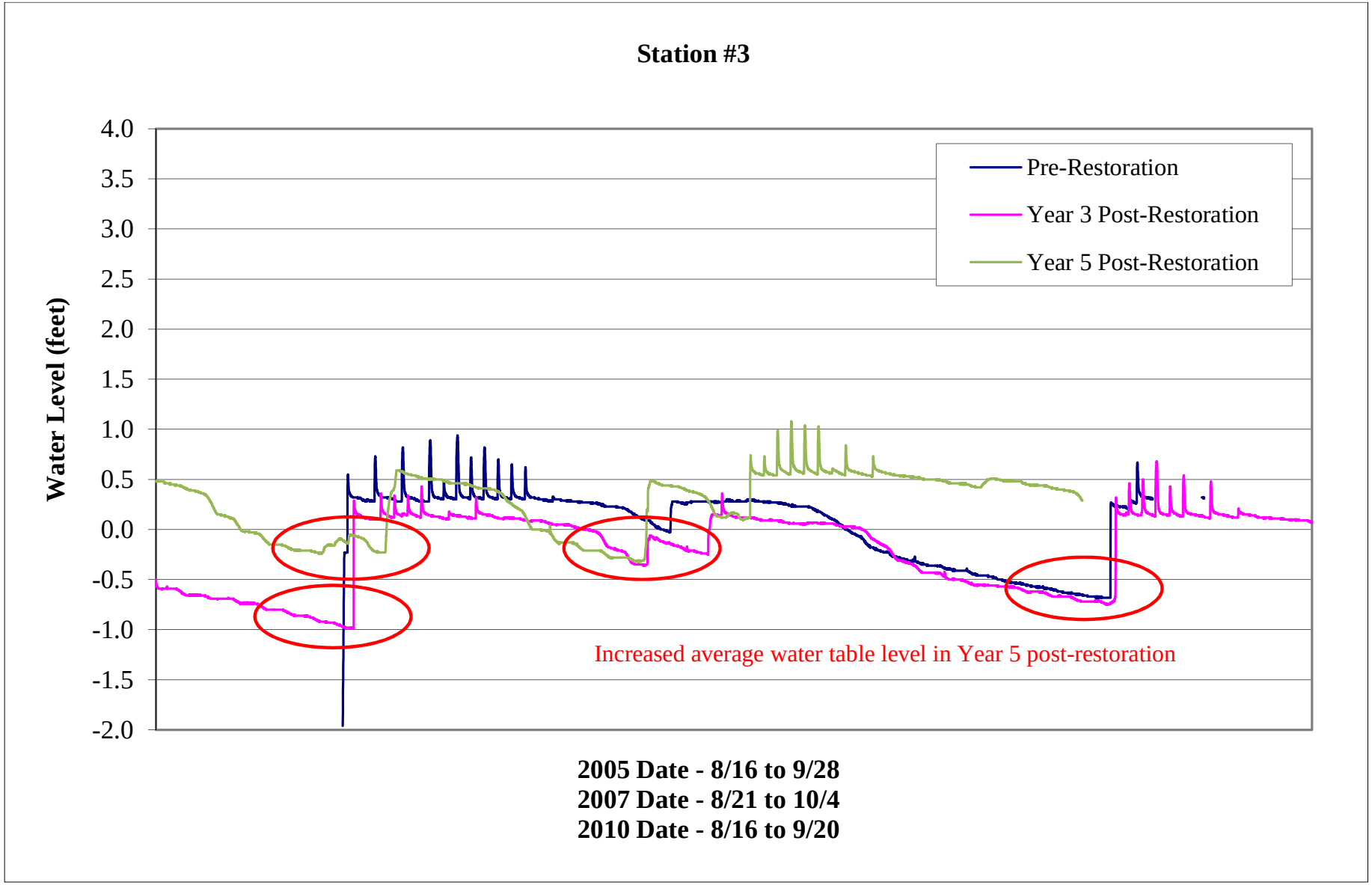
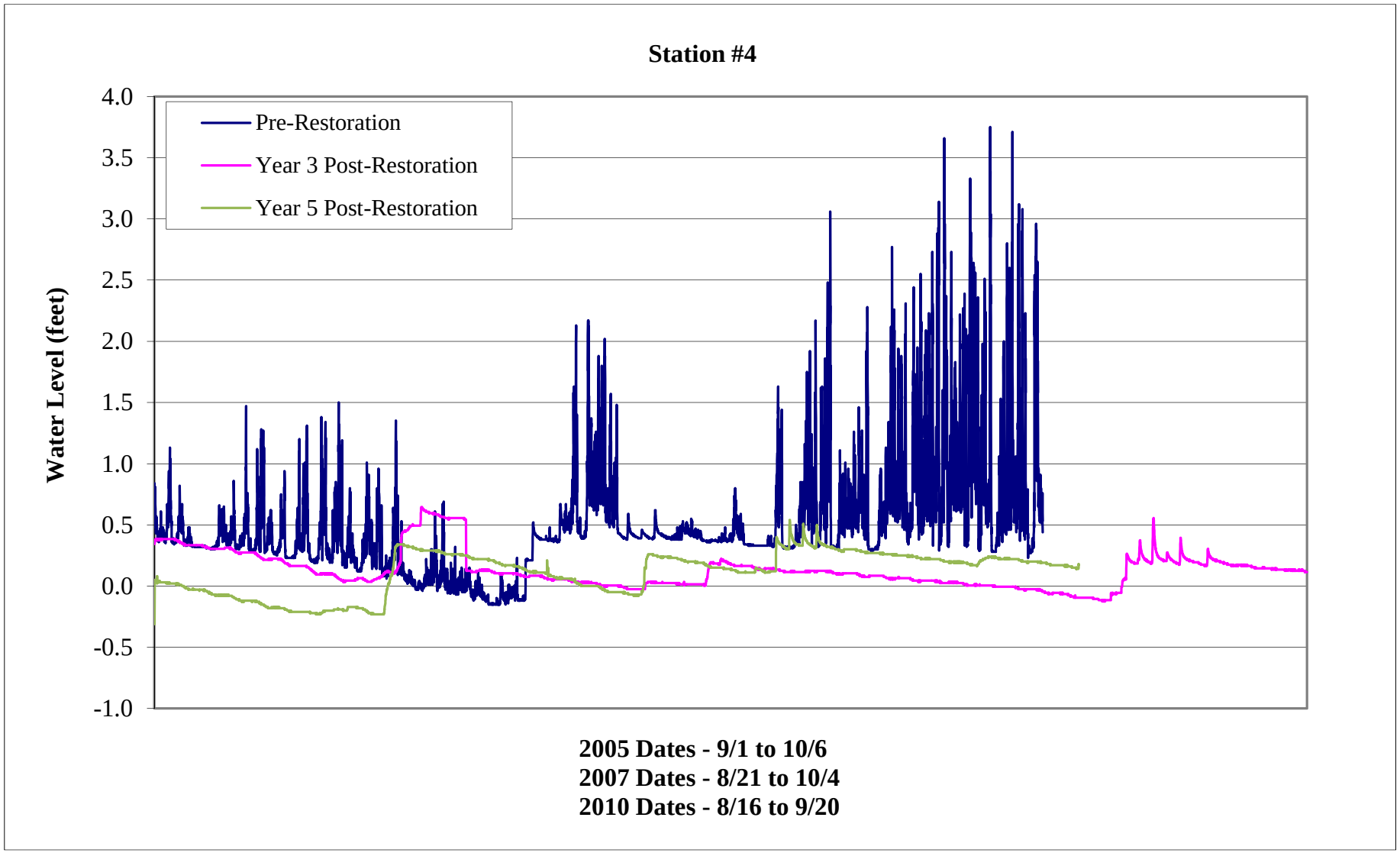
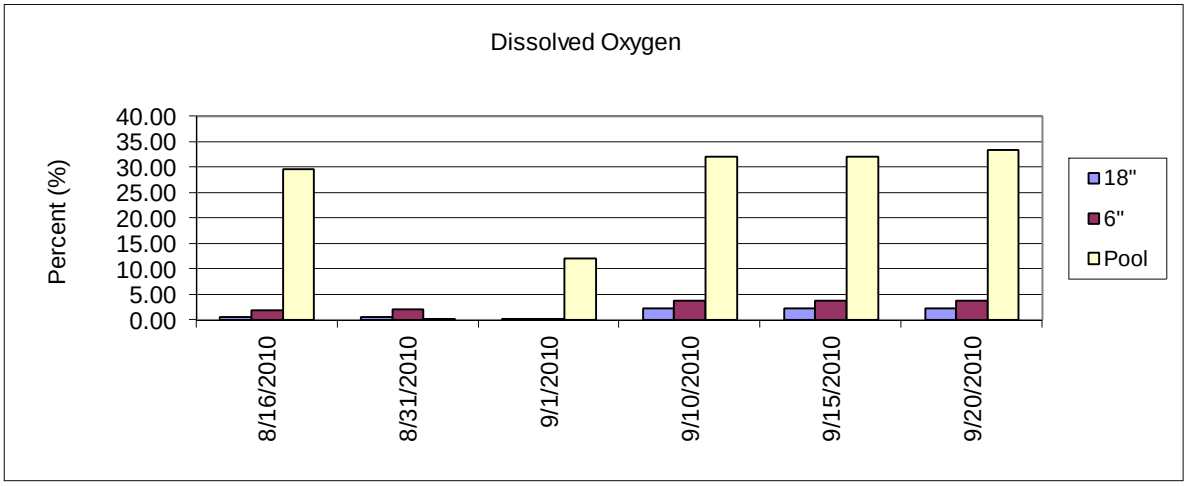

Station #1
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Water Level (feet)
Pre-Restoration
Year 3 Post-Restoration
Year 5 Post-Restoration
2005 Dates 8/16 to 9/28
2007 Dates 8/21 to 10/4
2010 Dates 9/27 to 11/12

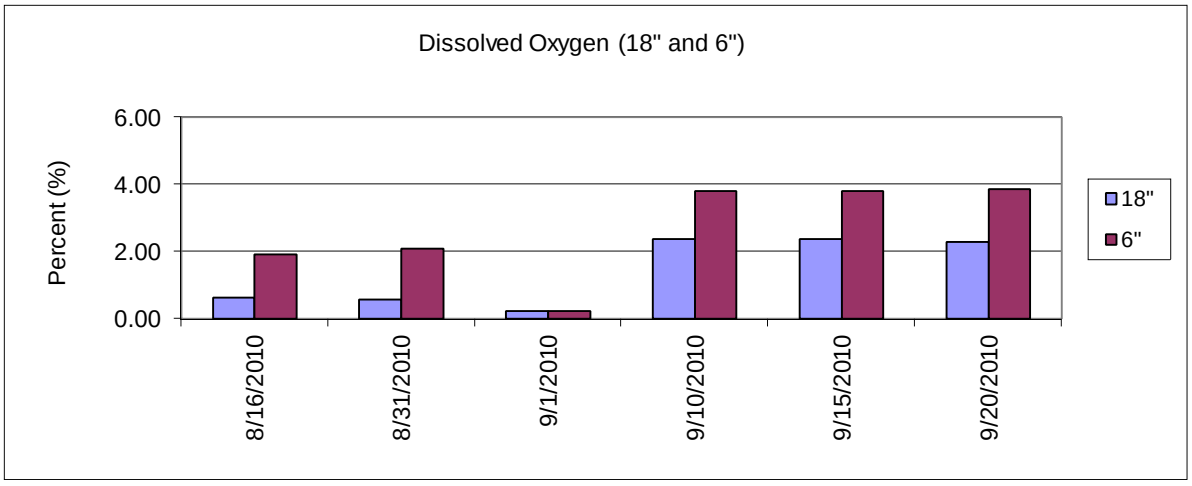

Station #2
Water Level (feet)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Pre-Restoration
Year 3 Post-Restoration
Year 5 Post- Restoration
Increased average water table level in Year 5 post-restoration
2005 Dates - 8/16 to 9/28
2007 Dates - 8/21 to 10/1
2010 Dates - 9/27 to 11/12

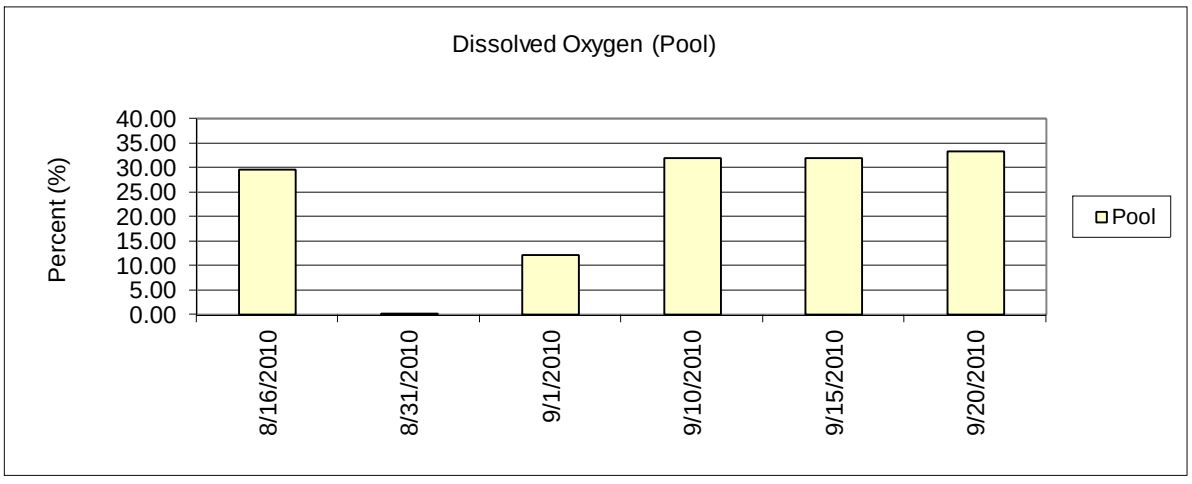

Station #3
Water Level (feet)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Pre-Restoration
Year 3 Post-Restoration
Year 5 Post-Restoration
Increased average water table level in Year 5 post-restoration
2005 Date - 8/16 to 9/28
2007 Date - 8/21 to 10/4
2010 Date - 8/16 to 9/20


Station #4
Pre-Restoration
Year 3 Post-Restoration
Year 5 Post-Restoration
Water Level (feet)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
2005 Dates - 9/1 to 10/6
2007 Dates - 8/21 to 10/4
2010 Dates - 8/16 to 9/20

