Emblem-Hyannis Restoration Plan
Barnstable, Massachusetts

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1.0 Introduction

The Emblem-Hyannis Restoration Plan provides an outline of work proposed for the restoration of approximately 9.8 acres of land that is presently an active golf course (see Figure 1) as mitigation for the redevelopment of the site. These 9.84 acres will be part of the 20.11 acre open space area that will be protected under a Conservation Restriction (see Figure 2). The restoration area is located between the main tree line which parallels both Joshua's Brook and Stewart's Creek and the limit of the proposed development. The remainder of the CR is vegetated with forested areas, wetlands, and waterways. The revised site plan which clusters development away from the wetlands is shown in Figure 3.

Approximately 9.84 acres of previously disturbed golf course areas will be restored by either allowing for natural revegetation or the planting native species of trees, shrubs, and groundcover to help restore these areas, improve the vegetated buffers, and allow for a more natural appearance and environment. Planting of native species of trees and shrubs along the new community's perimeter in the areas of the existing golf course (which represents degraded habitat), will improve the vegetated buffer and habitat for wildlife, and allow these areas to return to a more natural state. The plantings described in this plan do not include the landscaping proposed for the development.

This plan will be implemented by licensed landscape professionals who have experience in large-scale restoration projects.

The following are goals and objectives of the Restoration Plan:

- Restore managed turf areas with native plantings
- Create a more natural appearing environment
- Enhance buffers between existing natural areas and areas to be developed
- Increase habitat diversity
- Create passive recreation opportunities through development of trail systems
- Develop educational signage program
- Create restored areas that are able to self-maintain without any interventions to allow for natural revegetation

