

2007 Wetland Restoration Monitoring Report

Raytheon Company

Former Raytheon Facility
430 Boston Post Road
Wayland, Massachusetts

USACE Permit No. 200300294
MADEP File No. 322-533
MADEP BWSC Tier 1B Permit No. 133939/RTN 3-13302

13 December 2007

Raytheon Company

2007 Wetland Restoration Monitoring Report

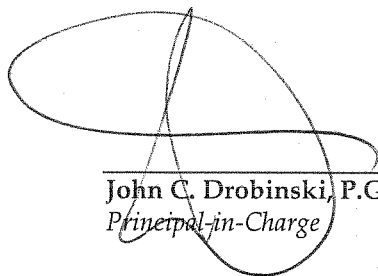
430 Boston Post Road
Wayland, Massachusetts
14 December 2007

USACE File #200300294

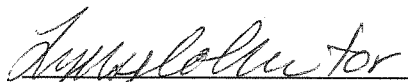
MADEP File #322-553

MADEP BWSC Tier 1B Permit #133939/RTN 3-13302

ERM Reference: 0061882.04



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On behalf of Raytheon Company (Raytheon), Environmental Resources Management (ERM) prepared this 2007 Wetland Restoration Monitoring Report to present fourth-year monitoring results for the wetland remediation site at the Former Raytheon Facility at 430 Boston Post Road in Wayland, Massachusetts (Site). A Site Locus Map and Site Plan are provided as Figure 1 and Figure 2, respectively. This report is prepared in accordance with the 3 August 2006 regulatory guidance letter by the U.S. Army Corps of Engineers (USACE) entitled, "Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Creation, Restoration, and/or Enhancement of Aquatic Resources." (USACE; 2006) It also meets the applicable permit condition requirements of the USACE, the Massachusetts Department of Environmental Protection (DEP), and the Wayland Conservation Commission (Commission). Project information is listed below.

USACE Permit No.: 200300294

DEP and Wayland Order of Conditions File No.: 322-553

Permittee: Raytheon Company, 880 Technology Park Drive, Billerica, MA

Consultant: ERM, Attn: John Drobinski, 399 Boylston Street, 6th Floor, Boston, MA
Telephone: 617-646-7800

Date Wetland Restoration Complete: 24 February 2003

Wetland Monitoring Dates: 13 July, 23 August, 28 September 2007

Inspected by: Ann McMenemy and Charles Katuska (ERM)

Site Directions: Route 20 West (Boston Post Road) from Interstate 95/Route 128 (Exit 26)

This project involved restoring an approximately two-acre remediation area by re-establishing the hydrology, topography, and the emergent marsh community disturbed by the excavation and removal of contaminated wetland soils in 2003 and 2004. Site activities in 2007 included three wetland monitoring events, invasive species management control work, and planting additional buttonbush (*Cephalanthus occidentalis*). The fourth-year monitoring results indicate that the remediation area has not met several of the Commission's permit requirements due to the continued presence of barnyard grass (*Echinochloa crusgalli*) and purple loosestrife (*Lythrum salicaria*). Raytheon is currently evaluating additional invasive plant species suppression methods for the wetland remediation area to meet the project's permit conditions and standards of success.

Special Condition No. 5 of the USACE Section 404 Permit requires that mitigation be performed in accordance with the Regulatory Permit Application for Wetland Impacts Resulting from Remediation of Oils, Hazardous Materials in Sudbury River Floodplain Wetlands, Wayland, Massachusetts (ERM, 2003). The above-referenced permit application was prepared to support the remedial activities conducted under the Phase IV Remedy Implementation for the Site. The goal of the restoration, as described in the above-referenced permit, is to produce an emergent marsh community with native herbaceous species consistent with the conditions historically found in the Sudbury River floodplain. The presence of exotic and invasive species is to be minimized.

The standards for success were established in the Plan to ensure that the project can be objectively evaluated to determine if it is developing into the desired resource type and providing the expected functions. The following table identifies which standards of the Plan and additional permit requirements in the Wayland Order of Conditions (OOC) have been met based on the results of the 2007 monitoring results.

Parameter	Standards for Success	Achieved
Hydrology	Final grading of the remediation project area must be consistent with the original contours.	Yes
Soils	The soils used for restoration shall be a mixture of sand, loam, silt, and clay and 12% organic matter.	Yes
Vegetation	<p>1. <i>Percent areal cover</i>: 1a. The remediation project area must attain at least 75% areal cover of native, non-invasive species within two growing seasons.</p> <p>1b. The OOC also requires 90% or more areal coverage of wetland vegetation for three consecutive growing seasons.</p> <p>2. <i>Survivorship of Planted Stock</i>: 2a. The herbaceous plantings have a 75% survival; planted buttonbush shrubs have an 80% survival within two growing seasons.</p> <p>2b. The OOC also requires 100% survival of the buttonbush for three consecutive growing seasons.</p> <p>3. <i>Invasive species</i>: To be controlled with reasonable measures.</p> <p>4. <i>Erosion control</i>: All slopes within and adjacent to the mitigation sites are stabilized.</p>	<p>1a. Yes</p> <p>1b. No</p> <p>2a. No; Yes</p> <p>2b. No*</p> <p>3. Yes</p> <p>4. Yes</p>
Wildlife Use	Wetland and aquatic-dependant species must utilize the site.	Yes

*Note that the current number of buttonbush planted in the restoration area (34 total) exceeds the 25 required by the Commission. Several shrubs were replaced during the 2006 and 2007 growing seasons.