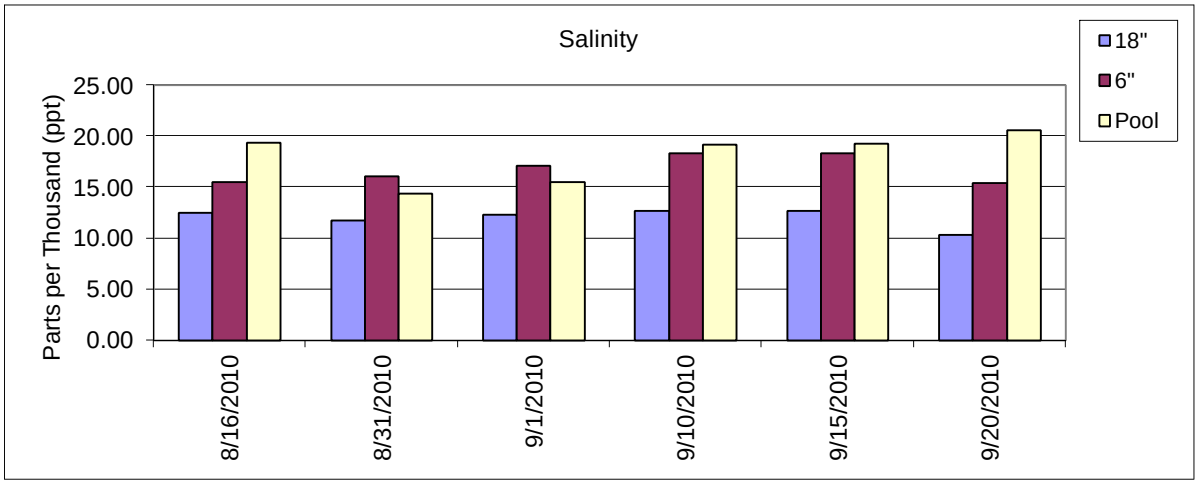
Water Quality Sampling Station 1

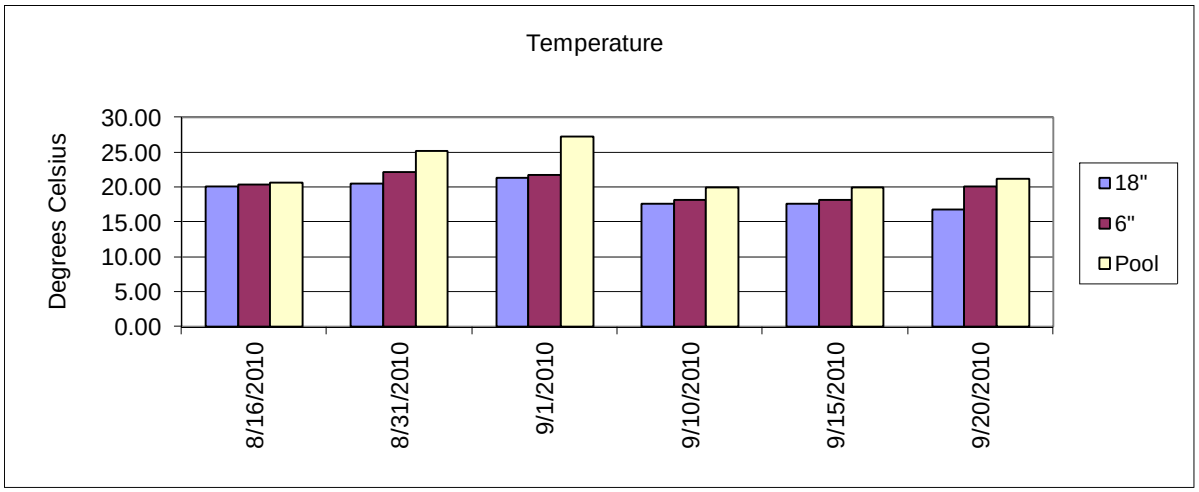






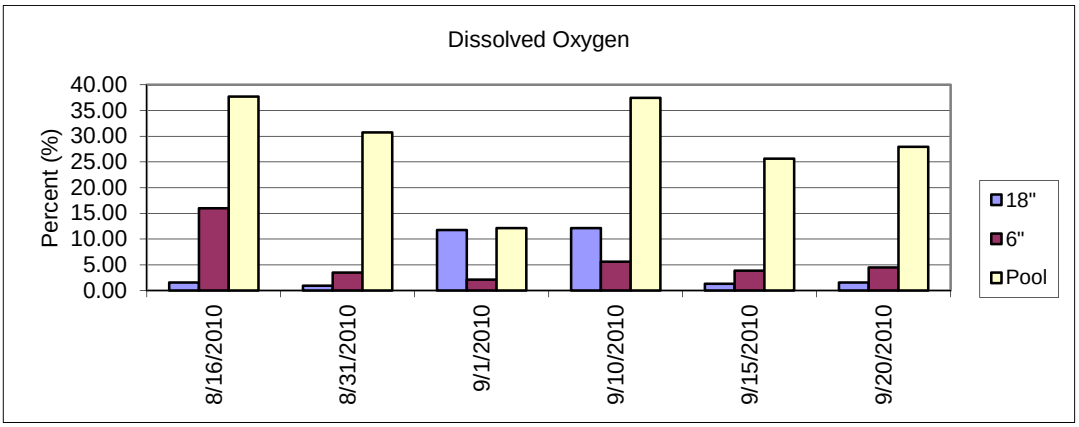
Note: due to the lack of water in the pool, dissolved oxygen readings were not collected on 9/25.

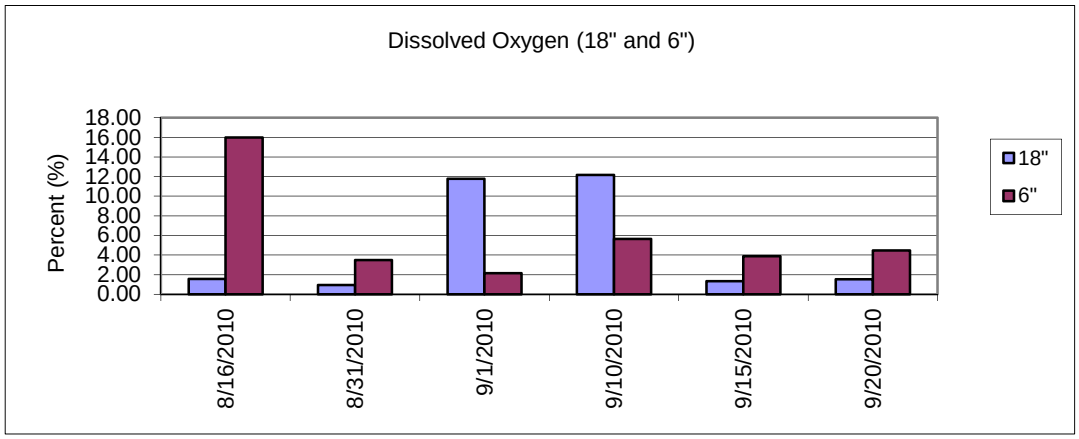


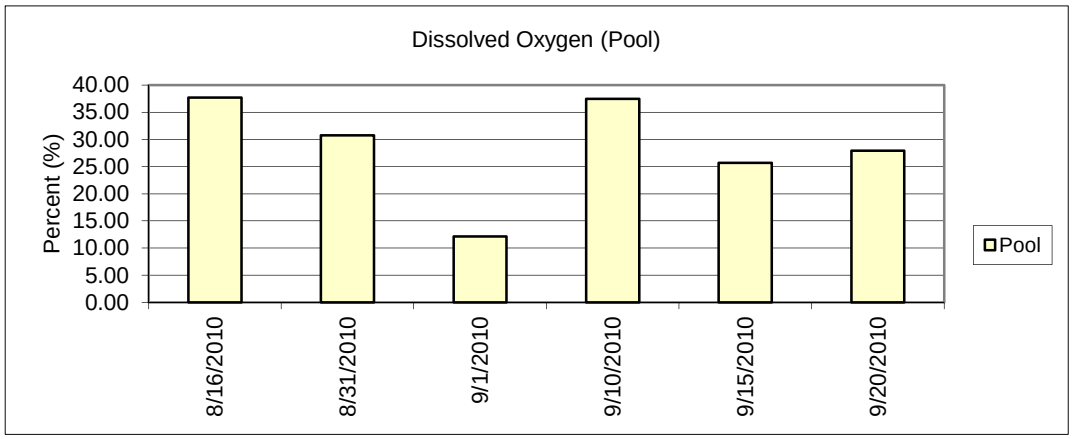


Note: due to the lack of water in the pool, salinity and temperature readings were not collected on 9/25.

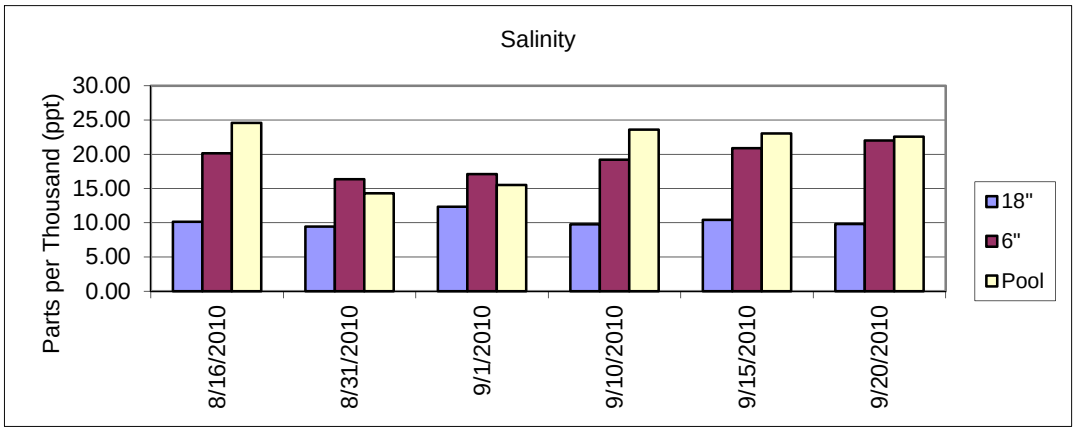
Water Quality Sampling Station 2

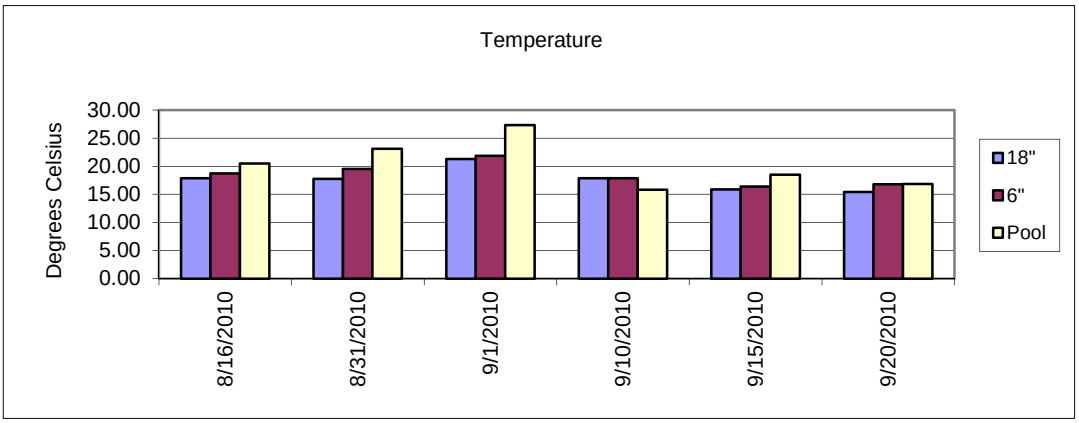






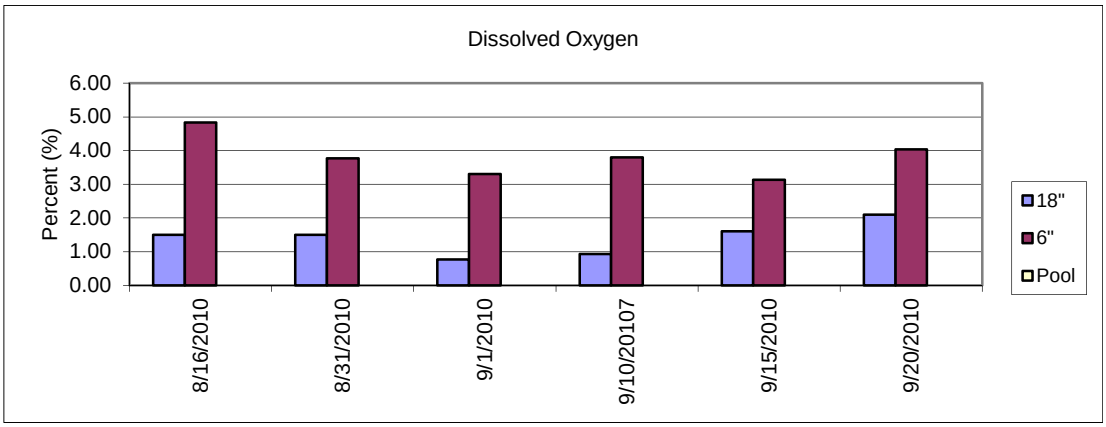
Note: due to the lack of water in the pool, dissolved oxygen readings were not collected on 9/10, 9/20, 9/21, and 9/25.

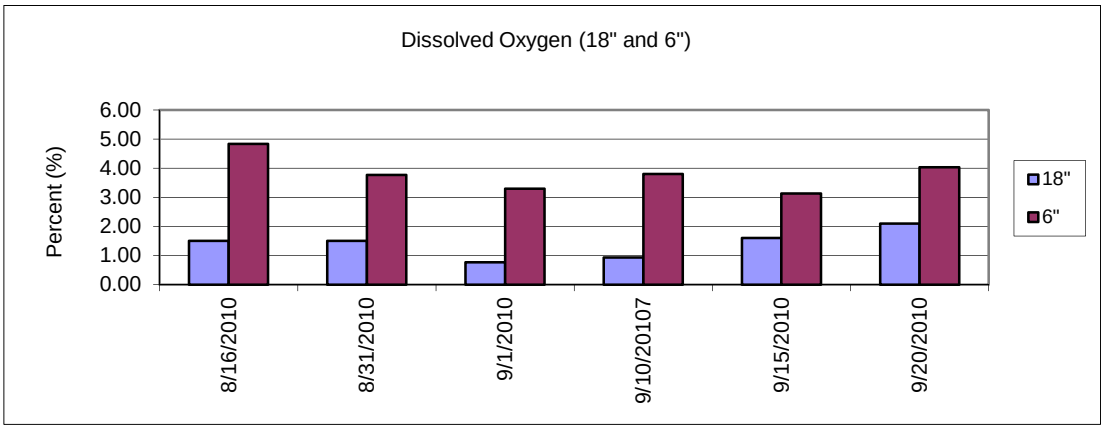


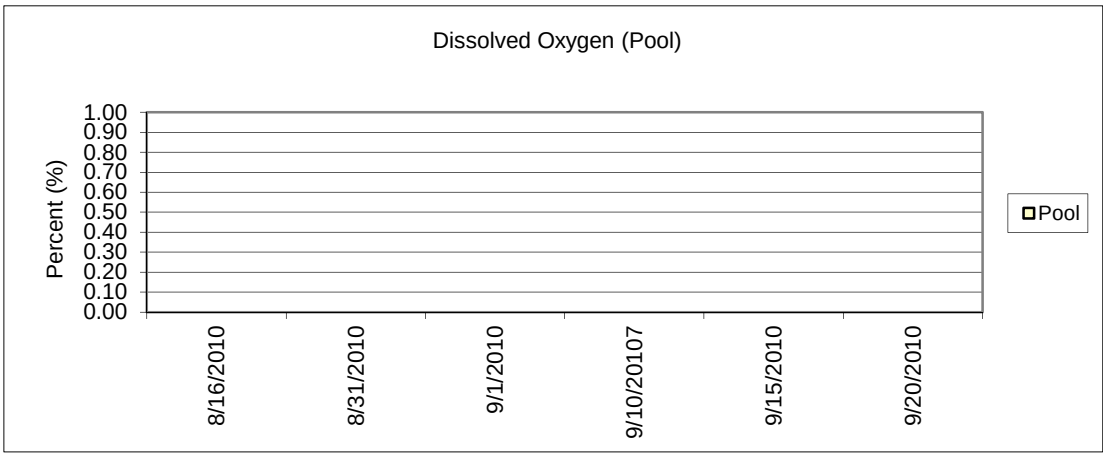


Note: due to the lack of water in the pool, salinity and temperature readings were not collected on 9/10, 9/20, 9/21, and 9/25.