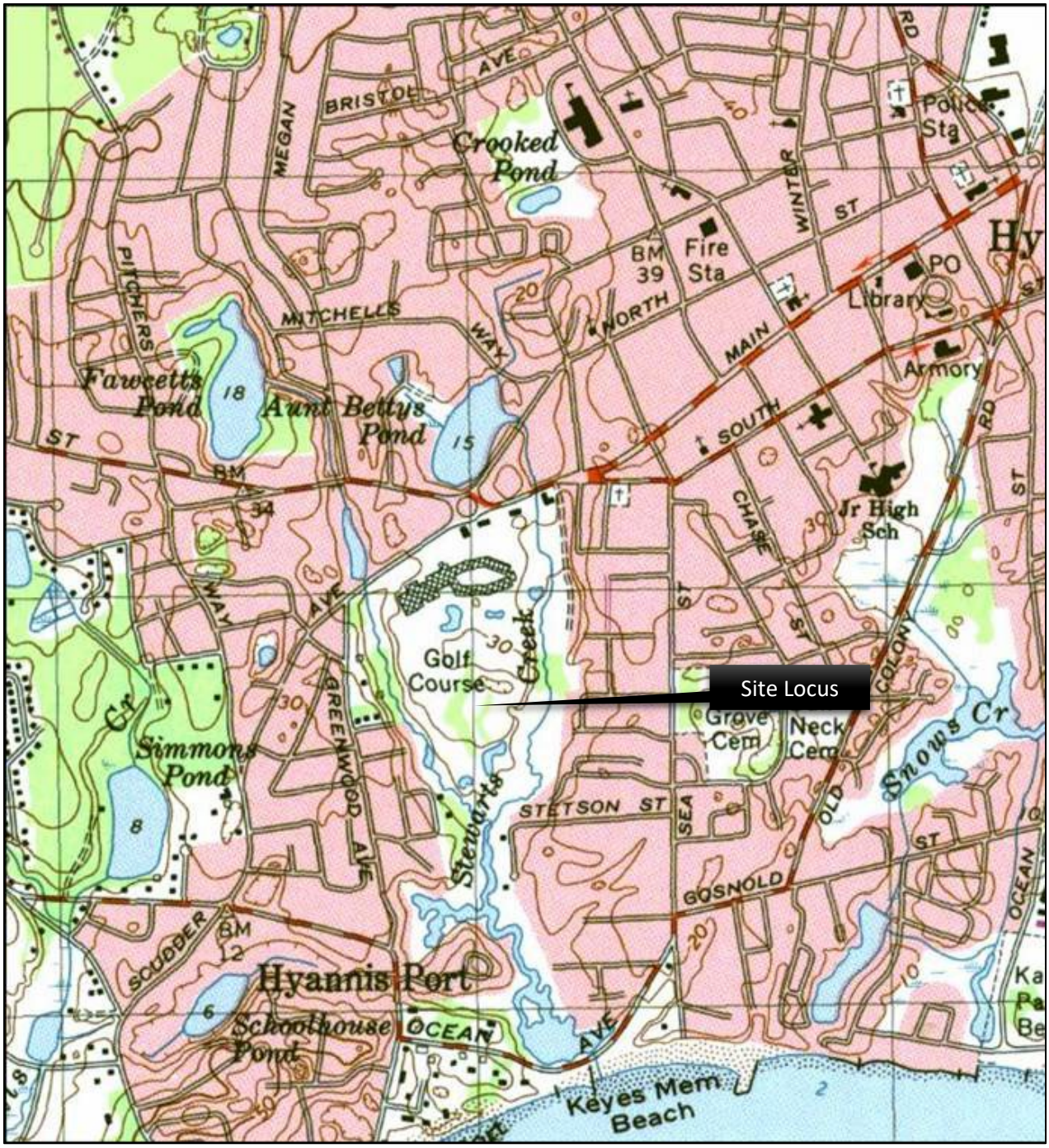

Figure 1: USGS Locus Map

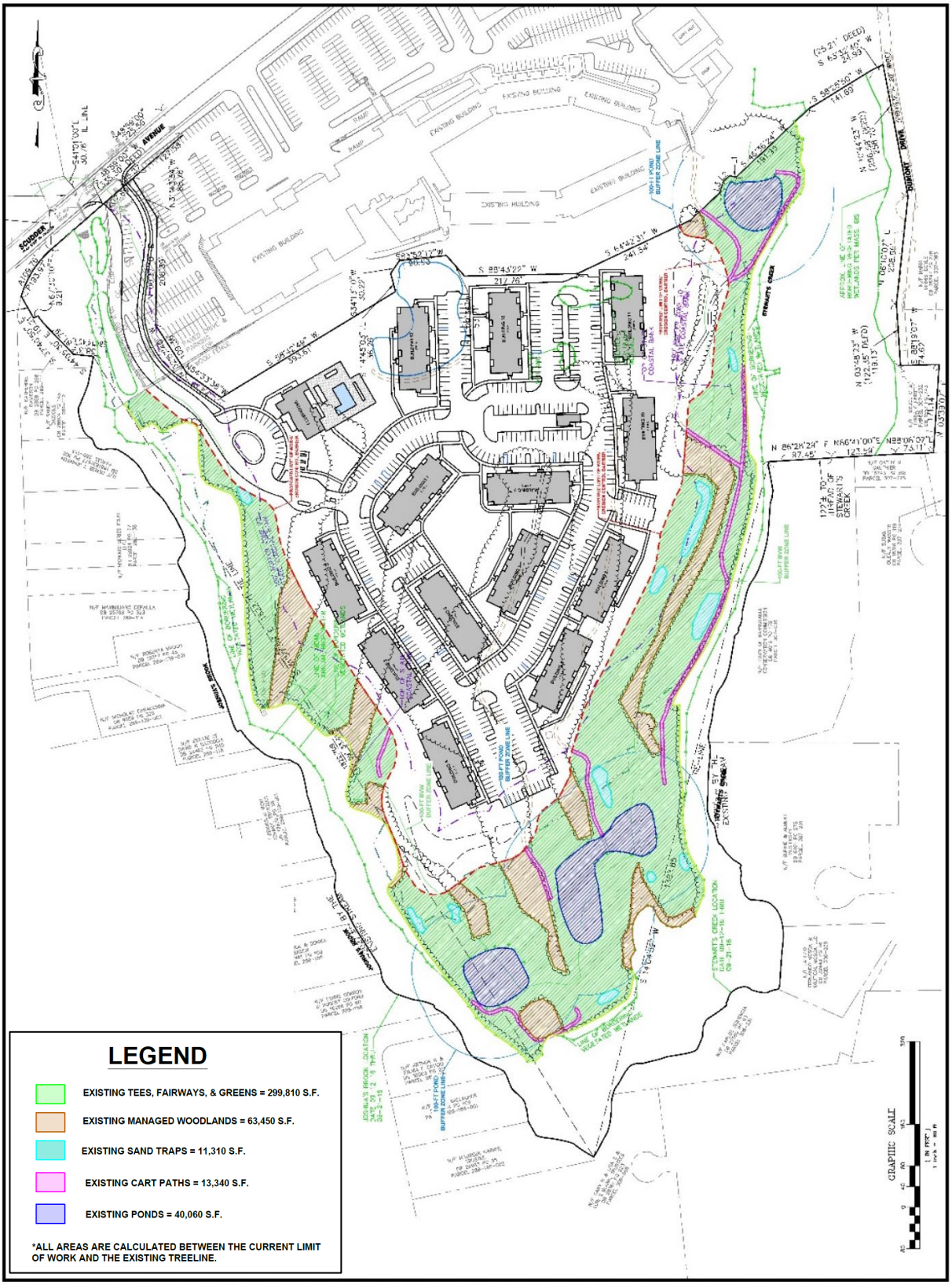

Figure 2: Restoration Area

Figure 3: Revised Layout over Aerial Photo

2.0 Existing Conditions

The topography of the Site is relatively flat (from clearing activities to build the golf course), with some small hills, ranging in surface elevation from approximately 35 feet in elevation above mean sea level (MSL) at the high point near the center, to approximately to 5 feet in elevation along the southeastern side near Stewart's Creek. There are moderate to steep-sided slopes between the uplands and wetlands adjacent to the two perennial streams. The southern tip of the Site is approximately 2,100 feet north of the mean high water line at Hyannis Harbor. The wetlands at the Site are freshwater transitioning to a more estuarine (i.e., salt water) habitat to the south of the Site and are likely freshwater wetlands that are tidally influenced. This section describes the upland and transitional wetland habitats observed at the site which will be used to help guide the type of restoration to be designed. Photographs of existing conditions are provided in Appendix A. A general vegetation cover type map is provided as Figure 4.

Native and non-native invasive vegetation is present on the site. Native species identified are provided in Table 1 and invasive species are provided in Table 2. These lists are not intended to catalog every species at the site but to document the most common species in addition to providing a summary of what habitat those plants are commonly found.

2.1 Uplands

The majority of the Site is a golf course that includes all of the highly managed play areas and landscape features, both vegetated and unvegetated, that typically occur at a golf course including tee boxes, fairways, greens, and roughs (all of which are frequently mowed and irrigated), also sand traps, paved and unpaved cart paths, water features (or "hazards"), and small service structures. In addition to the highly managed play areas, upland cover types include managed woodland "in course" and pitch pine-mixed oak woodland as described below. The restoration involves areas that are presently managed turf, sand traps, and buffer areas between managed areas and natural areas.

- **Managed Woodland "in-course":** Open woodland areas are managed within the golf course that serve as boundaries between many of the numbered fairways. These woodland areas are of various widths and consist primarily of mature hardwood trees with lesser amounts of coniferous trees. Scarlet oak (*Quercus coccinea*) is the predominant hardwood species and pitch pine (*Pinus rigida*) is the predominant coniferous species. Other than mowed grass, a woody understory within these woodland areas is absent.

- **Pitch Pine-Mixed Oak Woodland:** The only unmanaged upland cover type at the golf course is the pitch pine-mixed oak woodland, which comprises only relatively small and narrow portions of the Site. This cover type of comprised of mature, second-growth oak with scattered pines. This cover type is located between the wetlands along Joshua's Brook and the west margin of the golf course and between the wetlands along Stewart's Creek and the east margin of the course. This cover type has a canopy of pitch pine and tree oaks such as black oak (*Quercus velutina*), scarlet oak, chestnut oak (*Q. prinus*), and white oak (*Q. alba*), with blueberries (*Vaccinium angustifolium* and *V. pallidum*), black huckleberry (*Gaylussacia baccata*), and other ericaceous shrubs forming an often continuous low shrub layer.