3.0

SUMMARY DATA

ERM wetland scientists conducted wetland monitoring on 13 July, 23 August, and 28 September during the 2007 growing season. Wetland monitoring involved collecting data on vegetation, soils, hydrology, and wildlife. Data collection was consistent with the methodology used by Woodlot Alternatives, Inc. (Woodlot) during the 2004, 2005 (Woodlot, 2004 and 2005) and 2006 (ERM, 2006) monitoring events.

Figures attached to this report show the location of the restoration area relative to other landscape features, its boundaries, habitat types, locations of photographic reference points, sampling data points, and other features pertinent to the mitigation plan. The locations of the photographs are depicted on Figure 3.

3.1

HYDROLOGY

Pre- and post-remediation topographic elevations were previously surveyed and found to be consistent with the original contours (Woodlot, 2004). Based on field observations, hydrologic conditions range from shallow inundation to seasonal saturation depending on the season and location within the remediation project area. In July 2007, ERM observed a majority of the remediation area inundated with standing water (Appendix A, Photograph 1). Approximately 2 inches of standing water was observed in the northern portions of Areas B and C (Figure 2) with depths increasing to the north and west. In August and September 2007, the flood waters of the Sudbury River had subsided, and surface saturation was observed throughout the remediation area, except for several small pockets of standing water and about four to six inches of flowing water in the drainage swale (Figure 2).

3.2

SOILS

On 28 September 2007, ERM augured three holes to a depth of approximately 36 inches to document the soil characteristics, including texture, organic content, soil layers, Munsell matrix colors, and Munsell redoximorphic colors, size, and abundances of depletions and concentrations. A summary of soil descriptions is provided in Table 1. The soil boring locations are shown on Figure 3.

The soil profile descriptions show the constructed soil surface layers ranging from 22 inches or greater in depth and consisting of sandy loam and fine sandy loam textures high in organic matter content. The wetland soils of the remediation area were manufactured off-site by Agro-source, Inc. to ensure the proper organic matter content and textures consistent with the composition of floodplain soils (ERM, 2003). These soils are too young in the development of hydric soil morphology to show indicators. However, the frequently flooded nature of these soils for a long duration during the growing season is consistent with the definition of a hydric soil (New England Hydric Soils Technical Committee, 2004).

3.3 VEGETATION

3.3.1 *Areal Vegetative Cover*

On 23 August 2007, ERM collected vegetation data using 25 one-meter square plots. The plots were randomly spaced throughout Areas A, B and C of the remediation area (Figure 2). Data collected in each plot included a list of species present, estimated percent areal cover by species, and percent areal cover of bare ground and water for each plot. The data were tabulated and averaged across the plots (see Table 2 for results).

The 25 data plots, when extrapolated to the entire restoration area, yield the following results with respect to areal coverage:

- 69 percent coverage by non-invasive wetland vegetation;
- 14 percent coverage by invasive species; and
- 4 percent coverage of bare ground.

The 2006 annual monitoring report indicated that the remediation project area had attained 51 percent areal cover of native, non-invasive wetland species after three growing seasons. The attainment of 69 percent coverage by non-invasive wetland vegetation through 2007 reflects the restoration project's successful establishment and the continuing progress toward the goals established by the USACE (75%) and the Commission (90%).

The 2006 monitoring data also indicated that invasive plants, including hybrid cattails (*Typha spp.*), purple loosestrife and barnyard grass, averaged about 28 percent of the areal coverage. Between the 2006 and 2007 growing seasons, the percent coverage of invasive species decreased

from an estimated 28 percent to about 14 percent, a 50% reduction in one growing season.

3.3.2 *Planted Stock Survivorship*

The data collected on 28 August 2007 suggest that the survivorship of planted herbaceous stock and colonization by native volunteers remains less than 75 percent. The 28 August 2007 monitoring procedures also included meander surveys to identify additional plant species present in the remediation area but not recorded in the 25 vegetation plots. Table 3 presents a summary of the meander survey results, excluding those species identified in one or more of the 25 vegetation plots.