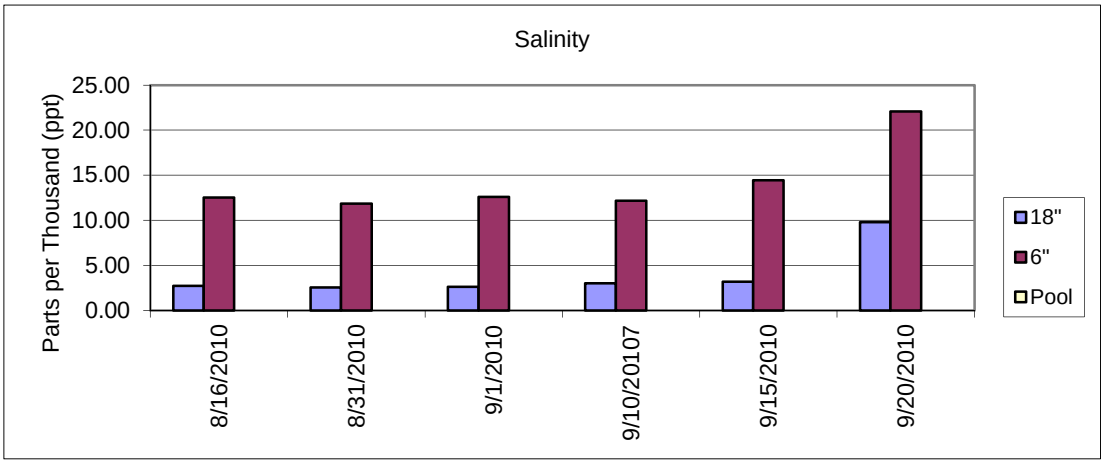
Water Quality Sampling Station 3



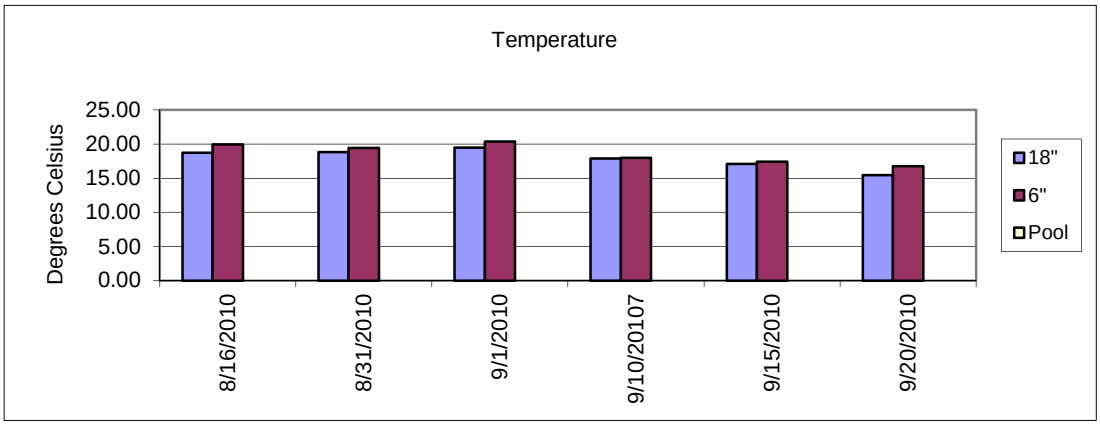




Note: A reference pool was not present during any of the site visits.
No dissolved oxygen readings were collected at a pool for this station.

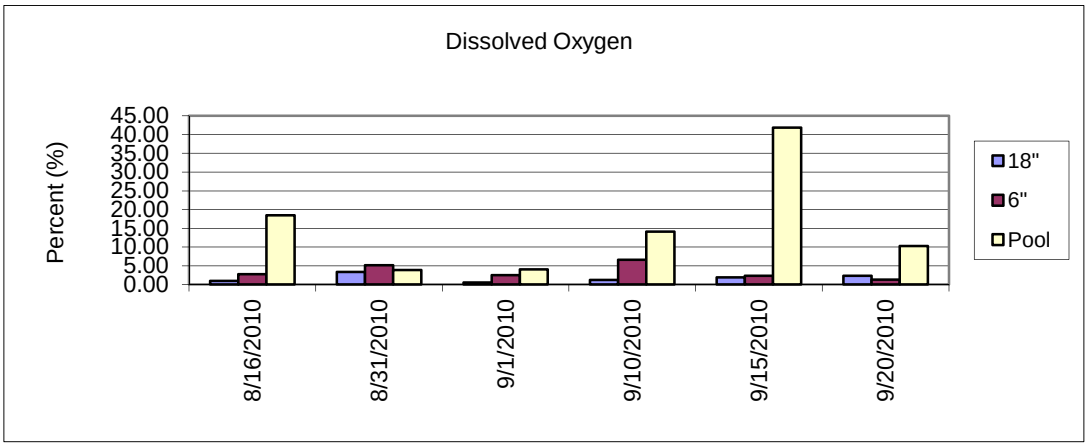


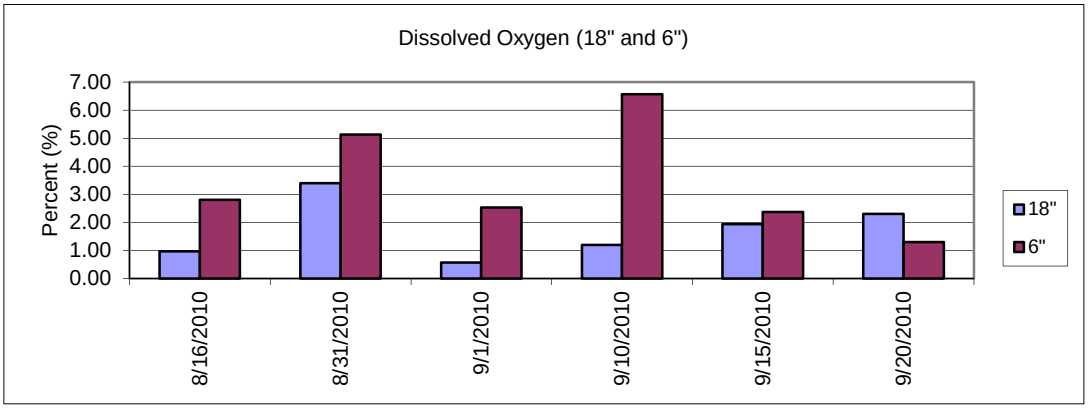
Note: no reference pool available at this station

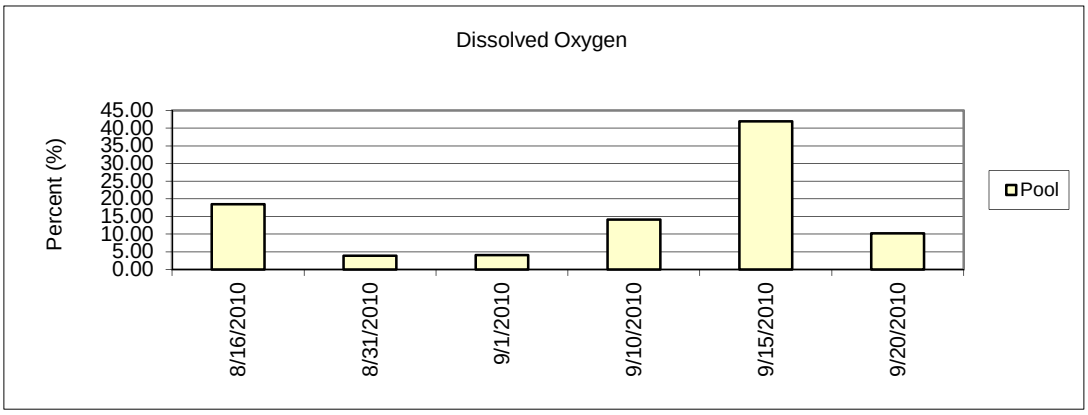


Note: no reference pool available at this station

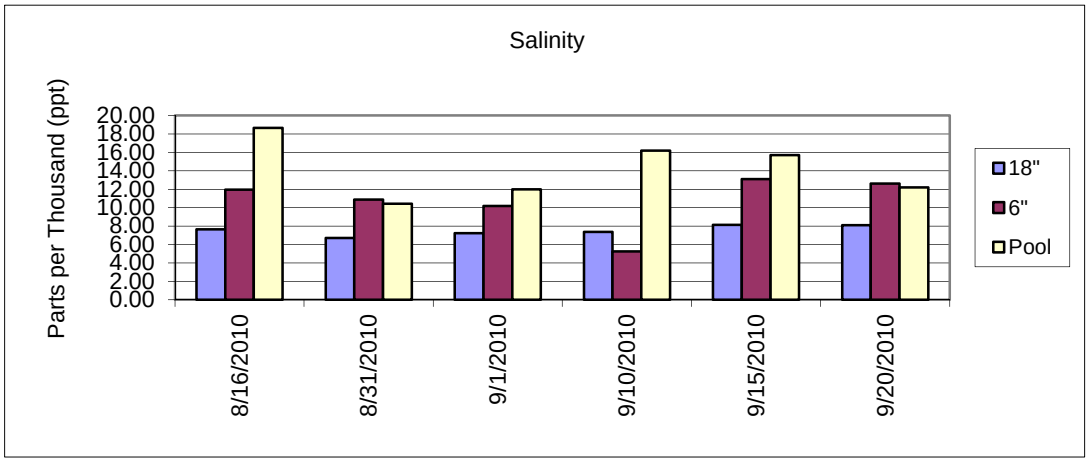
Water Quality Sampling Station 4

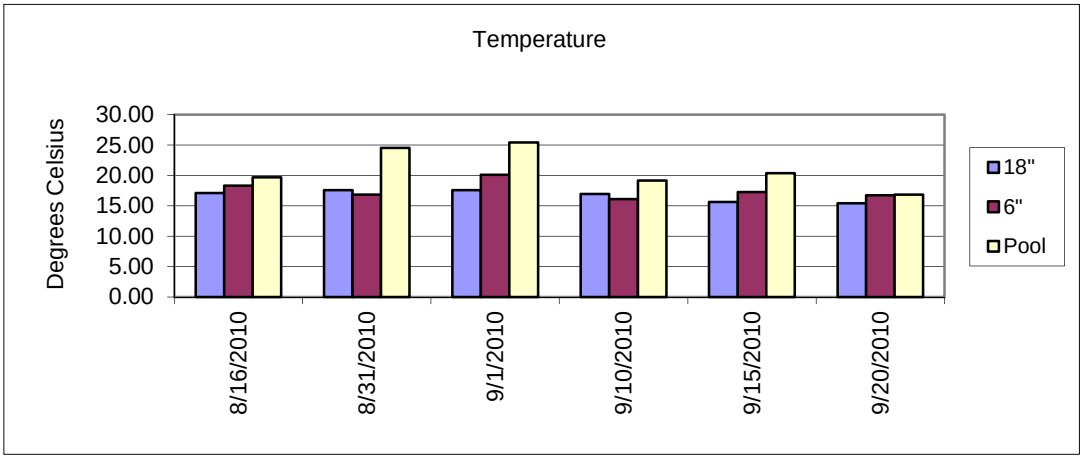






Note: due to the lack of water in the pool, dissolved oxygen readings were not collected on 9/25.





Note: due to the lack of water in the pool, salinity and temperature readings were not collected on 9/25.

APPENDIX D

2010
Vegetation Monitoring Data

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Nonesuch River Salt Marsh Restoration Monitoring (2010)

Scientific Name	Common Name	Strata of Vegetation	T1/Q1	T1/Q2	T1/Q3	T2/Q1	T2/Q2	T2/Q3	T2/Q4	T2/Q5	T2/Q6	T2/Q7	T2/Q8	T2/Q9	T3/Q1	T3/Q2	T3/Q3	T3/Q4
Aster novi-belgii	New York aster	H	1	3	2		2		2	2	2	3						
Atriplex patula	Marsh orach	H																
Carex scoparia	Broom sedge	H			3													
Cuscuta gronovii	Common dodder	V	T	1														
Distichlis spicata	Spike grass or saltgrass	H	1	2	2		2		2	3	3	2						
Elymus virginicus	Virginia wildrye	H																
Eleocharis parvula	Dwarf spike-rush	H																
Juncus balticus	Baltic rush	H																
Juncus canadensis	Canadian rush	H																
Juncus gerardii	Black grass	H		2														
Juncus sp.	Rush species	H									3							
Lythrum salicaria	Purple loosestrife	H																
Phragmites australis	Common reed	H																
Plantago major	Common plantain	H																
Schoenoplectus acutus	Hardstem bulrush	H		1	2	4									2		2	
Scirpus pungens	Common three-square	H					1	1	1	1	2							
Scirpus robustus	Salt marsh bulrush	H		2														
Scirpus species	Bulrush species	H																
Scirpus tabernaemontani	Hardstem bulrush	H																
Solidago sempervirens	Seaside goldenrod	H	1								1							
Spartina alterniflora	Smooth cordgrass	H				3					2				4			
Spartina patens	Salt meadow grass	H																
Spartina pectinata	Prairie cordgrass	H	3												2			
Triglochin maritimum	Common arrowgrass	H					1											
Typha angustifolia	Narrow-leaved cattail	H			2		4	5	4			3	5	5		5	3	5
Typha latifolia	Broad-leaved cattail	H	2															
--	Bare ground/Open Water					2									2	2	2	2
--	Litter		4				2	2	1			2	2	2		2	2	1
Missing stake; navigate to point using GPS						Y									Y			

Notes:

H = Herbaceous
S = Shrub
V = Vine

T = Transect
Q = Quadrat

Percent Cover Class	
Class	Percent
t	<1
1	1 to 5
2	6 to 25
3	26 to 50
4	51 to 75
5	>75

Scientific Name	Common Name	Strata of Vegetation	T3/Q5	T3/Q6	T3/Q7	T3/Q8	T3/Q9	T4/Q1	T4/Q2	T4/Q3	T4/Q4	T4/Q5	T4/Q6	T4/Q7	T4/Q8	T4/Q9	T5/Q1	T5/Q2
Aster novi-belgii	New York aster	H		1			2			2		2	2	2	2	2	3	2
Atriplex patula	Marsh orach	H																
Carex scoparia	Broom sedge	H																
Cuscuta gronovii	Common dodder	V								T						T		T
Distichlis spicata	Spike grass or saltgrass	H		3			2		1	3		1	2	3	2	2		4
Elymus virginicus	Virginia wildrye	H																
Eleocharis parvula	Dwarf spike-rush	H																
Juncus balticus	Baltic rush	H												3	4	3		3
Juncus canadensis	Canadian rush	H					3							2				
Juncus gerardii	Black grass	H																
Juncus sp.	Rush species	H								2			4					
Lythrum salicaria	Purple loosestrife	H																
Phragmites australis	Common reed	H																
Plantago major	Common plantain	H																
Schoenoplectus acutus	Hardstem bulrush	H							2						2			
Scirpus pungens	Common three-square	H									2	2	2	2				
Scirpus robustus	Salt marsh bulrush	H						5	5									
Scirpus species	Bulrush species	H																
Scirpus tabernaemontani	Hardstem bulrush	H																
Solidago sempervirens	Seaside goldenrod	H								1		1	2	2				
Spartina alterniflora	Smooth cordgrass	H		2									2					2
Spartina patens	Salt meadow grass	H		3							5	5						
Spartina pectinata	Prairie cordgrass	H												1			4	
Triglochin maritimum	Common arrowgrass	H					1								1			
Typha angustifolia	Narrow-leaved cattail	H	5	2	5	5	2									3		2
Typha latifolia	Broad-leaved cattail	H							1	2								
--	Bare ground/Open Water		1	1														
--	Litter		2		2	2	2	3	2					1		2	2	
Missing stake; navigate to point using GPS								Y									Y	
Notes:																		