Table 2-1: Native Vegetation Species Observed on the Site

Common Name	*Scientific Name*	Habitat	Layer
Wild sarsaparilla	*Aralia nudicaulis*	Upland	Herbaceous
Pennsylvania sedge	*Carex pensylvanica*	Upland	Herbaceous
Pink lady's slipper	*Cypripedium acaule*	Upland	Herbaceous
Wintergreen	*Gaultheria procumbens*	Upland	Herbaceous
Spotted touch-me-not	*Impatiens capensis*	Wetland	Herbaceous
Cinnamon fern	*Osmunda cinnamomea*	Wetland	Herbaceous
Royal fern	*Osmunda regalis*	Wetland	Herbaceous
Common reed	*Phragmites australis*	Wetland/Transitional	Herbaceous
Bracken fern	*Pteridium aquilinum*	Upland	Herbaceous
Skunk cabbage	*Symplocarpus foetidus*	Wetland	Herbaceous
Coastal sweet pepperbush	*Clethra alnifolia*	Wetland/Transitional	Shrub
Silky dogwood	*Cornus amomum*	Wetland	Shrub
Black huckleberry	*Gaylussacia baccata*	Wetland/Transitional	Shrub
Hightide bush	*Iva frutescens*	Wetland/Coastal	Shrub
Spicebush	*Lindera benzoin*	Wetland/Transitional	Shrub
Sweet gale	*Myrica gale*	Wetland	Shrub
Swamp azalea	*Rhododendron viscosum*	Wetland	Shrub
Swamp rose	*Rosa palustris*	Wetland	Shrub
Virginia rose	*Rosa virginiana*	Transitional	Shrub
Elderberry	*Sambucus canadensis*	Wetland	Shrub
Lowbush blueberry	*Vaccinium angustifolium*	Upland	Shrub
Highbush blueberry	*Vaccinium corymbosum*	Wetland/Transitional	Shrub
Blue ridge blueberry	*Vaccinium pallidum*	Wetland/Transitional	Shrub
Northern arrowwood	*Viburnum dentatum*	Wetland/Transitional	Shrub
Red maple	*Acer rubrum*	Wetland/Transitional	Tree
Alder	*Alnus spp.*	Wetland	Tree
Black tupelo	*Nyssa sylvatica*	Wetland/Transitional	Tree
White pine	*Pinus strobus*	Upland	Tree
Pitch pine	*Pinus rigida*	Upland	Tree
White oak	*Quercus alba*	Upland	Tree
Scarlet oak	*Quercus coccinea*	Upland	Tree
Scrub oak	*Quercus ilicifolia*	Upland	Tree
Dwarf chestnut oak	*Quercus prinoides*	Upland	Tree
Chestnut oak	*Quercus prinus*	Upland	Tree
Black oak	*Quercus velutina*	Upland	Tree
Catbrier	*Smilax rotundifolia*	Transitional	Vine

Scattered patches of scrub oak (*Q. ilicifolia*) and bear oak (*Q. prinoides*) can be dense. Catbrier and other briers (*Smilax rotundifolia* and Smilax spp.) often make dense barriers around low, dense openings. The herb layer is generally sparse with bracken fern (*Pteridium aquilinum*), wild sarsaparilla (*Aralia nudicaulis*), wintergreen (*Gaultheria procumbens*), Pennsylvania sedge (*Carex pensylvanica*), and, less commonly, pink lady's slipper (*Cypripedium acaule*). Occasional white pine (*Pinus strobus*) and red maple (*Acer rubrum*) contribute to the canopy.

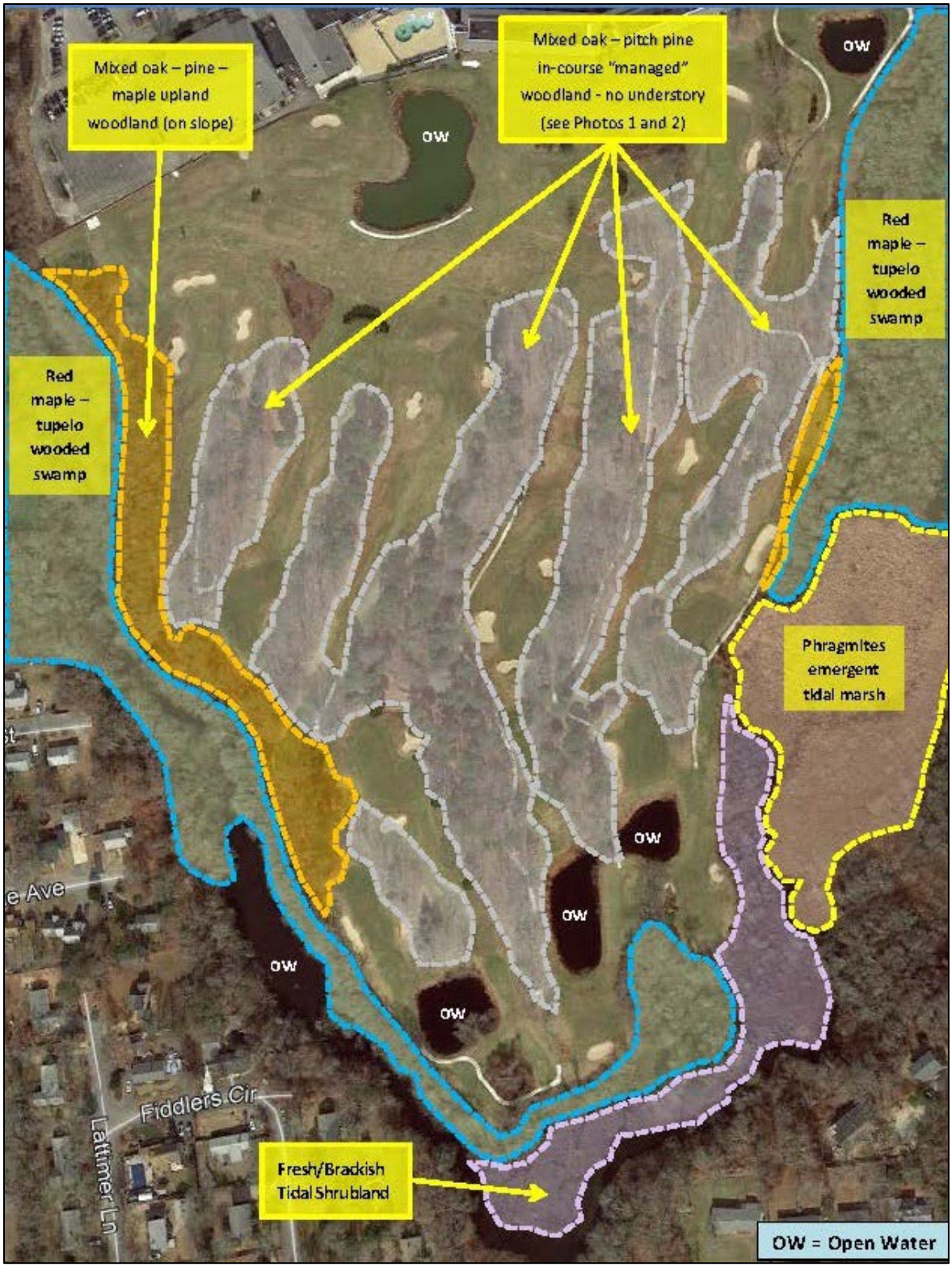

Figure 4: Vegetative Cover Types

2.2 Wetlands

This vegetation cover types found in the wetlands at the Site including red maple-tupelo wooded swamp, phragmites emergent tidal marsh, and fresh/brackish tidal shrubland (scrub-shrub emergent tidal marsh). Wetland resources form the Site's eastern, western, and southern boundaries. Generally, the transition from golf course and other upland areas to wetland habitat in most areas of the Site is abrupt due to existing, moderate to steep-grade slopes and golf course management practices.

- **Red Maple-Tupelo Wooded Swamp:** Forested wetland habitats occurring along and near these streams are red maple and black tupelo (*Nyssa sylvatica*)-dominant woodland habitats. These wooded wetlands habitat exhibit a dense woody understory in most locations and support species including coastal sweet pepperbush (*Clethra alnifolia*), spicebush (*Lindera benzoin*), northern arrowwood (*Viburnum dentatum*), highbush blueberry *(Vaccinium corymbosum*), and swamp azalea (*Rhododendron viscosum*). Where trees are sparse or absent along the streams, dense woody and herbaceous vegetation comprise the wetland habitats. Silky dogwood (*Cornus amomum*), alder (*Alnus spp*.), elderberry (*Sambucus canadensis*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), skunk cabbage (*Symplocarpus foetidus*),and spotted touch-me-not (*Impatiens capensis*) occur frequently in the more open wetland landscape.

- **Phragmites Emergent Tidal Marsh:** Unlike Joshua's Brook, Stewart's Creek along the eastern boundary of the Site eventually daylights from a wooded swamp into an expansive emergent tidal marsh that is common reed (*Phragmites australis*)-dominant.

- **Fresh/Brackish Tidal Shrubland:** At the southern extent of the Site, where the two waterways converge and where common reed or wooded swamp do not comprise the wetland habitat, a plant community consistent with a fresh/brackish tidal shrubland occurs. Species including hightide bush (*Iva frutescens*), swamp rose (*Rosa palustris*), Virginia rose (*R. virginiana*), and sweet gale (*Myrica gale*). There is no salt marsh located on or near to the Site.

- **Waterways and Water Bodies:** Joshua's Brook and Stewart's Creek are perennial streams that comprise the western and eastern Siteboundaries. Joshua's Brook flows from Fawcett's Pond and Stewart's Creak flows from Aunt Betty's Pond. These streams converge at the southern end of the Site and flow south eventually discharging into Nantucket Sound beneath a culvert at Ocean Avenue. There are artificially created freshwater open water areas within the golf course, all of which serve as water hazards. They are all relatively shallow in depth and each exhibits a relatively narrow band of woody and herbaceous vegetation serving as a buffer between the water margin and mowed golf course area. The vegetated pond margins are comprised of an assemblage of native plant species and invasive plant species including large gray willow (*Salix cinerea / S. atrocinerea*), multiflora rose (*Rosa multiflora*), and Asiatic bittersweet (*Celastrus orbiculatus*).

2.3 Specimen Trees

On September 26, 2022, a count of the specimen trees to be cut within the limit of work were counted for an exact number of trees to be replaced in accordance with the Cape Cod Commission's Wildlife and Plant Habitat Technical Bulletin. Specimen trees are defined as softwoods greater than 18" dbh (diameter at breast height) and hardwoods greater than 12" dbh. The following table provides the data collected.

Table 2-2: Specimen Trees

Type of Tree	Tree Species	Number Counted
Hardwood	Black oak	119
Hardwood	White oak	10
Hardwood	Black cherry	1
Hardwood	Red maple	4
Softwood	Pitch Pine	10
	Total	**144**

Previously, the amount of 375 specimen trees had been provided in documents submitted to the Cape Cod Commission. This amount represents the estimated number of specimen trees on the entire site. Approximately 144 trees (including a mixture of deciduous and evergreen trees) are proposed to be planted over the 9.84 acres restoration area. Additional trees will be planted in the development area so that in total, there will be 350 trees planted on the Site. In addition, there are other vegetation management (or treatment) options as described below. The restoration plantings together with the landscaped plantings will provide greater habitat values in conjunction with each other.

2.4 Invasive Species

Woody invasive species are prevalent at the Site within unmanaged plant communities. Vegetated areas appearing most impacted by invasive plants are along the margins of the two ponds and two surface water bodies and along the margins of in-play golf areas at the Site's perimeter. Invasive species most frequently encountered at the Site are listed in the table below. The species noted below were observed in altered areas and are not as commonly found within the more natural areas on the site.