H = Herbaceous
S = Shrub
V = Vine

T = Transect
Q = Quadrat

Percent Cover Class	
Class	Percent
t	<1
1	1 to 5
2	6 to 25
3	26 to 50
4	51 to 75
5	>75

Scientific Name	Common Name	Strata of Vegetation	T5/Q3	T5/Q4	T5/Q5	T5/Q6	T5/Q7	T5/Q8	T5/Q9	T5/Q10	T6/Q1	T6/Q2	T6/Q3	T6/Q4	T6/Q5	T6/Q6	T6/Q7	T6/Q8
Aster novi-belgii	New York aster	H	2	2	2	1	2	2	3			1		2	2	2		2
Atriplex patula	Marsh orach	H									2							
Carex scoparia	Broom sedge	H																
Cuscuta gronovii	Common dodder	V						1										1
Distichlis spicata	Spike grass or saltgrass	H	1	2		2		2		1	2	2	1	1	2	5		
Elymus virginicus	Virginia wildrye	H							1									T
Eleocharis parvula	Dwarf spike-rush	H																
Juncus balticus	Baltic rush	H		3				4				2		3				
Juncus canadensis	Canadian rush	H																
Juncus gerardii	Black grass	H																
Juncus sp.	Rush species	H																1
Lythrum salicaria	Purple loosestrife	H																
Phragmites australis	Common reed	H																
Plantago major	Common plantain	H																
Schoenoplectus acutus	Hardstem bulrush	H							3									
Scirpus pungens	Common three-square	H										2				2		
Scirpus robustus	Salt marsh bulrush	H							1	2	4							4
Scirpus species	Bulrush species	H													1			
Scirpus tabernaemontani	Hardstem bulrush	H																
Solidago sempervirens	Seaside goldenrod	H										1		2				
Spartina alterniflora	Smooth cordgrass	H												1				
Spartina patens	Salt meadow grass	H	1							5		4	1	3	T		1	
Spartina pectinata	Prairie cordgrass	H		2														
Triglochin maritimum	Common arrowgrass	H								1								
Typha angustifolia	Narrow-leaved cattail	H	4	3	4	4	4	2	3				4	2	5	1	2	
Typha latifolia	Broad-leaved cattail	H																
--	Bare ground/Open Water				1	2					1					1	5	
--	Litter		2		3	2	2	2		2	2		2	2	2			3
Missing stake; navigate to point using GPS											Y							Y

Notes:

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V = Vine

T = Transect
Q = Quadrat

Percent Cover Class	
Class	Percent
t	<1
1	1 to 5
2	6 to 25
3	26 to 50
4	51 to 75
5	>75

Scientific Name	Common Name	Strata of Vegetation	T6/Q9	T6/Q10	T6/Q11	T6/Q12	T7/Q1	T7/Q2	T7/Q3	T7/Q4	T7/Q5	T7/Q6	T7/Q7	T7/Q8	T7/Q9	T7/Q10	T7/Q11
Aster novi-belgii	New York aster	H		2	1				2	1		2				1	
Atriplex patula	Marsh orach	H					1								T		
Carex scoparia	Broom sedge	H															
Cuscuta gronovii	Common dodder	V							1								
Distichlis spicata	Spike grass or saltgrass	H	2	2	2		4		3		2	4	4	4	2	5	1
Elymus virginicus	Virginia wildrye	H							1								
Eleocharis parvula	Dwarf spike-rush	H															
Juncus balticus	Baltic rush	H															
Juncus canadensis	Canadian rush	H															
Juncus gerardii	Black grass	H															
Juncus sp.	Rush species	H															
Lythrum salicaria	Purple loosestrife	H															
Phragmites australis	Common reed	H															
Plantago major	Common plantain	H			2												
Schoenoplectus acutus	Hardstem bulrush	H													1		
Scirpus pungens	Common three-square	H												1			
Scirpus robustus	Salt marsh bulrush	H			2		2		1		2	2					2
Scirpus species	Bulrush species	H				T							2				
Scirpus tabernaemontani	Hardstem bulrush	H															
Solidago sempervirens	Seaside goldenrod	H							1								
Spartina alterniflora	Smooth cordgrass	H							1								
Spartina patens	Salt meadow grass	H			2		3	3	3			3	2	2			2
Spartina pectinata	Prairie cordgrass	H															
Triglochin maritimum	Common arrowgrass	H									1		2	1		T	
Typha angustifolia	Narrow-leaved cattail	H	5	5	2	3	2	4	3	5	3			2	3		1
Typha latifolia	Broad-leaved cattail	H															
--	Bare ground/Open Water				2	3					2	2	1				3
--	Litter		2	2	2	2	2	3				2		1	3		

Missing stake; navigate to point using GPS

Notes:

H = Herbaceous
S = Shrub
V = Vine

T = Transect
Q = Quadrat

Percent Cover Class	
Class	Percent
t	<1
1	1 to 5
2	6 to 25
3	26 to 50
4	51 to 75
5	>75

Scientific Name	Common Name	Strata of Vegetation	T7/Q12	T7/Q13	T8/Q1	T8/Q2	T8/Q3	T8/Q4	T8/Q5	T8/Q6	T8/Q7	T8/Q8	T8/Q9	T8/Q10	T8/Q11	T8/Q12	T8/Q13
Aster novi-belgii	New York aster	H				2	2	2			1						
Atriplex patula	Marsh orach	H								2							
Carex scoparia	Broom sedge	H															
Cuscuta gronovii	Common dodder	V					1										
Distichlis spicata	Spike grass or saltgrass	H				2		3	5		1	1		1		3	5
Elymus virginicus	Virginia wildrye	H															
Eleocharis parvula	Dwarf spike-rush	H														2	
Juncus balticus	Baltic rush	H				3	2	3									
Juncus canadensis	Canadian rush	H															
Juncus gerardii	Black grass	H															
Juncus sp.	Rush species	H															
Lythrum salicaria	Purple loosestrife	H															
Phragmites australis	Common reed	H															
Plantago major	Common plantain	H															
Schoenoplectus acutus	Hardstem bulrush	H															
Scirpus pungens	Common three-square	H				2	2		2								
Scirpus robustus	Salt marsh bulrush	H	4	1	3					4		2		1	3		
Scirpus species	Bulrush species	H															
Scirpus tabernaemontani	Hardstem bulrush	H															
Solidago sempervirens	Seaside goldenrod	H				1	1	1									
Spartina alterniflora	Smooth cordgrass	H					1	1	2								
Spartina patens	Salt meadow grass	H		2			3		2		5	5	5	2	2	3	3
Spartina pectinata	Prairie cordgrass	H								3							
Triglochin maritimum	Common arrowgrass	H	1			T	2										
Typha angustifolia	Narrow-leaved cattail	H						3			1						
Typha latifolia	Broad-leaved cattail	H															
--	Bare ground/Open Water			4						2				5	3		
--	Litter		3		4	4		1	2		2				1		
Missing stake; navigate to point using GPS				Y												Y	
Notes:																	

H = Herbaceous
S = Shrub
V = Vine

T = Transect
Q = Quadrat

Percent Cover Class	
Class	Percent
t	<1
1	1 to 5
2	6 to 25
3	26 to 50
4	51 to 75
5	>75

Scientific Name	Common Name	Strata of Vegetation	T8/Q14	T9/Q1	T9/Q2	T9/Q3	T9/Q4	T9/Q5	T9/Q6	T9/Q7	T9/Q8	T10/Q1	T10/Q2	T10/Q3	T10/Q4	T10/Q5	T10/Q6
Aster novi-belgii	New York aster	H		2					1								
Atriplex patula	Marsh orach	H		1													
Carex scoparia	Broom sedge	H															
Cuscuta gronovii	Common dodder	V															
Distichlis spicata	Spike grass or saltgrass	H			2							4					
Elymus virginicus	Virginia wildrye	H															
Eleocharis parvula	Dwarf spike-rush	H															
Juncus balticus	Baltic rush	H															
Juncus canadensis	Canadian rush	H															
Juncus gerardii	Black grass	H															
Juncus sp.	Rush species	H															
Lythrum salicaria	Purple loosestrife	H															
Phragmites australis	Common reed	H															
Plantago major	Common plantain	H															
Schoenoplectus acutus	Hardstem bulrush	H															
Scirpus pungens	Common three-square	H															
Scirpus robustus	Salt marsh bulrush	H				1											5
Scirpus species	Bulrush species	H										2					
Scirpus tabernaemontani	Hardstem bulrush	H															
Solidago sempervirens	Seaside goldenrod	H															
Spartina alterniflora	Smooth cordgrass	H										T					
Spartina patens	Salt meadow grass	H		2	4	5	5	5	5				5				
Spartina pectinata	Prairie cordgrass	H		4	2												
Triglochin maritimum	Common arrowgrass	H					T										
Typha angustifolia	Narrow-leaved cattail	H															
Typha latifolia	Broad-leaved cattail	H															
--	Bare ground/Open Water		5			1				5	5			5	5	5	2
--	Litter			2								3					2
Missing stake; navigate to point using GPS				Y	Y												

Notes:

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S = Shrub
V = Vine

T = Transect
Q = Quadrat

Percent Cover Class	
Class	Percent
t	<1
1	1 to 5
2	6 to 25
3	26 to 50
4	51 to 75
5	>75

Scientific Name	Common Name	Strata of Vegetation	T10/Q7	T10/Q8	T10/Q9	T10/Q10	Phrag 1	Phrag 2	Phrag 3	Phrag 4
Aster novi-belgii	New York aster	H					2		2	
Atriplex patula	Marsh orach	H								
Carex scoparia	Broom sedge	H								
Cuscuta gronovii	Common dodder	V								
Distichlis spicata	Spike grass or saltgrass	H					4	5	4	5
Elymus virginicus	Virginia wildrye	H								
Eleocharis parvula	Dwarf spike-rush	H								
Juncus balticus	Baltic rush	H								
Juncus canadensis	Canadian rush	H								
Juncus gerardii	Black grass	H								
Juncus sp.	Rush species	H								
Lythrum salicaria	Purple loosestrife	H					1			
Phragmites australis	Common reed	H					1			
Plantago major	Common plantain	H								
Schoenoplectus acutus	Hardstem bulrush	H								
Scirpus pungens	Common three-square	H					2			
Scirpus robustus	Salt marsh bulrush	H			1					1
Scirpus species	Bulrush species	H						1		
Scirpus tabernaemontani	Hardstem bulrush	H							2	
Solidago sempervirens	Seaside goldenrod	H								
Spartina alterniflora	Smooth cordgrass	H			2	1				
Spartina patens	Salt meadow grass	H			4	5				
Spartina pectinata	Prairie cordgrass	H								
Triglochin maritimum	Common arrowgrass	H						1		
Typha angustifolia	Narrow-leaved cattail	H						1		2
Typha latifolia	Broad-leaved cattail	H								
--	Bare ground/Open Water		5	5	2					2
--	Litter									1

Missing stake; navigate to point using GPS

Notes:

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T = Transect
Q = Quadrat

Percent Cover Class	
Class	Percent
t	<1
1	1 to 5
2	6 to 25
3	26 to 50
4	51 to 75
5	>75

Nonesuch River Salt Marsh Restoration Monitoring (2010)

Phragmites Site:	T1/Q2	T1/Q3	T6/Q11	T7/Q8	T7/Q10	Phrag 1	Phrag 2	Phrag 3	Phrag 4
Number stems per square meter	NA	NA	NA	NA	NA	10	NA	NA	NA
Height of 3 tallest individuals (inches)						60			
						60			
						74			

Nonesuch River Salt Marsh Restoration Project - Vegetation Monitoring Data Sorted by Stratum and Indicator Status