Table 2-3: Invasive Plants Identified at the Site

Common Name	*Scientific Name*	Habitat	Layer
Multiflora rose	*Rosa multiflora*	Upland	Shrub
Glossy buckthorn	*Frangula alnus*	Upland	Shrub
Large graywillow	*Salix cinerea*	Wetland/Transitional	Tree/shrub
Asiatic bittersweet	*Celastrus orbiculatus*	Upland	Vine
Morrow's honeysuckle	*Lonicera morrowii*	Upland	Shrub
Japanese honeysuckle	*Lonicera japonica*	Upland	Shrub
Norway maple	*Acer platanoides*	Upland	Tree
European privet	*Ligustrum vulgare*	Upland	Shrub
Japanese knotweed	*Fallopia japonica*	Upland	Herbaceous
Common reed	*Phragmites australis*	Wetland/Transition	Herbaceous

2.5 Soils

According to the USDA Natural Resource Conservation Service (NRCS), soils at the Site are comprised primarily as Carver coarse sand for upland areas and as either Freetown coarse sand or Freetown and Swansea mucks for wetland areas along both stream corridors (see Figure 5). For the wetland habitat at the most southern end of the Site, the soil type is mapped as Ipswich - Pawcatuck - Matunuck complex

(0-2% slopes, very frequently flooded). Soil profile observations made during wetland delineation efforts were generally consistent with the descriptions of these identified soil types. None of the soil classes identified for the Site are defined as Prime Farmland, Farmland of Unique Importance, or Farmland of Statewide Importance.

Figure 5**: Soils**

3.0 Management Areas

In order to determine what restoration treatment is to go in what location, we have identified five management areas as described below. Each management area typically includes all or some of the typical features found in a golf course (i.e., tees, fairways, roughs, bunkers, water hazards, cart paths, buildings, putting greens, etc.) Each feature may require specific treatment depending on conditions in the field such as soil compaction, soils chemistry, type of vegetation present including grass used for the different parts of a course, removal of subsurface irrigation, removal of buildings or other structures, etc. This section describes the management areas and the restoration of different habitats. The 9.84 acres has been divided up into five areas (Area A through Area E) as shown on Figure 5. Oblique aerial photos are included for each of the management areas to show more detail of what existing conditions are. These photos are provided in Appendix B. The following table provides an overview of the treatment proposed based on the existing golf course feature.

Table 3-1: Treatment Options by Golf Course Feature

Golf Course Feature	Acreage	Treatment Proposed
Tees and Greens	1.88	• Removal of grass • Aeration of surficial and subsoils • Removal of gravel drainage material if appropriate • Removal of piping if present • Planting of trees and shrubs
Fairways	2.15	• Removal of grass if considered invasive • Determine if surficial and subsoils need aeration • Regrade if needed for more natural landscape • Planting of trees and shrubs
Roughs	2.85	• Allow to revegetate naturally where native grasses are present • If any of the roughs contain invasive grasses, treat like fairways
Bunkers/Sand Traps	0.27	• Determine if areas are compacted, aeration if needed • Maintain some sand traps for diversity of habitat, possible turtle nesting areas if any individuals are nearby
Managed Woodlands	1.46	• Determine if areas are compacted, aeration if needed • Plant some understory • Allow remainder of understory to revegetate naturally • Manage for invasive species
Water Hazards/Ponds	0.92	• Allow edges and buffer zones to revegetate naturally • Supplemental plantings of shrubs and trees • Allow for access to ponds edge in limited areas • Manage for invasive species
Cart Paths	0.31	• Allow unpaved cart paths to remain as walking trails • Remove pavement from paved cart paths and replace with gravel or other similar suitable material • If necessary, remove compacted soils in areas where walking trails are not needed or need to be relocated • Allow natural vegetation to grow along edges of cart paths for a more natural experience • Maintain walking trails per recreational specifications (to be determined)
Structures	NA	• Maintain existing structures which may be used in association with possible recreational trails
TOTAL	**9.84 acres**	

Figure 6: Management Areas

4.0 Testing and Management Options

Management and control methods were selected to avoid or minimize adverse impact on the surrounding plant communities and are organized in the sections below by soil treatment options, vegetation treatment options, and invasive species treatment options. A combination of the treatment options will be utilize to provide for a comprehensive restoration of the landscape.

4.1 Chemical Soil Testing

Chemical soil testing and physical soil testing will occur as described below in order to determine the level of de-compaction that is needed and to determine if any soil supplements will be required as part of the restoration. As noted in the CCC staff report dated June 6, 2022, this section provides details on soil testing that will proceed as part of the Restoration Plan and the details below can be included in the Development Agreement terms and conditions as appropriate.

> Given the site's historical use as a golf course, soil chemistry may be altered, and soils may be compacted. Therefore, prior to any restoration, staff suggests the applicant test the soils for nutrient levels and acidity to help inform appropriate plantings and loosen or de-compact soils to help store water and assist seed establishment. Commission staff recommends that any Development Agreement include terms and conditions to this effect.

A testing plan (including the number and location of test cores) will be developed for the testing of the soils within the restoration area, specifically the areas where open golf course features are located (i.e., fairways, greens, tees, etc.) Testing will also occur within the managed woodlands to a lesser degree. Samples will be taken about 4-6 inches beneath the vegetated surface and placed in a clean container appropriately labelled. Samples may be mixed together for a composite sample from similar areas, if appropriate.

Testing will include standard parameters such as pH, levels of nitrate, phosphorus, potassium, calcium, magnesium, manganese, iron, zinc, salt, etc. Soil texture will help to determine soil moisture potential, nutrient availability, and potential erosion. Percent organic matter in soils is an important test to determine if additional of organic matter will be required to support new plantings. Laboratories used for testing may include the Cape Cod Extension Service, University of Massachusetts Amherst soil testing laboratory, or a commercial laboratory. Chain of custody forms will be used for all samples.

The results of the testing will dictate if any applications of amendments such as lime or other fertilizer is needed. Some laboratory results may even provide recommendations for soil supplements. Once the analyses are received, they will be analyzed to determine the appropriate level of organic matter and other soil supplements like nitrogen, phosphorus, and potassium that need to be added to aid in the success of the restored vegetation. This analysis will also include determination of what needs to be acted on as the new vegetation is planted and if there is any need to continue adding supplements for the near future. The goal is to limit future supplements in order that the restored areas are able to self-maintain without any interventions.