Scientific Name	Common Name	Strata of Vegetation	Indicator Status	Year	T1/Q1	T1/Q2	T1/Q3	T2/Q1	T2/Q2	T2/Q3	T2/Q4	T2/Q5	T2/Q6	T2/Q7	T2/Q8	T2/Q9	T3/Q1	T3/Q2	T3/Q3	T3/Q4	T3/Q5	T3/Q6	T3/Q7	T3/Q8	T3/Q9	T4/Q1	T4/Q2	T4/Q3	T4/Q4	T4/Q5	T4/Q6	T4/Q7	T4/Q8	T4/Q9	T5/Q1	T5/Q2	T5/Q3	T5/Q4	T5/Q5	T5/Q6	T5/Q7	T5/Q8	T5/Q9	T5/Q10	T6/Q1	T6/Q2	T6/Q3	T6/Q4	T6/Q5	T6/Q6	T6/Q7	T6/Q8	T6/Q9	T6/Q10	T6/Q11
Plantago major	Common plantain	H	FACU	2005																			0.5		0.5																					3									15.5
Rumex crispus	Sour dock	H	FACU	2005																																							3												
Aster novi-belgii	New York aster	H	FACW+	2005	3	15.5	15.5	15.5	3		15.5	38	3	3								3		15.5	15.5				15.5			3	3	15.5	15.5	15.5	3		0.5		3	3	3					15.5	15.5	3		15.5		3	3
Atriplex patula	Marsh orach	H	FACW	2005																																																			
Distichlis spicata	Spike grass	H	FACW+	2005	63		3	38	38		3	38	15.5	15.5								38		38	38		3		63		88	63	38	38		63	15.5	63	15.5	15.5	15.5	15.5	63	3	3	63		15.5	15.5	15.5				38	15.5
Juncus balticus	Baltic rush	H	FACW+	2005			63					38													3				3				3			15.5		0.5								3		88	3						
Juncus gerardii	Black grass	H	FACW+	2005																																																			
Phragmites australis	Common reed	H	FACW	2005		38	15.5																																																15.5
Phragmites australis	Common reed (dead)	H	FACW	2005																																																			
Scirpus pungens	Common three-square	H	FACW+	2005			3																								0.5					3		15.5								15.5		3		15.5					
Solidago sempervirens	Seaside goldenrod	H	FACW	2005																																		3										3							
Spartina patens	Salt meadow grass	H	FACW+	2005																		38					3			88	38						15.5	15.5						3		63	0.5			63					38
Potentilla anserina	Silverweed	H	OBL	2005																																																			
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2005									15.5												15.5							15.5	38																						
Scirpus maritimus	Alkali bulrush	H	OBL	2005		3																0.5				88	38		3															15.5	38				15.5						
Scirpus robustus	Salt marsh bulrush	H	OBL	2005																																																			
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2005	3		3	3									15.5		3														15.5	3									15.5												
Spartina alterniflora	Smooth cordgrass	H	OBL	2005													15.5																		38																				
Spartina pectinata	Prairie cordgrass	H	OBL	2005	15.5		3	15.5																																		3			15.5							3			
Typha angustifolia	Narrow-leaved cattail	H	OBL	2005			15.5			15.5	15.5		15.5	38	38	38		15.5	15.5	15.5	15.5	3	15.5	3	15.5	3	63		3					15.5		3	38		38	38	38	38	3				38		38	3	3		38	38	15.5
Typha latifolia	Broad-leaved cattail	H	OBL	2005					15.5																																														
Bromus species	Unknown grass	H	NA	2005																																						0.5													
Elymus species	Unknown rye grass	H	NA	2005																				15.5																		0.5													
Scirpus species	Unknown bulrush	H	NA	2005																																																			
	Unknown moss	H	NA	2005														15.5																																					
Portulaca species	Purslane species	H	NL	2007		0.5																																																	
Vicia cracca	Cow/Bird vetch	H	NL	2007																																																			
Plantago major	Common plantain	H	FACU	2007		3						3		0.5											3						15.5	0.5		3		3		0.5								3				0.5					
Rumex crispus	Sour dock	H	FACU	2007																																							0.5												
Oenothera fruticosa	Sundrops	H	FAC	2007																																																			
Aster novi-belgii	New York aster	H	FACW+	2007	3	15.5	15.5	3	0.5		3	15.5	3	3			3			0.5		15.5			3			15.5		0.5	15.5	3	3	15.5	3	3	15.5	15.5	0.5		3	38	15.5					38	15.5	3		15.5		0.5	
Atriplex patula	Marsh orach	H	FACW	2007																																																			
Distichlis spicata	Spike grass	H	FACW+	2007	63	15.5	38	15.5	3		3	38	3	15.5			3					15.5			3			88		15.5	15.5	38	3	3	15.5	63	3	15.5	15.5	15.5	15.5	38	15.5		15.5	15.5		38	3	15.5				15.5	
Elymus virginicus	Viriginia wildrye	H	FACW-	2007																																																0.5			
Juncus balticus	Baltic rush	H	FACW+	2007						0.5		38													3			15.5			3		15.5	3		15.5						3				15.5		15.5	0.5						
Juncus gerardii	Black grass	H	FACW+	2007																																																			
Scirpus pungens	Common three-square	H	FACW+	2007					3				3												3					3	0.5	0.5				3		15.5								3		3		15.5					
Solidago sempervirens	Seaside goldenrod	H	FACW	2007																								3																				3							
Spartina patens	Salt meadow grass	H	FACW+	2007					3										3			63					3		88	88	38	38					3	15.5						88		15.5	0.5			15.5					
Carex hormathoides	Marsh-straw sedge	H	OBL	2007		3																												0.5																					
Carex paleacea	Chaffy sedge	H	OBL	2007																																																			
Cyperus filicinus	Umbrella-sedge	H	OBL	2007			3																																																
Leersia oryzoides	Rice cutgrass	H	OBL	2007	0.5			0.5				3																			0.5			0.5								3													
Lycopus virginicus	Virginia water horehound	H	OBL	2007																																																			
Polygonum punctatum	Dotted smartweed	H	OBL	2007																																																			
Potentilla anserina	Silverweed	H	OBL	2007																								0.5																											
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2007									3												3							3	15.5	15.5																					
Scirpus maritimus	Alkali bulrush	H	OBL	2007		15.5																																				3							15.5						3
Scirpus robustus	Salt marsh bulrush	H	OBL	2007																						15.5	88	3																0.5	38										
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2007	0.5		3	15.5									15.5		3														15.5	0.5									3												
Spartina alterniflora	Smooth cordgrass	H	OBL	2007													15.5																		15.5																				
Spartina pectinata	Prairie cordgrass	H	OBL	2007	15.5			15.5				0.5												3											3																	3			
Typha angustifolia	Narrow-leaved cattail	H	OBL	2007						15.5	15.5		15.5	15.5	15.5	38		15.5	15.5	38	38	3	15.5	15.5	15.5		3							0.5		15.5	15.5	3	38	38	38	3	3				38	3	15.5	15.5	3		63	15.5	3
Typha latifolia	Broad-leaved cattail	H	OBL	2007					15.5																	3		3																											
Bromus species	Unknown grass	H	NA	2007								3																																											
Carex species	Sedge species	H	NA	2007			15.5					0.5																																											
Elymus species	Unknown rye grass	H	NA	2007																																						0.5													
Scirpus species	Unknown bulrush	H	NA	2007																												0.5														0.5									
Trifolium species	Clover species	H	NA	2007																																																			
	Unknown moss	H	NA	2007							3							15.5				15.5																																	
Plantago major	Common plantain	H	FACU	2010																																																			15.5
Aster novi-belgii	New York aster	H	FACW+	2010	3	38	15.5		15.5		15.5	15.5	15.5	38								3			15.5			15.5		15.5	15.5	15.5	15.5	15.5	38	15.5	15.5	15.5	15.5	3	15.5	15.5	38			3		15.5	15.5	15.5		15.5		15.5	3
Atriplex patula	Marsh orach	H	FACW	2010																																									15.5										
Carex scoparia	Broom sedge	H	FACW	2010			38																																																
Distichlis spicata	Spike grass or saltgrass	H	FACW+	2010	3	15.5	15.5		15.5		15.5	38	38	15.5								38			15.5		3	38		3	15.5	38	15.5	15.5		63	3	15.5		15.5		15.5		3	15.5	15.5	3	3	15.5	88			15.5	15.5	15.5
Elymus virginicus	Virginia wildrye	H	FACW-	2010																																							3									0.5			
Juncus balticus	Baltic rush	H	FACW+	2010																												38	63	38		38		38				63				15.5		38							
Juncus gerardii	Black grass	H	FACW+	2010		15.5																																																	
Lythrum salicaria	Purple loosestrife	H	FACW+	2010																																																			
Phragmites australis	Common reed	H	FACW	2010																																																			
Scirpus pungens	Common three-square	H	FACW+	2010					3	3	3	3	15.5																15.5	15.5	15.5	15.5														15.5				15.5					
Solidago sempervirens	Seaside goldenrod	H	FACW	2010	3								3															3		3	15.5	15.5														3		15.5							
Spartina patens	Salt meadow grass	H	FACW+	2010																		38							88	88							3							88		63	3	38	0.5		3				15.5
Eleocharis parvula	Dwarf spike-rush	H	OBL	2010																																																			
Juncus canadensis	Canadian rush	H	OBL	2010																					38							15.5																							
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2010		3	15.5	63									15.5		15.5								15.5						15.5										38												
Scirpus robustus	Salt marsh bulrush	H	OBL	2010		15.5																				88	88																3	15.5	63							63			15.5
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2010																																																			
Spartina alterniflora	Smooth cordgrass	H	OBL	2010				38					15.5				63					15.5									15.5					15.5												3							
Spartina pectinata	Prairie cordgrass	H	OBL	2010	38												15.5															3			63			15.5																	
Triglochin maritimum	Common arrowgrass	H	OBL	2010					3																3								3											3											
Typha angustifolia	Narrow-leaved cattail	H	OBL	2010			15.5		63	88	63			38	88	88		88	38	88	88	15.5	88	88	15.5									38		15.5	63	38	63	63	63	15.5	38				63	15.5	88	3	15.5		88	88	15.5
Typha latifolia	Broad-leaved cattail	H	OBL	2010	15.5																						3	15.5																											
Juncus sp.	Rush species	H	NA	2010									38															15.5			63																					3			
Scirpus species	Unknown bulrush	H	NA	2010																																													3						
Polygonum ramossisimum	Bushy knotweed	S	FAC	2005																																																			
Rosa palustris	Swamp rose	S	OBL	2005																																																			
Polygonum ramossisimum	Bushy knotweed	S	FAC	2007																																																			
Cuscuta gronovii	Common dodder	V	NL	2005								3												3										0.5	3	3					0.5											0.5			
Calystegia sepium	Hedge bindweed	V	FAC-	2005		3						15.5																														0.5	3									0.5			
Cuscuta gronovii	Common dodder	V	NL	2007																																		0.5				0.5													
Calystegia sepium	Hedge bindweed	V	FAC-	2007																								3							3	3																			
Cuscuta gronovii	Common dodder	V	NL	2010	0.5	3																						0.5						0.5		0.5						3										3			
--	Bare ground/Open Water		NA	2005	3	3		15.5	15.5	38	38		3	3		3	63	15.5	15.5	38	15.5	3	3		3										88*			15.5						38	15.5*		15.5				88	88	38		15.5
--	Litter		NA	2005		63			38	38	38		15.5	38	63	63	15.5	38	38	63	63		63		15.5	15.5			3	15.5	15.5			15.5			38		38	38	38	38	15.5	15.5	15.5		38		38	15.5			38	38	15.5
--	Bare ground/Open Water		NA	2007	0.5	15.5	15.5	15.5	38	38	38	0.5	38	15.5	15.5	15.5	3	38	38	38	38	15.5	15.5	63	3	--	15.5			3		3	3	3	15.5	0.5	15.5	3	15.5	15.5	15.5	3	0.5	0.5	38	0.5	15.5	3	3	3	88	88	15.5	3	88
--	Litter		NA	2007		0.5	3	3	15.5	38	38	3	15.5	15.5	38	38	63	38	38	38	38	0.5	38	15.5	3	88	15.5		3			3	3	15.5	3	0.5	38	0.5	38	15.5	15.5	3	15.5	15.5	3	15.5	38	3	38	3			38	63	15.5
--	Bare ground/Open Water		NA	2010				15.5									15.5	15.5	15.5	15.5	3	3																	3	15.5					3					3	88				15.5
--	Litter		NA	2010	63				15.5	15.5	3			15.5	15.5	15.5		15.5	15.5	3	15.5		15.5	15.5	15.5	38	15.5					3		15.5	15.5		15.5		38	15.5	15.5	15.5		15.5	15.5		15.5	15.5	15.5			38	15.5	15.5	15.5

Notes: 2010 data are unhighlighted; 2007 data are in green; 2005 data are in grey.

H = Herbaceous
S = Shrub
V = Vine

T = Transect
Q = Quadrat

Percent Cover Class		
Braun-Blanquet Cover Class	Percent Cover	Median Cover Class Value
t	<1	0.5
1	1 to 5	3
2	6 to 25	15.5
3	26 to 50	38
4	51 to 75	63
5	>75	88

Nonesuch River Salt Marsh Restoration Project - Vegetation Monitoring Data Sorted by Stratum and Indicator Status