4.2 Physical Soil Testing

Testing of the physical characteristics of the soil at the site will take two forms: soil texture (tested in a laboratory) and soil compaction (tested in the field).

Testing of soil texture will occur as part of the chemical testing (see previous section). Testing of soil compaction is needed in certain areas where there has been past grading or alteration of soils such as tees, greens, etc. The site is comprised of Carver coarse sands which are anticipated to be less disturbed with less compaction in areas such as the managed woodlands. Limited testing of soil particle size (texture) is proposed as the native soil is Carver coarse sands that may have been supplemented with organic matter. For purposes of this restoration plan, the upland restoration areas are presumed to contained sandy soils. Therefore, only half of the samples taken for chemical analysis will be tested for soil particle size in order to confirm existing conditions.

Testing of soil compaction occurs in the field using a specialized tool called the penetrometer. It is likely that portion of the golf course have been compacted during construction and operations of the golf course and will be mostly located in the upper surficial soils. In order to determine this, the penetrometer will be used in transects throughout the site. At each station, the depth of the penetrometer and the pounds per square inch (psi) are recorded. Readings will be taken in areas with more foot traffic from the golf course and compared with areas with less traffic. Once the field work has been completed, the readings will be charted and analyzed. Readings below 30 psi = no compaction; 30 to 50 = slight compaction; 50-75 = moderate compaction, and above 75 psi = severe compaction.

4.3 Soil Treatment Options

Based on these readings, the type of de-compaction treatment can be identified as described below.

4.3.1 Soil Decompaction Treatment

Mechanical treatment of compacted soils will be dependent if the soil readings indicate moderate or severe compaction. No treatment is recommended for areas with no or slight compaction. Specialized equipment may be used including, but not limited to, plug aeration which improves drainage and aeration and reduces compaction and tilling the soil which breaks up and reduces compaction. The depth of the tilling will be based on field readings and typically will be performed within the top six inches but may go deeper if deeper compaction is found. This mechanical treatment reduces compaction of soils, allows for more robust growth of roots by breaking up the compacted soil structure, allows vegetation roots to absorb more oxygen in order to respire, allows the soils for greater uptake of rainfall, increases soil moisture levels, and aids to increase buildup of organic matter over time.

4.3.2 Soil Amendments

As the area is comprised primarily of sand, soil amendments will help to improve the sands ability to hold moisture which in turn will hold more nutrients to be taken up by vegetation. Soil amendments may be needed and the soil tests described previously will determine the type and application rates of amendments. Examples of amendments include compost, manure, other organic matter, and lime (to adjust the soil pH).

If amendments are needed, one single treatment would be preferable at a minimum in the beginning of the restoration work before or during planting of the vegetation. The amendments can be incorporated into the soils using large machinery if the top soil (and grass layer) has been removed. The goal is to limit future supplements in order that the restored areas are able to self-maintain without any interventions.

The use of different mulches will be determined depending on the vegetation type to be planted, topography, and slope. Mulches are used with the initial plantings in order to retain moisture, protect the roots of the plants from extreme heat or cold, and to reduce weed growth.

4.4 Vegetation Management Options

The restoration of the former golf course areas will have new plantings of trees, shrubs and ground cover with native species compatible to the area. Approximately 144 trees (including a mixture of deciduous and evergreen trees) are proposed to be planted over the 9.84 acres restoration area. Additional trees will be planted in the development area so that in total, there will be 350 trees planted on the Site. In addition, there are other vegetation management (or treatment) options as described below.

4.4.1 Removal of Herbaceous and Grass Vegetation

Removal of grass may be used in specific areas such as tees and greens in order to remove the thick layer of grass. Other options may include removing portions of these areas and breaking up the grass mat in others to allow it to grow naturally. The treatment depends on the type of grass to be identified.

4.4.2 Removal of Woody Vegetation

In some instances, there may be the need to remove woody species especially if they are non-native and invasive (i.e., multiflora rose, Norway maple). In these areas where individuals have been removed will be replanted if appropriate. There may be existing native plants nearby that would be able to grow into the space where the invasive species was removed. If larger areas of removal are required, then additional plants will be replanted appropriate to the location on the landscape.

4.4.3 Revegetate Naturally

Where there is already existing natural vegetation within the restoration area, these areas may be left to revegetate naturally with no additional treatment. There may be areas such as the managed woodlands that may be left to revegetate naturally if located on the edge of a restoration area with minimum width.

4.4.4 Seeding of Herbaceous and Grass Seed Mix

In areas such as the greens and the tees, once the soil treatment has occurred, these areas will be revegetated with appropriate seed mixes that contain a variety of native species that can survive in conditions found on Cape Cod. These disturbed areas will be seeded following grading with an upland native seed mix such as the New England Conservation/Wildlife Mix or similar seed mix. The soil will be prepared through tilling or other mechanical means to allow for success of the seeds to be stratified.

4.5 Planting of Native Plant Species

When making the final choices for what is to be planted may depend on what is available at the time of planting. Substitutions for proposed plantings are appropriate if approved by the environmental monitor. All efforts shall be made to avoid cultivars of native plants. Cultivars may be sterile so they are unable to cross-pollinate which may reduce the availability of pollen and nectar food sources to

pollinators such as bees and butterflies. Cultivars may also be different from the native species in color, growth form, foliage shape, bloom time, other physical characteristics, and lack genetic diversity. Native wildlife may not be able to utilize the cultivars as they would native species due to the physical and possibly chemical changes of the vegetation. At this time, the revised site plan design including stormwater basins is being finalized. Once completed the following general guidelines will be applied to the restoration areas:

- **Trees:** Tree sizes depends on the site conditions and site accessibility but for the most part it is anticipated that deciduous/hardwood trees will be of approximately 2-inch diameter and evergreen/softwood trees will be approximately 6-feet in height. We have specified small diameter (or caliper) tree sizes for the restoration area compared to the landscaping proposed in the development area as it is generally better to plant smaller sizes which are able to establish and root faster and acclimate better for better survival rate and increased growth rates. In addition, these trees will have less water needs than if planted at a larger size. All materials will depend on availability. Some tree species cannot be located locally of this size, therefore, it should be acknowledged that smaller diameter plants may be substituted as necessary.