Scientific Name	Common Name	Strata of Vegetation	Indicator Status	Year	T6/Q12	T7/Q1	T7/Q2	T7/Q3	T7/Q4	T7/Q5	T7/Q6	T7/Q7	T7/Q8	T7/Q9	T7/Q10	T7/Q11	T7/Q12	T7/Q13	T8/Q1	T8/Q2	T8/Q3	T8/Q4	T8/Q5	T8/Q6	T8/Q7	T8/Q8	T8/Q9	T8/Q10	T8/Q11	T8/Q12	T8/Q13	T8/Q14	T9/Q1	T9/Q2	T9/Q3	T9/Q4	T9/Q5	T9/Q6	T9/Q7	T9/Q8	T10/Q1	T10/Q2	T10/Q3	T10/Q4	T10/Q5	T10/Q6	T10/Q7	T10/Q8	T10/Q9	T10/Q10	Phrag 1	Phrag 2	Phrag 3	Phrag 4
Plantago major	Common plantain	H	FACU	2005	15.5						0.5			3	15.5	15.5				0.5	3		0.5									3		0.5					3													
Rumex crispus	Sour dock	H	FACU	2005																																																
Aster novi-belgii	New York aster	H	FACW+	2005				15.5	15.5				0.5	15.5			15.5				15.5	3										15.5																	15.5		3
Atriplex patula	Marsh orach	H	FACW	2005																																		3													
Distichlis spicata	Spike grass	H	FACW+	2005		88		15.5	3	15.5	63	3	15.5	63			63			63	38	38	63		38				38				38													0.5	3	15.5		15.5
Juncus balticus	Baltic rush	H	FACW+	2005																15.5	38	38																												3		3
Juncus gerardii	Black grass	H	FACW+	2005																			3									15.5							3	88											
Phragmites australis	Common reed	H	FACW	2005									3		15.5																																	63	63	38	88
Phragmites australis	Common reed (dead)	H	FACW	2005																																												3	15.5	38	15.5
Scirpus pungens	Common three-square	H	FACW+	2005							15.5									15.5	3																														0.5
Solidago sempervirens	Seaside goldenrod	H	FACW	2005				3		3				3							3	3										15.5							0.5												
Spartina patens	Salt meadow grass	H	FACW+	2005	38		15.5			15.5		88	15.5		3	88		15.5				15.5		88	63	88	3	15.5	88	88		63	3	88	88	88	88		38	88				3		3	88					
Potentilla anserina	Silverweed	H	OBL	2005																		3																	3													
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2005																																															
Scirpus maritimus	Alkali bulrush	H	OBL	2005		3					3						3		88			3	63																													
Scirpus robustus	Salt marsh bulrush	H	OBL	2005						3																	15.5	63																								
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2005																																												15.5			0.5
Spartina alterniflora	Smooth cordgrass	H	OBL	2005																											3							38					3			15.5				
Spartina pectinata	Prairie cordgrass	H	OBL	2005				3												0.5			15.5								15.5																				
Typha angustifolia	Narrow-leaved cattail	H	OBL	2005	15.5		38	15.5	15.5	15.5			38	15.5								3																													15.5	0.5
Typha latifolia	Broad-leaved cattail	H	OBL	2005		3																																													
Bromus species	Unknown grass	H	NA	2005																																															
Elymus species	Unknown rye grass	H	NA	2005																																														
Scirpus species	Unknown bulrush	H	NA	2005				0.5																																										
	Unknown moss	H	NA	2005																																														
Portulaca species	Purslane species	H	NL	2007																																														
Vicia cracca	Cow/Bird vetch	H	NL	2007																																														3
Plantago major	Common plantain	H	FACU	2007						0.5	3				0.5					0.5	3	0.5	3										3																		
Rumex crispus	Sour dock	H	FACU	2007																																														
Oenothera fruticosa	Sundrops	H	FAC	2007																																														3
Aster novi-belgii	New York aster	H	FACW+	2007				3	0.5		0.5	0.5									15.5	15.5										15.5																		15.5
Atriplex patula	Marsh orach	H	FACW	2007		3																																												
Distichlis spicata	Spike grass	H	FACW+	2007		88		38	3	3	38	63			15.5		3			15.5	38	15.5	88		38				38			38	38						15.5							3	38		38
Elymus virginicus	Virginia wildrye	H	FACW-	2007																																														
Juncus balticus	Baltic rush	H	FACW+	2007																15.5	15.5	15.5																													
Juncus gerardii	Black grass	H	FACW+	2007																			0.5									15.5							88												
Scirpus pungens	Common three-square	H	FACW+	2007																15.5	0.5		0.5																												
Solidago sempervirens	Seaside goldenrod	H	FACW	2007				0.5													3			0.5							3	0.5							0.5												
Spartina patens	Salt meadow grass	H	FACW+	2007			15.5	15.5		15.5	3	3				38		15.5			0.5	0.5	3		3*	63	63*	0.5	3	3	0.5				88	88	88		38						3		0.5	88				
Carex hormathoides	Marsh-straw sedge	H	OBL	2007																																														
Carex paleacea	Chaffy sedge	H	OBL	2007																3	0.5		0.5																												
Cyperus filicinus	Umbrella-sedge	H	OBL	2007																																														
Leersia oryzoides	Rice cutgrass	H	OBL	2007				15.5	0.5												0.5	0.5																	3											15.5			
Lycopus virginicus	Virginia water horehound	H	OBL	2007																																														0.5
Polygonum punctatum	Dotted smartweed	H	OBL	2007																																														3
Potentilla anserina	Silverweed	H	OBL	2007																			3																	3												
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2007																																														
Scirpus maritimus	Alkali bulrush	H	OBL	2007		3													88				3	63												0.5											3				
Scirpus robustus	Salt marsh bulrush	H	OBL	2007							3			88	15.5												0.5	15.5																	3						
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2007																																														
Spartina alterniflora	Smooth cordgrass	H	OBL	2007																																		3							0.5		15.5			
Spartina pectinata	Prairie cordgrass	H	OBL	2007																		3		3							63																				
Typha angustifolia	Narrow-leaved cattail	H	OBL	2007	3*		38	15.5	38	15.5			3	15.5	3					15.5																													3		
Typha latifolia	Broad-leaved cattail	H	OBL	2007		15.5																																												
Bromus species	Unknown grass	H	NA	2007																																														
Carex species	Sedge species	H	NA	2007				0.5			38																																							
Elymus species	Unknown rye grass	H	NA	2007																																														
Scirpus species	Unknown bulrush	H	NA	2007											0.5																								3												
Trifolium species	Clover species	H	NA	2007																																														0.5
	Unknown moss	H	NA	2007																																														
Plantago major	Common plantain	H	FACU	2010																																														
Aster novi-belgii	New York aster	H	FACW+	2010				15.5	3		15.5				3					15.5	15.5	15.5			3							15.5					3											15.5		15.5	
Atriplex patula	Marsh orach	H	FACW	2010		3								0.5									12.5								3																			
Carex scoparia	Broom sedge	H	FACW	2010																																														
Distichlis spicata	Spike grass or saltgrass	H	FACW+	2010		63		38		15.5	63	63	63	15.5	88	3				15.5		38	88		3	3		3		38	88		15.5						63										63	88	63	88
Elymus virginicus	Virginia wildrye	H	FACW-	2010				3																																										
Juncus balticus	Baltic rush	H	FACW+	2010																38	15.5	38																													
Juncus gerardii	Black grass	H	FACW+	2010																																														
Lythrum salicaria	Purple loosestrife	H	FACW+	2010																																											3			
Phragmites australis	Common reed	H	FACW	2010																																											3			
Scirpus pungens	Common three-square	H	FACW+	2010								3								15.5	15.5		15.5																										15.5			
Solidago sempervirens	Seaside goldenrod	H	FACW	2010				3												3	3	3																													
Spartina patens	Salt meadow grass	H	FACW+	2010		38	38	38			38	15.5	15.5			15.5		15.5			38		15.5		88	88	88	15.5	15.5	38	38		15.5	63	88	88	88				88							63	88			
Eleocharis parvula	Dwarf spike-rush	H	OBL	2010																									15.5																							
Juncus canadensis	Canadian rush	H	OBL	2010																																														
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2010										3																																					
Scirpus robustus	Salt marsh bulrush	H	OBL	2010		15.5		3		15.5	15.5					15.5	63	3	38				63		15.5		3	38					3								88			3							3
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2010																																													15.5	
Spartina alterniflora	Smooth cordgrass	H	OBL	2010				3													3	15.5																0.5							15.5	3			
Spartina pectinata	Prairie cordgrass	H	OBL	2010																											63	15.5																	
Triglochin maritimum	Common arrowgrass	H	OBL	2010						3		15.5	3		0.5		3			0.5	15.5															0.5											3			
Typha angustifolia	Narrow-leaved cattail	H	OBL	2010	38	15.5	63	38	88	38			15.5	38		3					38			3																							3		15.5	
Typha latifolia	Broad-leaved cattail	H	OBL	2010																																													
Juncus sp.	Rush species	H	NA	2010																																													
Scirpus species	Unknown bulrush	H	NA	2010	0.5							15.5																											15.5									3		
Polygonum ramosissimum	Bushy knotweed	S	FAC	2005																																		3												
Rosa palustris	Swamp rose	S	OBL	2005													15.5																																
Polygonum ramosissimum	Bushy knotweed	S	FAC	2007																																													3
Cuscuta gronovii	Common dodder	V	NL	2005				15.5	3				0.5	0.5																																			
Calystegia sepium	Hedge bindweed	V	FAC-	2005					3														3																											3
Cuscuta gronovii	Common dodder	V	NL	2007																	3																												
Calystegia sepium	Hedge bindweed	V	FAC-	2007					0.5														0.5								3							3												
Cuscuta gronovii	Common dodder	V	NL	2010				3													3																													
--	Bare ground/Open Water		NA	2005	15.5	3	3			15.5	15.5				15.5			88				3					88	63			88						88	88	63		15.5			3						
--	Litter		NA	2005	15.5		15.5	15.5	63	15.5			15.5		15.5							3															88	88									15.5			
--	Bare ground/Open Water		NA	2007	88	3	3		0.5	38	15.5	3	3		3	15.5	15.5	88		3		0.5	3			3					88	63					0.5	88	88	88	88	88	88	88			15.5	3	3
--	Litter		NA	2007	15.5		15.5	3	38	15.5	3	38	88	88	63	38				3		3			3		15.5	0.5	0.5	38	88					3*			0.5	3	0.5				3		88*	38	88	0.5
--	Bare ground/Open Water		NA	2010	38					15.5	15.5	3				38		63					15.5					88	38			88			3				88	88			88	88	88	15.5	88	15.5			15.5
--	Litter		NA	2010	15.5	15.5	38				15.5		3	38			38		63	63		3	15.5		15.5			3			15.5							38					15.5							3	

Notes: 2010 data are unhighlighted; 2007 data are in green; 2005 data are in grey.

H = Herbaceous
S = Shrub
V = Vine

T = Transect
Q = Quadrat

Percent Cover Class		
Braun-Blanquet Cover Class	Percent Cover	Median Cover Class Value
t	<1	0.5
1	1 to 5	3
2	6 to 25	15.5
3	26 to 50	38
4	51 to 75	63
5	>75	88

Nonesuch River Salt Marsh Restoration Project - Vegetation Monitoring Data Sorted by Stratum and Indicator Status

Scientific Name	Common Name	Strata of Vegetation	Indicator Status	Year	SUM Median Cover	SUM by Indicator Status	Indicator Status
Plantago major	Common plantain	H	FACU	2005	77	80	FACU
Rumex crispus	Sour dock	H	FACU	2005	3		
Aster novi-belgii	New York aster	H	FACW+	2005	397	4743	FACW
Atriplex patula	Marsh orach	H	FACW	2005	3		
Distichlis spicata	Spike grass	H	FACW+	2005	1736.5		
Juncus balticus	Baltic rush	H	FACW+	2005	317.5		
Juncus gerardii	Black grass	H	FACW+	2005	106.5		
Phragmites australis	Common reed	H	FACW	2005	339.5		
Phragmites australis	Common reed (dead)	H	FACW	2005	72		
Scirpus pungens	Common three-square	H	FACW+	2005	90.5		
Solidago sempervirens	Seaside goldenrod	H	FACW	2005	37		
Spartina patens	Salt meadow grass	H	FACW+	2005	1643.5		
Potentilla anserina	Silverweed	H	OBL	2005	6	1737	OBL
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2005	84.5		
Scirpus maritimus	Alkali bulrush	H	OBL	2005	364.5		
Scirpus robustus	Salt marsh bulrush	H	OBL	2005	81.5		
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2005	77.5		
Spartina alterniflora	Smooth cordgrass	H	OBL	2005	113		
Spartina pectinata	Prairie cordgrass	H	OBL	2005	90		
Typha angustifolia	Narrow-leaved cattail	H	OBL	2005	901.5		
Typha latifolia	Broad-leaved cattail	H	OBL	2005	18.5		
Bromus species	Unknown grass	H	NA	2005	0.5	32.5	NA
Elymus species	Unknown rye grass	H	NA	2005	16		
Scirpus species	Unknown bulrush	H	NA	2005	0.5		
	Unknown moss	H	NA	2005	15.5		
Portulaca species	Purslane species	H	NL	2007	0.5	3.5	NL
Vicia cracca	Cow/Bird vetch	H	NL	2007	3		
Plantago major	Common plantain	H	FACU	2007	49.5	50	FACU
Rumex crispus	Sour dock	H	FACU	2007	0.5		
Oenothera fruticosa	Sundrops	H	FAC	2007	3	3	FAC
Aster novi-belgii	New York aster	H	FACW+	2007	370	3196.5	FACW
Atriplex patula	Marsh orach	H	FACW	2007	3		
Distichlis spicata	Spike grass	H	FACW+	2007	1334		
Elymus virginicus	Viriginia wildrye	H	FACW-	2007	0.5		
Juncus balticus	Baltic rush	H	FACW+	2007	175		
Juncus gerardii	Black grass	H	FACW+	2007	104		
Scirpus pungens	Common three-square	H	FACW+	2007	69.5		
Solidago sempervirens	Seaside goldenrod	H	FACW	2007	17		
Spartina patens	Salt meadow grass	H	FACW+	2007	1123.5		
Carex hormathoides	Marsh-straw sedge	H	OBL	2007	3.5	1599	OBL
Carex paleacea	Chaffy sedge	H	OBL	2007	4		
Cyperus filicinus	Umbrella-sedge	H	OBL	2007	41		
Leersia oryzoides	Rice cutgrass	H	OBL	2007	46.5		
Lycopus virginicus	Virginia water horehound	H	OBL	2007	0.5		
Polygonum punctatum	Dotted smartweed	H	OBL	2007	3		
Potentilla anserina	Silverweed	H	OBL	2007	6.5		
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2007	40		
Scirpus maritimus	Alkali bulrush	H	OBL	2007	197.5		
Scirpus robustus	Salt marsh bulrush	H	OBL	2007	270.5		
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2007	56.5		
Spartina alterniflora	Smooth cordgrass	H	OBL	2007	50		
Spartina pectinata	Prairie cordgrass	H	OBL	2007	109.5		
Typha angustifolia	Narrow-leaved cattail	H	OBL	2007	733		
Typha latifolia	Broad-leaved cattail	H	OBL	2007	37		
Bromus species	Unknown grass	H	NA	2007	3	97	NA
Carex species	Sedge species	H	NA	2007	54.5		
Elymus species	Unknown rye grass	H	NA	2007	0.5		
Scirpus species	Unknown bulrush	H	NA	2007	4.5		
Trifolium species	Clover species	H	NA	2007	0.5		
	Unknown moss	H	NA	2007	34		
Plantago major	Common plantain	H	FACU	2010	15.5	15.5	FACU
Aster novi-belgii	New York aster	H	FACW+	2010	659.5	4891	FACW
Atriplex patula	Marsh orach	H	FACW	2010	37.5		
Carex scoparia	Broom sedge	H	FACW	2010	38		
Distichlis spicata	Spike grass or saltgrass	H	FACW+	2010	1710		
Elymus virginicus	Virginia wildrye	H	FACW-	2010	6.5		
Juncus balticus	Baltic rush	H	FACW+	2010	423		
Juncus gerardii	Black grass	H	FACW+	2010	15.5		
Lythrum salicaria	Purple loosestrife	H	FACW+	2010	3		
Phragmites australis	Common reed	H	FACW	2010	3		
Scirpus pungens	Common three-square	H	FACW+	2010	185.5		
Solidago sempervirens	Seaside goldenrod	H	FACW	2010	73.5		
Spartina patens	Salt meadow grass	H	FACW+	2010	1736		
Eleocharis parvula	Dwarf spike-rush	H	OBL	2010	15.5	3680	OBL
Juncus canadensis	Canadian rush	H	OBL	2010	53.5		
Schoenoplectus acutus	Hardstem bulrush	H	OBL	2010	184.5		
Scirpus robustus	Salt marsh bulrush	H	OBL	2010	737		
Scirpus tabernaemontani	Soft-stem bulrush	H	OBL	2010	15.5		
Spartina alterniflora	Smooth cordgrass	H	OBL	2010	209.5		
Spartina pectinata	Prairie cordgrass	H	OBL	2010	251.5		
Triglochin maritimum	Common arrowgrass	H	OBL	2010	56.5		
Typha angustifolia	Narrow-leaved cattail	H	OBL	2010	2122.5		
Typha latifolia	Broad-leaved cattail	H	OBL	2010	34		
Juncus sp.	Rush species	H	NA	2010	119.5	157	NA
Scirpus species	Unknown bulrush	H	NA	2010	37.5		
Polygonum ramosissimum	Bushy knotweed	S	FAC	2005	3	3	FAC
Rosa palustris	Swamp rose	S	OBL	2005	15.5	15.5	OBL
Polygonum ramosissimum	Bushy knotweed	S	FAC	2007	3	3	FAC
Cuscuta gronovii	Common dodder	V	NL	2005	33	33	NL
Calystegia sepium	Hedge bindweed	V	FAC-	2005	31.5	31.5	FAC
Cuscuta gronovii	Common dodder	V	NL	2007	4	4	NL
Calystegia sepium	Hedge bindweed	V	FAC-	2007	16	16	FAC
Cuscuta gronovii	Common dodder	V	NL	2010	17	17	NL
--	Bare ground/Open Water		NA	2005	1760.5	1760.5	
--	Litter		NA	2005	1311.5	1311.5	
--	Bare ground/Open Water		NA	2007	2295	2295	
--	Litter		NA	2007	1660.5	1660.5	
--	Bare ground/Open Water		NA	2010	1279.5	1279.5	
--	Litter		NA	2010	987.5	987.5	
Notes: 2010 data are unhighlighted; 2007 data are in green; 2005 data are in grey.							

H = Herbaceous
S = Shrub
V = Vine

T = Transect
Q = Quadrat

Percent Cover Class		
Braun-Blanquet Cover Class	Percent Cover	Median Cover Class Value
t	<1	0.5
1	1 to 5	3
2	6 to 25	15.5
3	26 to 50	38
4	51 to 75	63
5	>75	88

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Nonesuch River Salt Marsh Restoration Project - Vegetation Monitoring Data, Summary by Year and Indicator Status

Strata of Vegetation	Indicator Status	IS Key (0=dry… 5=wet)	Year	SUM by Indicator Status Median Cover	
H	FACU	2	2005	80	FACU
H	FACW+	4	2005	4743	FACW
H	OBL	5	2005	1737	OBL
H	NA	-	2005	32.5	NA
H	NL	0	2007	3.5	NL
H	FACU	2	2007	50	FACU
H	FAC	3	2007	3	FAC
H	FACW+	4	2007	3196.5	FACW
H	OBL	5	2007	1599	OBL
H	NA	-	2007	97	NA
H	FACU	2	2010	15.5	FACU
H	FACW+	4	2010	4891	FACW
H	OBL	5	2010	3680	OBL
H	NA	-	2010	157	NA
S	FAC	3	2005	3	FAC
S	OBL	5	2005	15.5	OBL
S	FAC	3	2007	3	FAC
V	NL	0	2005	33	NL
V	FAC-	3	2005	31.5	FAC
V	NL	0	2007	4	NL
V	FAC-	3	2007	16	FAC
V	NL	0	2010	17	NL
Bare ground/Open Water	NA	-	2005	1760.5	
Bare ground/Open Water	NA	-	2007	2295	
Bare ground/Open Water	NA	-	2010	1279.5	
Litter	NA	-	2005	1311.5	
Litter	NA	-	2007	1660.5	
Litter	NA	-	2010	987.5	

Percent Cover Class		
Class	Percent	Median Cover Value
t	<1	0.5
1	1 to 5	3
2	6 to 25	15.5
3	26 to 50	38
4	51 to 75	63
5	>75	88

Year by Strata	Indicator Status				
	NL	FACU	FAC	FACW	OBL
Herbaceous					
2005	0	80	0	4743	1737
2007	3.5	50	3	3196.5	1599
2010	0	15.5	0	4891	3680
Shrub					
2005			3		15.5
2007			3		0
2010			0		0
Vine					
2005	33		31.5		
2007	4		16		
2010	17		0		

To evaluate and compare vegetation cover change over time (i.e., pre-restoration 2005, Year 2 post-restoration 2007, and Year 5 post-restoration 2010), the percent cover class was replaced with the median percent value for the cover class. The total percent for each species was summed across all vegetation monitoring plots. Species were grouped by strata (i.e., herbaceous, shrub, vine) and indicator status. DESCRIBE INDICATOR STATUS. These data were tallied by indicator status so that basic trends could be identified, and are summarized in table above.