  It is recommended that clustering of the trees saplings occur to create a more natural look than planting on a grid system. Based on the number of specimen trees counted as described in Section 2.0, at least 144 trees will be planted in the restoration areas, primarily in the tee and green areas where soils will be de-compacted and planted with wildflower meadow plants. In these areas, depending on the specific shape of the area to be restored, the trees can be clustered at a spacing no less than 10 feet on center for softwoods and 20 feet on center for hardwoods.

- **Shrubs:** Shrub sizes depend on availability of locally grown native species. Most shrubs are available in the #1, #2, and #3 gallon sizes. It is recommended that clustering of the shrubs occur to create a more natural look than planting on a grid system. We propose to plant approximately 350 shrubs to be clustered in groupings similar to how the trees are proposed to be planted in the restoration area. We recommend clustering tree and shrub plantings together or creating areas of just shrubs closely spaced to create wildlife habitat. Please refer to the Landscape Plans and the "bioretention area palette" for a list of shrubs species that are acceptable for plantings. Consultation with the Barnstable Conservation Commission will also inform the final species list and number of shrubs planted.

- **Groundcover:** Groundcovers or other herbaceous vegetation like ferns would be a great addition to the restored areas. These could be planted in amongst both the trees and/or shrubs and are available in 1, #2, and/or #3-gallon size containers.

4.5.1 Site Preparation

The following information has been taken from the Guidelines for Planting within the 100 Foot Buffer[1] by the Barnstable County Extension Service.

- Compost or other organic amendments should be mixed into the back-fill soil to increase water-holding capacity where appropriate.

[1] https://ag.umass.edu/landscape/fact-sheets/guidelines-for-planting-within-100-foot-buffer

- Planting hole depth for trees should be only as deep as measured from the trunk flare to the bottom of the root ball.
- Planting hole width should be a minimum of three times the diameter of the root ball.
- If plant material is balled and burlapped, all burlap should be removed or cut from the top third of the root ball. If large materials are in wire baskets, the top third of the basket should be cut and removed. The trunk flare should be located to insure correct planting depth.
- Large trees may be staked for stability for one growing season.
- All plants should be thoroughly watered in at the time of planting (15-20 gal. per plant).
- Container plants should be planted at the same depth as grown in the container.
- Root balls should be mulched.
- No fertilization is necessary at planting time.

4.5.2 Watering

All newly planted or seeded areas will need to be watered depending on the time of year and weather conditions. Watering can also keep the dust down in areas where the vegetation has not yet established. During the construction phase of the development, water trucks are usually used to keep the dust down and can be easily used to water the new plantings as directed by the landscaper (pending weather conditions).

4.5.3 Fertilizing

Fertilizing will be performed in accordance with the recommendations based on soil chemistry testing. This will allow for site specific treatment to be developed without over-enrichment of the inland and coastal waters at or near the site.

All fertilizing will be performed in accordance with the Barnstable Fertilizer and Phosphorus Control ordinance (Chapter 78) specifically Section 78-5 (Standards of Performance) which outlines best management practices (BMPs). For example:

- The Project will require that the landscaper performing the work at the site has Fertilizer Certified Applicator(s).
- A single application of fertilizer that contains nitrogen shall not exceed one pound of actual nitrogen per thousand square feet and shall consist of 20% slow-release nitrogen fertilizer.

4.6 Wildlife Habitat Features

Some of the trees to be cut and other woody debris from tree removal will be retained and placed within the restoration area to create wildlife habitat features such as habitat piles (piles of smaller trees, tree limbs, stick, etc.), log piles, and downed trees (keep trees on the ground in order to create a micro-habitat, allow to naturally decompose). Also keep dead trees (snags) if possible which provide a variety of habitats and if located away from cart paths for safety reasons.

The site presently has numerous sand traps through the site. Although no turtles were observed at the site it is likely that there may be snapping turtles using the adjacent wetlands. As such, we propose to allow the sand traps to exist and be allowed to naturally revegetate slowly. Approximately five sand traps will be retained. The remainder will be restored in a manner similar to the treatment proposed for fairways and/or roughs. During site inspections and monitoring, wildlife usage, if any, will be identified.

Although the two southern-most ponds were constructed for the golf course and lack the ecological values and functions of a natural pond, they serve a limited function as wildlife habitat for fish, birds, mammals, etc. To improve the value of these ponds, invasive species will be removed from the buffer zones of this area and replaced with native species. No hydraulic or hydrologic physical connections exist between the ponds, which were constructed in connection with the development of the golf course. No significant impacts to existing wildlife in these areas would be anticipated to result from the Redevelopment project. In addition to removing invasive species, a buffer zone restoration area will be created between the ponds.

Unlike the two southern ponds, the northeastern-most pond was likely present before the golf course was constructed. This pond may be a natural pond or maybe associated with historic cranberry bogs at the site. There is presently a culvert connecting the pond to Stewart's Creek, which maintains the hydrologic features of the pond. As with the other ponds, no removal of culverts or manipulation of the hydraulic or hydrologic features of the pond is proposed as this would likely impact the existing habitat that the pond provides.

4.7 Invasive Species Management Options

It is understood that during construction it is important to prevent the introduction and spread of invasive plant species. All proposed plant species, as well as the imported planting/topsoil materials, will be inspected at the source and after placement to guard against the introduction of invasive species.

4.7.1 Herbicide Application

The application of herbicides for the control of invasive species is not proposed at this time due to the fact that there are not significant areas of invasive species that need to be controlled. For example, the common reed is contained to the marsh area and is not likely to take hold in the upland restoration areas. That said, once the restoration work begins, the alteration of the soil surface provides opportunities for invasive species to take hold. Therefore, monitoring of invasive species will be performed throughout the restoration process.