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APPENDIX E

2010
Field Notes

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8/16/10 T. Gaudet + L. Rward

Install WLRs + WQ

↳ need to verify setting at next site visit: No laptop in field.

Station #4	0905		0845
49902		7'.9"	
		PVC = 3'9"	
Subsurface depth		= 4'.0"	

Start 0906 No water @ base of LWLR

end 0920

→ Rained w/in 12 hrs previous

WQ	%DO	DO mg/L	T°C	SAL ppt
18"	1.1	0.08	18.9	10.0
↓	1.0	0.10	17.7	11.3
↓	1.0	0.11	17.4	11.6
6"	1.2	0.12	18.2	6.0
↓	4.0	0.42	18.3	5.8
↓	3.5	0.50	18.3	6.2
pool				
↓				
↓				
1.5" deep	16.4	1.17	19.7	19.0
	14.9	1.57	19.7	17.2
	24.0	1.80	19.7	19.8

Note: 6" data + 18" data were taken in opposite riffles, at each

Weather: overcast ~ 70°; breezy

Station #3 49901

6'. 8" depth = pipe length 3'8"

Depth = ~~4'~~ 3'

	Do%	Do mg/L	T°	Sal (ppt)
6'	5.1	.44	20.0	12.3
	4.1	.36	19.9	12.6
	5.3	.44	19.9	12.7
18"	1.5	0.14	18.5	2.9
	1.4	0.12	18.8	2.7
	1.6	0.14	18.9	2.6

- No Pool Present

☆ - Cap to W/Q PVC need replacement

Station # 2 49906

~~7.1~~ depth 6'3"

- 3.09 ← Pipe length

~~4.02~~ 3 2" = depth

3/4 of water @ base of WLR and WQ Pipes

	Do%	Do mg/L	T°	Sal (ppt)
6" —	16.3	1.35	18.7	20.1
	15.8	1.30	18.7	20.1
	15.9	1.31	18.8	20.1
18" —	1.5	0.13	17.8	10.1
	1.3	0.11	17.8	10.1
	1.9	0.17	18.0	10.1
Pool-2" —	32.5	2.43	20.5	24.5
(flag)	40.6	3.19	20.5	24.5
	40.0	3.20	20.5	24.6

6'4" - 3.8 depth = 4.4"

Station ⇒ 49899

#1 - .5" Standing H_2O @ base of WLR

	Do%	Do mg/L	T°	Sal (ppt)
6" —	2.0	.20	20.5	15.5
	2.3	.18	20.5	15.6
	1.5	0.12	20.4	15.5
18" -	0.9	0.07	20.2	12.4
	0.6	0.04	20.1	12.5
	.4	.03	20.1	12.5
pool-5"	30.6	2.46	20.7	19.6
	26.7	2.22	20.7	9.0
	31.5	2.43	20.7	19.6

Station 4- redo

	DO%	DO mg/L	T°C	Sal (ppt)
6"	2.0	0.18	18.5	12.00
	2.5	.24	18.2	12.00
	3.9	.33	18.3	11.9
18"	0.40	.07	17.0	7.8
	1.10	0.08	17.1	7.6
	1.00	.09	17.2	7.5

sampling completed at 11:45 (at cad)

Deer tracks

Swatts cell- 638 0453

16.

Tues

1st WLR download 8/31/10

8:15am ~75°F sunny

Station 4- 49902

WQ	%DO	DO mg/L	T°C	Sal (ppt)
6"	5.3	.47	16.9	11.1
	5.2	.29	16.9	10.8
	4.9	.33	16.7	10.7
18"	3.1	.16	17.5	6.7
	3.4	.22	17.8	6.7
	3.7	.20	17.5	6.7
Pool 1.5' deep	3.8	.29	24.8	11.1
	4.0	.33	24.4	9.5
	3.8	.35	24.4	10.7

★ - Could not save WLR data
- changed batteries in WLR

Station 3 - 9:38 am

	DO%	DO mg/L	T°C	Sal (PPT)
6"	3.4	.26	19.8	11.8
	4.0%	.28	19.3	11.9
	3.9	.22	19.2	11.9
18"	1.4	.06	18.9	2.6
	1.3	.14	18.8	2.6
	1.8	.13	18.8	2.5
Pool -	no Pool Present to Sample			

☆ changed batteries in WLR it is Sampling Properly

Station 2 - 9:58

	DO%	DO mg/L	T°C	Sal (PPT)
6"	2.8	.22	20.1	16.6
	3.7	.29	19.5	16.2
	4.0	.34	18.9	16.2
14"	0.9	.22	17.8	9.4
18"	0.8	.18	17.6	9.4
	1.1	.29	17.8	9.4
Pool - 6' deep	31.0	2.71	23.3	14.3
	30.7	2.80	22.9	14.3
	30.6	~~2.78~~ 2.63	23.2	14.3

Station 2 - WLR data was not saved
↳ changed name in Setup to Stat. 2 - it was ~~Sta~~ setup as Station 4
- changed to lithium battery
- No Standing water @ WLR base

Station 1 - WLR data not Saved
- no water @ WLR base
- adjacent Pool could not be Sampled - bone dry and surface cracked - Sampled different Pool SW of WLR

	DO%	DO mg/L	T°C	Sal (PPT)
6"	2.1	.14	22.3	16.1
	2.2	.13	22.1	16.1
	2.0	.14	22.1	16.1
18"	0.4	.06	20.3	11.7
	0.5	.05	20.7	11.7
	0.8	.09	20.5	11.7
Pool 8"	0.2	0.09	25.1	14.4
	0.1	0.04	25.3	14.4
	0.1	0.06	25.3	14.4

9/1/10 Wednesday TG - Water Quality Sampling

82°F - Sunny, hot, no breeze - no rain w/in 24hr

9:50am

Station 4

	Do%	Do mg/L	T°C	sal (ppt)	
6"	12.6	0.21	20.1	10.4	
	2.6	0.19	20.1	10.1	
	2.4	0.18	20.1	10.1	
18"	0.7	.09	17.6	7.3	
	0.5	.05	17.6	7.3	
	.5	.05	17.6	7.1	
Pool	4.2	3.37	25.0	~~12.0~~	11.9
3" deep	4.0	3.33	25.4	11.4	
	4.0	3.30	25.4	12.2	

Station 3

	Do%	Do mg/L	T°C	sal (ppt)
6"	3.0	0.30	20.9	12.5
	3.1	0.24	20.1	12.8
	3.8	0.25	20.1	12.5
18"	1.1	0.08	19.4	2.8
	.6	0.06	19.5	2.7
	.6	0.05	19.5	2.4

Pool - no Pool Present to sample

Station 2

	Do%	Do mg/L	T°C	Sal (ppt)
6"	2.4	.40	20.3	16.8
	2.0	.19	20.2	16.7
	2.0	.20	20.2	16.7
18"	12.1	1.06	19.8	4.6
	12.0	1.03	19.7	4.6
	11.2	1.02	19.7	4.6
Pool	24.6	1.98	25.3	14.3
	23.2	1.59	25.0	14.8
	23.4	1.59	25.2	15.0

Station 1

	Do%	Do mg/L	T°C	sal (ppt)
6	0.3%	.01	22.0	17.1
	0.2	.01	21.8	17.1
	0.2	.01	21.7	17.1
14"	0.3	.13	21.4	12.2
	0.2	.10	21.4	12.2
	0.2	.07	21.0	12.6
Pool	13.0	.89	27.1	15.5
9" deep	12.2	.80	27.5	15.5
	11.3	.69	27.4	15.5

Friday 9/10/10
6:30am - start
cloudy - but Sunny - rained yesterday
~62°F
Station 4 - 2 in water @ base of WLR

	Do%	Do mg/L	T°C	Sal (PPT)
6"	6.9	.78	16.1	5.3
	6.4	.74	16.1	5.3
	6.4	.75	16.1	5.1
18	1.2	0.09	16.9	7.5
	1.3	0.08	17.2	7.3
	1.1	0.07	16.8	7.3
Pool	14.0	1.57	19.1	16.2
	14.5	1.61	19.1	16.2
	13.8	1.54	19.3	16.2

☆ WLR data would not ~~record~~ download again

Station 3 7:16 am start

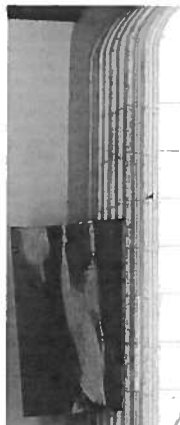
	Do%	Do mg/L	T°C	Sal (PPT)
6"	4.4	.59	18.0	12.1
	3.5	.36	18.0	12.2
	3.5	.39	18.1	12.2
18"	10	.13	17.9	3.0
	.9	.08	17.9	3.0
	.9	.07	17.9	3.0
Pool	No Pool Present			

☆ WLR data would not download

Station 2: 7:38 am - 4 in water @ base

	Do%	Do mg/L	T°C	Sal (PPT)
6"	5.8	.47	18.0	19.2
	5.5	.43	18.0	19.2
	5.6	.43	17.7	19.2
18"	12.4	.99	17.9	9.8
	12.3	.98	17.9	9.8
	11.8	.92	17.9	9.7

→ Pool on next page



STATION 2

	DO%	DO mg/L	T°	Sal
Pool	36.8	3.48	15.8	23.5
	35.4	3.40	15.8	23.6
	40.2	3.66	15.9	23.6

Station 1 7:52 start

↳ 4in water ↳ base of WLR

	DO%	DO mg/L	T°	Sal (ppt)
6"	0.3	0.03	18.1	16.9
	6.3	0.07	16.2	16.6
	0.2	0.01	18.2	16.6
18"	0.7	0.06	18.4	12.2
	0.6	0.05	18.9	12.2
	0.6	0.05	18.9	12.2
Pool	~~0.09~~	~~0.01~~	17.9	23.4
	~~2.07~~	~~0.01~~	18.4	23.3
	0.2	0.01	18.6	23.3
	0.2	0.01		
	0.3	0.01		

9/15/10 wednesday

Sunny w/ breeze ~65°F

Station 4 10.32 - done

	DO%	DO mg/L	T°	Sal (ppt)
6"	2.4	.16	17.3	13.1
	2.6	.18	17.3	13.1
	2.[illegible]	.12	17.3	13.1
18"	2.0	.16	15.6	8.0
	2.0	.16	15.7	8.2
	1.6	.15	15.6	8.2
Pool	73.9	7.5	20.4	15.7
	26.8	2.53	20.4	15.7
	25.0	2.57	20.4	15.7

~~DO~~ failed to DL WLR again

So took a Print Screen for watts

Station 3 - 10:45 am - Start

	DO%	DO mg/L	T°C	Sal (ppt)
6"	3.1	.26	17.4	14.5
	3.3	.27	17.4	14.5
	3.0	.23	17.4	14.3
14"	1.8	.16	17.1	3.2
	1.7	.15	17.1	3.2
	1.3	.11	17.1	3.2
Pool	- no Pool			

could not DL WLR data -
saved a Print Screen

Station 2 11:02 start

	DO%	DO mg/L	T°C	Sal (ppt)
6"	4.0	.39	16.3	20.8
	3.4	.33	16.4	20.8
	3.6	.34	16.4	21.0
14"	1.6	.13	15.8	10.4
	1.4	.11	15.9	10.4
	1.0	.07	15.9	10.4
Pool	26.8	1.89	18.5	23.0
	26.4	1.80	18.5	23.0
	23.8	1.74	18.5	23.0

Station 1 11:32

	DO%	DO mg/L	T°C	Sal (ppt)
6"	3.9	.30	18.2	18.3
	4.1	.31	18.2	18.3
	3.4	.25	18.2	18.3
14	2.8	.24	17.7	12.7
	2.2	.17	17.4	12.7
	2.1	.15	17.7	12.6
Pool	32.0	2.47	20.0	19.1
	31.8	2.43	20.0	19.3
	32.4	2.53	20.0	19.3

Mon 9/20/10 Sunny 15:00
breezy

Station 4

	DO%	DO mg/L	Sal (ppt)	T°C
6"	1.4	.20	12.6	15.6
	1.3	.13	12.6	15.6
	1.2	.11	12.6	15.7
18"	3.3	.61	8.1	14.5
	1.7	.23	8.1	14.6
	1.9	.25	8.1	14.5
Pool	10.2	.72	12.2	24.1
4'	10.6	.75	12.2	24.2
	10.0	.70	12.2	24.2

Pulled WLR @ 15:09

Ser# 44902 - Station 4

Station 3

	DO%	DO mg/L	Sal (ppt)	T°C
6"	4.0	.36	17.9	16.2
	4.3	.39	17.8	16.4
	3.8	.33	17.8	16.3
18"	2.4	.22	18.2	5.6
	2.0	.17	18.2	5.6
	1.9	.18	18.2	5.6

- No Pool to Sample -

Pulled WLR @ 15:29

44901

Station 2 - Pulled WLR @ 15:38

	DO%	DO mg/L	Sal (ppt)	T°C
6"	4.7	.46	22.0	16.9
	4.4	.41	22.2	16.7
	4.3	.40	22.0	16.7
18"	2.0	.19	9.8	15.4
	1.4	.15	9.8	15.4
	1.2	.13	9.8	15.5
Pool	32	2.30	22.7	16.9
2'	26.2	1.78	22.5	16.9
	25.6	1.63	22.5	16.8

Station 1

	DO%	DO mg/L	T°C	Sal
6"	4.2	.34	20.1	15.4
	4.0	.32	20.0	15.4
	3.4	.29	20.2	15.4
18	2.0	.14	16.8	10.3
	2.4	.19	16.8	10.5
	2.5	.22	16.7	10.2
Pool	34.0	2.64	21.2	20.6
5"	33.4	2.43	21.4	20.6
	32.9	2.27	21.2	20.5

Pulled WLR @ 15:51
~~49~~ 49819

9/27/10 - overcast, slight breeze ~60°F
6:32 am
Station 1 - reinstallation
subsurface depth of WLR ⇒ 4.0ft

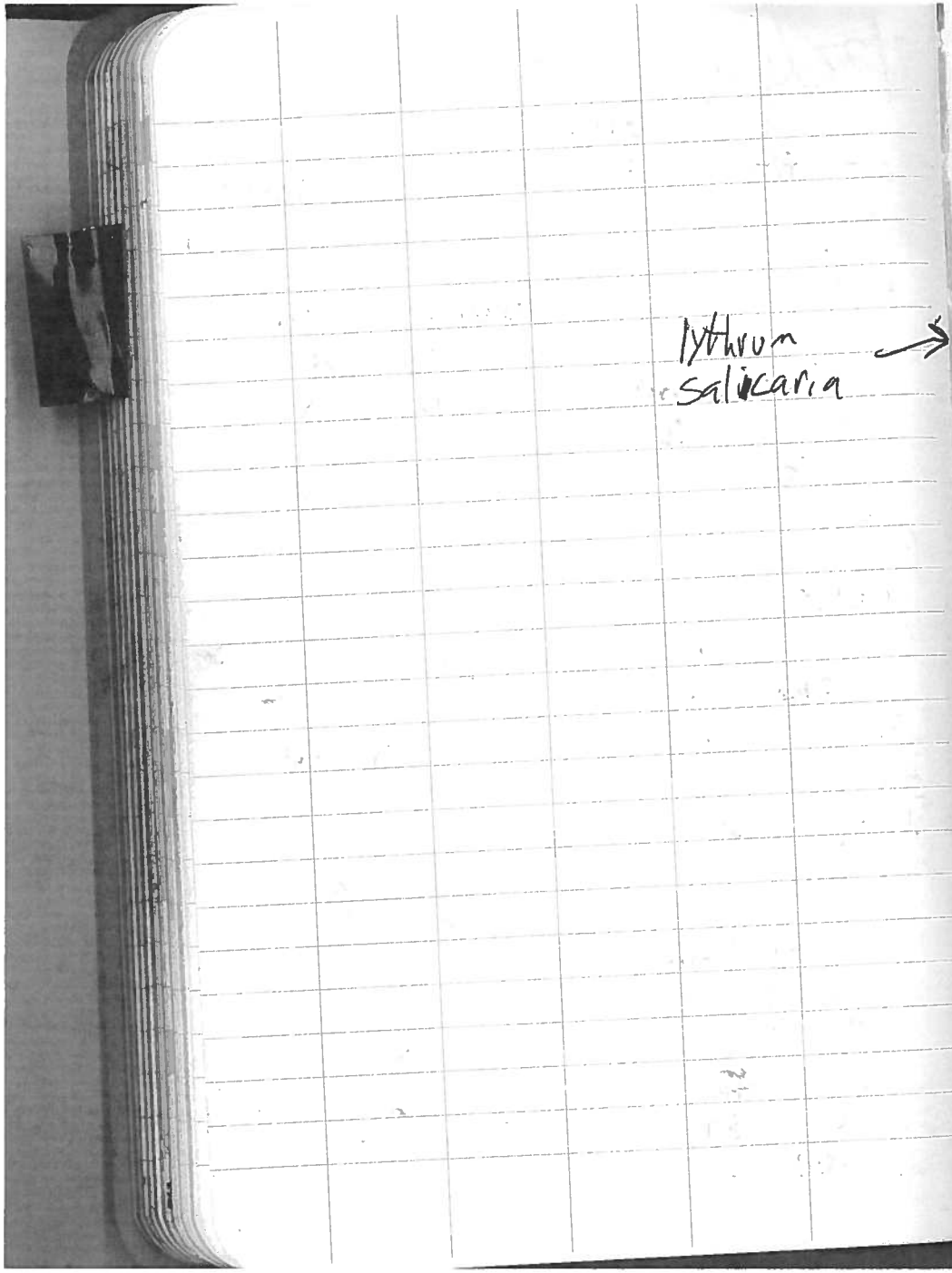
Station 2 - subsurface depth - 3.75ft
installed @ 9:04 am

10/2/10 13:20 on site
S. Watts.

Veg survey recon.

Download WLRs
#2 - OK data looks good
#1 - OK "

END 16:03
SW



NONESUCH 10/13/10
Vegetation monitoring
S Watts, L. Eiser 0645

PHRAG1
PHRAG 5
LYSA 5
DISP ~~40~~ 60
SCPU ~~10~~ 20
NYaster 15

T1/1
NYaster 5
TYLA 10
SP Poaceae 30
Litter 60
Cuscuta sp. T
Solidago 2
DISP 4

T1/2 ~~SCVA 2~~
~~Solidago~~ JUGE 10
DISP 20 ~~5~~
SCRO 20 ~~15~~
NYaster 50
SCHONoplect 5
Dodder 1

T1/3
~~Solago~~ 10
TYAN 15
NYaster 25
Carex sp. 30
DISP 20

T2/7
NYast 30
TYAN 50
DISP 10
Litter ~~20~~ 10

T2/8
TYAN 100
Litter 10

T2/9
TYAN 100
Litter 10

lythrum salicaria →

T3/9
TYAN 20
Triglochen 5
JUCA 30
DISP 10
NYaster 15
Litter 20

T3/8
TYAN >90
Litter 20

T3/7
TYAN >90
Litter 10

T3/6
TYAN 10
DISP 30
NYast 5
SPAL 10
OPEN <5
~~JUCA~~ ~~20~~
SPPA 40

T3/5
TYAN >75
OPEN <5
Litter 20

T3/4
TYAN >75
Open 10
Litter <5

T3/3
TYAN ~~20~~ >50
Schno 20
Open ~~5~~ 10
Litter 20

T3/2
TYAN >75
Litter ~~<25~~ 20
Bare 5-10

T3/1 (No stake)
~~Schno~~ 10
SCPE 20
SPAL 60
Open 10

(No stake)
T2/1
Schno 55
SPAL 45
Open 10

T2/2
TYAN >50
DISP 20
Triglo 2
NYast >5
SCPU <5
Litter 15-20

T2/3
TYAN >75
SCPU T-1%
Litter <25

T2/4
TYAN 70
DISP 30
NYaster >5
SCPU 1
~~Open~~ Litter 1-5

T2/5
NYaster 20
DISP <50
SCPU 1-5

T2/6
NYast 25
DISP 40
SCPU 7
SPAL 7
Solidago 45
Juncus 30

T2/7
TYAN 40
DISP 10
NYaster 20
Juncus CA 25

T4/1 (No stake)
Scirpus RO ~~10~~
(F?) >75
Litter >25

T4/2

TYLA	<5
SCRO	>75
Schno	>5
Litter	<25
DISP	<5

T4/3

TYLA	25
NYaster	25
DISP	30
Solidago	<5
JUBA	20
Cuscuta	T

T4/4

SPPA	>90
SCPU	15

T4/5

SPPA	>80
SCPU	7
NYaster	7
DISP	<5
Solidago	<5

T4/6

Solidago sem.	7
NYaster	10
SCPU	7
~~SPPA~~	~~10~~
Juncus	>50
SPAL	10
DISP	20

T4/7

NYaster	7-10
DISP	>25
SCPU	7
Juncus BA	40
Sol. SE	>5-10
SPPE	2
JUCA	20
Litter	<5

T4/8

Schno	10
NYaster	25
Juncus BA	>50
Triglochin	2
DISP	<25

T4/9

TYAN	>25-50
JUBA	~~10~~ 25-50
NYaster	10
DISP	20
Dodder	T
Litter	<25

T5/10

SPPA	>75
~~SPAL~~SCRO	20
Tri MA	1
DISP	1
Litter	>5

T5/9

Schno	40
NYaster	30
Grass sp.	1
TYAN	30

Elymus virginicus

SCRO	1

T5/8

TYAN	15
NYaster	<25
Cuscuta	1-5
DISP	15
JUBA	>50
Litter	10

T5/7

TYAN	>50
NYaster	10
Litter	<25

T5/6

TYAN	>50
NYaster	<5
DISP	10
Open	5-10
Litter	<25

T5/5

TYAN	>50
NYaster	>5
Litter	25-50
~~Open~~	5

T5/4
TYAN >25
NYaster 5-10
DISP 10-20
JUBA <50
SCPE >5

T5/3
TYAN >50
NYaster >5
SPPA 5
DISP 5
Litter <25

T5/2
TYAN <25
SPAL 10
NYaster 10
DISP >50
JUBA >25
Cuscuta T

T5/1 (No stake)
SPPE >50
NYaster 50
Litter 10

T6/1 (No stake)
SCRO >50
ATPA <25
DISP 10
Open 5
Litter <25

T6/2
SOSE <5
SCPU 10
DISP <25
JUBA 10
NYaster <5
SPPA 50-75

T6/3
TYAN 50-75
SPPA <5
DISP <5
Litter <25

T6/4
TYAN >5
SPPA <50
NYaster 10
SOSE >5
Litter 10
JUBA <50
DISP <5
SPAL <5

T6/5
TYAN >75
NYaster 10
DISP >5
Scirpus 1-5
SPPA T
Litter 5-10

T6/6
TYAN 5
NYaster 10
DISP >75
SCPU 10
Open <5

T6/7
TYAN <25
Open Water >75
SPPA <5

T6/8 (No stake)
SCRO >50 JU <5
NYaster 10
Cuscuta 1-5
Litter >25
Grass sp <1

T6/9
TYAN <100
Litter >5-25
DISP >5

T6/10
TYAN 75-100
NYaster >5
Litter >5
DISP >5

T6/11
SCRO 5-10
TYAN 5-10
DISP 10
NYaster 1-5
SPPA 15
Open 20
Litter 10
Plantain MA 5-10

T6/12
TYAN <50
Open 40
Litter Litter 10
SCSp <1

T7/13 (No stake)
SPPA <25
SCRO ~~5-75~~ 5
Open 50-75

T7/12
SCRO 50-75
Litter >25
~~TRMA~~ 1-5

T7/11
SCRO ~20
SPPA <25
DISP ~5
TYAN <5
open ~45%

T7/10
DISP 95
ASNY 5
TRMA <1

T7/9 Litter 40
TYAN 40 SCRO 5
DISP 10
ATRA <1

~~T7/8~~ Plrag 4
TYAN 15-20
DISP >75
Open 15
Litter <5
Scirpus RO 1-5

T7/8
TYAN 20
DISP >50
~~TRMA~~ 1-5
Litter 1-5
SPPA 15
SCPU 1-5

T7/7
DISP >50
SPPA 20
TRMA >5
SCPU >5
Open <5

Stopped 7

T7/6
SCRO <25
NYaster >5
SPPA 25-50
DISP >50
Open >5
Litter <25

T7/5
TYAN 45
DISP 20
SCRO 10
TRMA <5
~20 open-water

T7/4
TYAN 95
ASNY 1-5

T7/3 SPPA <50
TYAN >25 Grass 1-5
ASNY <20 SPAL 1-5
DISP <50
SCRO ~5
Cuscuta 1-5
SOSE 1-5

T7/2
TYAN >50
SPPA 25-50
Litter 25-50

stake
T7/1
SCRO 20
TYAN 15
SPPA >25
DISP >50
ATRA 1-5
Litter 10

T8/1
SCRO <50
Litter >50

T8/2
SCPU 7
NYaster 20
SOSE 1-5
DISP >5
JUBA <50
TRMA <1
Litter >50

T8/3
SCPU >5
JUBA >25
TRMA >5
SOSE 1-5
NYaster >5
SPPA >25
Cuscuta 1-5
SPAL 1-5

T8/4
JUBE 25-50
TYAN 25-50
DISP >25
SOSE 1-5
SPAL 1-5
Litter <5
NYaster >5

T8/5
SPAL >5
DISP >75
SPPA <25
SCPU >5
Litter 5-10

T8/6
ATPA 15
Open 10
SCRO ~~70~~ >50
SPPE 25-50

T8/7
SPPA 75-100
TYAN 1-5
Litter 10
NYast 1-5
DISP 1-5

T8/8
SPPA 85
SCRO >5-15
~~SPAL~~
DISP 1-5

T8/9
SPPA 100%

T8/10
SPPA >5
DISP 1-5
open >75
SCRO 1-5

T8/11
SCRO 25-50
SPPA <25
open 25-50
Litter >5

T8/12 (No stake)
DISP 25-50
~~JUBE~~
Eleocharis <25
SPPA 25-50

T8/13
DISP >75
SPPA >25

T8/14 ——
open 100%

T9/8 + T9/7
Open 100%

T9/6
SPPA >75-100
NYaster 1-5

T9/5 SPPA 100%
T9/4 SPPA <100
TRMA T

T9/3 SPPA >75
SCRO 1-5
Open >1<5

T9/2 (No stake)
SPPE <25
SPPA >50
DISP <25

T9/1 (No stake)
SPPE <75
NYaster 5-25
ATPA 1-5
SPPA >5
Litter 5-25

T10/&2
SPPA 100%

T10/1 Litter >25
DISP >50
Scirpus >5
SPAL +1

T10/3-4-5
100% Open

T10/6
SCRO >75
Open <25
Litter >5

T10/7 + T10/8
Open 100%

T10/9
SPPA >150
SPAL >5
SCRO 1-5
Open <25

T10/10
SPPA 100%
SPAL 1-5%

Phrag 2
DISP ≤ >85
TRMA 1-5
SC 1-5
TYAN 1-5

Phrag 3
SCTA 20 (SS talitrus)
ASNY 10
DISP 70

Red tailed hawk
Sparrow
~~Marsh wolves~~
~~(mp dogs)~~

Nemesis 11-7-10
Onsite 11:15 AM
High tide photos + site assmt.

Photo Stations 1, 4, 3, 2
Photos @ Station 1 (WLRS)

11-12-10
Onsite 0845
Low tide Photos
Check ditch plugs + do site assmnt.

Photo Stations 1, 4, 3, 2

Site Assement
Cover Type Mapping

END 11/12
SW

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APPENDIX F

2010
Species List

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Species Observed During Monitoring Activities for the Nonesuch River Project.

Common Name	Scientific Name	Visual Categories
Birds		
American black duck	*Anas rubripes*	Water bird
American crow	*Corvus brachyrhynchos*	Passerine
American goldfinch	*Carduelis tristis*	Passerine
American robin	*Turdus migratorius*	Passerine
Belted Kingfisher	*Megaceryle alcyon*	Non-passerine
Black-capped chickadee	*Poecile atricapillus*	Passerine
Canada goose	*Branta canadensis*	Swimming bird
Common egret	*Bubulcus ibis*	Wading bird
Common snipe	*Gallinago gallinago*	Water bird
Great Blue Heron	*Ardea herodias*	Wading bird
Greater yellowlegs	*Tringa melanoleuca*	Wading bird
Herring Gull	*Larus argentatus*	Seabird
Lesser Yellowlegs	*Tringa flavipes*	Wading bird
Marsh wren	*Cistothorus palustris*	Passerine
Northern harrier	*Circus cyaneus*	Bird of prey
Red-tailed hawk	*Buteo jamaicensis*	Bird of prey
Saltmarsh sharp-tailed sparrow	*Ammodramus caudacutus*	Passerine
Sandpiper species	*Actitis or Calidris* spp.	Wading bird
Sparrow species		Passerine
Virginia Rail	*Rallus limicola*	Wading bird
Willet	*Catoptrophorus semipalmatus*	Wading bird
Mammals		
Field Mouse	*Apodemus sylvaticus*	Small mammal
Raccoon (tracks)	*Procyon lotor*	Large mammal
White-tailed deer (tracks)	*Odocoileus virginiana*	Large mammal
Amphibians/Reptiles		
Eastern garter snake	*Thamnophis sirtalis*	
Frog	*Rana* spp.	
Insects		
Damselflies	*Zygoptera* spp.	
Dragonflies	*Epiprocta* spp.	
Moth larvae	*Lepidoptera* spp.	

Note: Data collected on species observed using the Project area are anecdotal observations collected during field sampling activities onsite, and are intended to provide additional information, and do not represent qualitative data collection. Additionally, these data are collected by individuals with a range of expertise in the identification of birds and wildlife, and therefore represent only a partial list of the species that may actually be using the Project area.