4.7.2 Mechanical Removal

Removal of invasive species encountered during restoration will occur using mechanical methods such as grubbing, flush-cutting, and hand removal. Any invasive species removed will be transferred off-site to an appropriate disposal location so as to not spread any seeds or pieces of vegetation.

4.7.3 Species Specific Treatment

Guidelines will be develop for the invasive species that may be encountered at the site in order to provide guidance on actions needed. The following are examples of what this information may provide

- **Multiflora Rose (*Rosa multiflora*):** Smaller plants may be removed physically by hand pulling. When access is available for mowing or cutting equipment, more extensive thickets of multiflora rose may be treated by cutting or mowing with appropriate equipment. Eradication requires repeated or mowing of the plants three to six (or more) times during the growing season.
- **Morrow Honeysuckle (*Lonicera morrowii*):** Small infestations may be removed by hand-pulling in the spring when the ground is loose and moist. Cutting treatments are effective, but

repeated cuttings of up to 6 to 8 times during the growing season are necessary to obtain optimum control results. A cutting program in combination with herbicide applications is the generally recommended treatment.

- **Privet (*Ligustrum vulgare*):** Manual controls are effective in areas of light infestations where young plants are removed by hand pulling. A combination of cutting and mowing may be used in sensitive areas.
- **Oriental Bittersweet (*Celastrus orbiculatus*):** Young vines can be removed by hand pulling with the proper disposal of the material collected. All root material must be removed for this method to be effective. If fruits are present the vines should be bagged in plastic trash bags and removed to a landfill for disposal. Climbing vines can be cut at breast height to kill the upper portion of the vine and release the tree canopy. Since rooted portions will survive unless cut back repeatedly, physical controls in combination with herbicide treatments are recommended to eradicate Oriental bittersweet.

4.8 Erosion Control

The seed mix shall be sown over designated areas at a rate of 1 pound per 1,250 square feet. Weed-free straw or similar mulch or stabilizer shall be used to cover the seed. Steeper slopes may need erosion control such as mats to protect soils from erosion and to protect the seed. Biodegradable erosion control is recommended as it will degrade over time, will not impede growth of the seed or plants, and will not require follow up maintenance such as removal. More sturdy erosion control such as coir logs may be needed at the base of steeper slopes and/or near to the wetland resource areas including the water hazard ponds.

An erosion control plan will be developed for project including the construction of the restoration areas including the development of a Stormwater Pollution Prevention Plan (SWPPP). At this time, additional detailed information regarding the specific erosion controls to be used and where will be finalized.

5.0 Monitoring and Maintenance

Post-construction monitoring of the areas to be restored is proposed to ensure successful restoration through field inspections of vegetation and assessment of presence of invasive species control. The restored areas will be inspected to monitor the health of the newly planted vegetation. A period of three years for the monitoring is proposed. If additional action items are needed (i.e., due to survival goals not being met), this may be extended for multiple one year periods not to exceed a total of five years. Maintenance activities, if needed, include stabilization of eroded slopes, erosion repairs, supplemental or replacement plantings if individuals have not survived, and control of invasive species, if present. Monitoring will be performed through field surveys and vegetation plots to determine species present and percent cover obtained. This will help to document the survival rate of the planted species.

5.1 Goals

Goals associated with the evaluation of the success of the plantings shall be formalized and may include specific goals such as if new herbaceous cover does not meet or exceed 75% cover after two growing seasons, then additional seeding may be required. A goal of 75% survival of woody species is anticipated within two years. If less than 75% of the woody species survive (counted by individual trees and shrubs) within two years, then a contingency/action plan will be established to replace some of the dead vegetation including an assessment of why they were lost (i.e., insects, wildlife damage, disease, etc.)

5.2 Inspections

An environmental consultant shall be on call during the construction and to visit the site on a regular basis (timing to be determined) and work with the construction contractor(s) to ensure that work follows the guidelines established in this Restoration Plan and other BMPs. The environmental consultant or monitor shall make periodic visits to evaluate the progress of the restoration work as it occurs and be available to address unforeseen circumstances. The environmental consultant shall make the following inspections post-construction:

- Inspection immediately following construction completion of the Restoration Plan to document conditions through photographs and field plots
- Inspection during the spring of the first growing season following construction completion
- Inspection during the fall of the first growing season

5.3 Recommended Monitoring Standards

The monitoring inspection will be performed to document site conditions upon the completion of the landscape restoration activity.

- Restoration work shall be supervised by a landscape professional or environmental monitor.
- Monitoring inspections will be performed annually during the late summer/early fall.
- Monitoring sample plots will be established the first year (marked by stakes).
- Information collected from the plots will include the percent cover of all vegetative layers including herbaceous, shrub, tree, and woody vines following standard methodology.

- An environmental monitor will be on site to evaluate the progress of the landscape restoration effort and address unforeseen environmental issues. The environmental monitor will be responsible for the annual monitoring report.
- A set of dated photographs shall be prepared for each monitoring inspection. Representative photographs shall be submitted with the annual monitoring report.
- Results of the monitoring inspection will be reported to the Natural Resources Coordinator for work performed during the calendar year (December 31st). The monitoring report will be submitted to the Natural Resources Coordinator by January 31st of the next year.
- Corrective measures undertaken will be included in the annual monitoring report.
- Identification and early detection of invasive species is critical in determining what course of action should be taken to control the species (i.e., mechanically, chemically, etc.)
- Identification of wildlife use, marks, etc. should be noted.

5.4 Reporting

Monitoring reports shall be prepared for the property owner and the CR holder to be submitted on a schedule to be established. The inspections will be performed to document site conditions upon the completion of the restoration work including environmental site conditions, general field observations, and an evaluation of the success of the plantings.

Appendix A: Site Photographs

Looking south toward the tee at the 17th hole across the fairway.

Looking at the 16th putting green with western tree line in the background.

Looking to the southeast toward the 14th tee from cart path.

Looking north toward the 14th putting green across the fairway (between two ponds).

Looking south from the 13th putting green over sand trap.

Looking to the east from 12th fairway towards the 5th and 6th holes.

Looking east toward the 6th putting green.

Looking north through managed woodlands.

Appendix B: Management Areas


3
Area B
4


Area C
4
6


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Area E
16
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