The results of the data plots and meander surveys reveal that only 13 of the 19 wetland plant species installed in 2003 are established. In addition, 6 species were identified from the original seed mixes planted in the restoration area. Rice-cut grass (*Leersia oryoides*) had the highest areal coverage of this group, averaging about 24 percent. Plant species installed in 2003, but not observed during the 2006 surveys, include northern blue flag (*Iris versicolor*), rattlesnake manna grass (*Glyceria canadensis*) cardinal flower (*Lobelia cardinalis*), river bulrush (*Scirpus fluviatilis*), ostrich fern (*Matteuccia struthiopteris*), and marsh fern (*Thelypteris palustris*). Failure to recover these species during the monitoring and meander surveys is not complete proof of their absence, but does likely reflect the competitive success of other native wetland plant species now dominating the restoration area. It is possible that some of these planted species may yet be present at low population levels. Random change vectors within the restoration area (woody debris, variable flooding) may allow these low-number species to play a greater role in the future vegetation community.

The Commission requires the survival of 25 planted buttonbush (*Cephalanthus occidentalis*) for three consecutive growing seasons. These shrubs were initially planted in the northern portion of Area C, generally along the intermittent swale. The 13 July 2007 survey found 14 of the 25 buttonbush remaining in thriving condition. On 23 August 2007, ERM planted 20 additional buttonbush in the same general area. The approximately 3-foot tall shrubs were purchased from Bigelow Nurseries, in Northborough, Massachusetts. Additional buttonbush, 9 more than the required 25, were planted in order to allow for the possibility of future plant loss without additional replanting.

3.3.3 *Invasive Species*

ERM conducted invasive species control measures on 13, 14 and 23 August 2007 for purple loosestrife and barnyard grass. The 2007 invasive

species control measures continued the maintenance practices conducted during the 2005 and 2006 growing seasons.

Purple loosestrife and barnyard grass seed heads were cut throughout Areas B and C, collected in plastic bags, and then disposed of off-site. No invasive species management was warranted in Area A.

On 28 September 2007, ERM classified the vegetative composition of the wetland remediation area into three classes based on wetland type and dominance of invasive species, and then field-estimated the areal extent of each class (Figure 4). This mapping was performed to supplement the data collected from the 25 random data plots conducted on 23 August 2007 and to provide a better understanding of the distribution of invasive species within the restoration area. The data collected from the 25 vegetation plots provides the actual percentage of areal coverage invasive species, while the mapping provides an estimate of the extent of areas where one or more invasive species is the dominant vegetative cover.

Based on this mapping, it is estimated that purple loosestrife is a dominant species in the vegetative composition, still covering approximately 25 percent of the remediation area. As in previous years of monitoring, Barnyard grass is also a dominant species in the vegetative composition over approximately 20 percent of the restoration area. Cattail is encroaching into the remediation area from adjacent areas outside of the project area; however, this species is not dominant in any project location. Common reed (*Phragmites australis*) is not present in the remediation area; however, this species is dominant in the wetland to the south of Area C.

Results of the 2007 invasive species mapping indicate that, while barnyard grass has decreased in density since the 2006 growing season, this species continues to dominate in a large portion of the restoration area. In addition, purple loosestrife is the dominant species across a greater percentage of the restoration area as compared to the 2006 growing season. These results suggest that mechanical control of barnyard grass, an annual species, may be a factor in reducing seedfall and, as a result, reducing its coverage in the continuing development of a perennial wetland plant community. Also barnyard grass is not a hydrophyte, and will likely have difficulty establishing over the long term in the emergent floodplain hydrology of the restoration area. For purple loosestrife, a widespread perennial herb common if not dominant in many areas of the adjacent Sudbury River floodplain, the results suggest that limited mechanical control may not be effective in limiting its competitive success.

3.3.4

Erosion

The upland areas disturbed during the remediation project have been reclaimed and planted with upland trees and shrubs, and seeded with an erosion control seed mix. The 2005 annual monitoring report indicated that the survival of upland trees and shrubs was approximately 94 percent, including temporary access roads and the area along the edge of the embankment leading to the wetland floodplain (Woodlot; 2005). ERM's 2006 and 2007 monitoring work confirms that the upland plantings have a high degree of survival, and that no associated erosion problems exist in the remediation area.

3.4

WILDLIFE USE

Wildlife observations in the remediation project area are presented in Table 4. Wetland-dependent species observed during the 2007 monitoring work include Red-winged Blackbird (*Agelaius phoeniceus*), Great Blue Heron (*Ardea herodias*), Snapping Turtle (*Chelydra serpentina*), Pickeral Frog (*Rana palustris*) and Green Frog (*Rana clamitans*). The wildlife sightings confirm that the remediation area is continuing to meet its success standard of supporting wetland and aquatic-dependent species.

The results of the 2007 wetland monitoring indicate that there has been a significant shift in the type and coverage of invasive species in the restoration area. In addition, there have been several changes in conditions since the 2006 wetland monitoring. The results of the 2007 monitoring indicate the following:

- Barnyard grass, an upland, annual species, was identified in the restoration area. However, monitoring results suggest that areal coverage of barnyard grass has been significantly reduced since 2006. Invasive species management activities conducted to date have been useful in suppressing the colonization of barnyard grass;
- Purple loosestrife was identified as a dominant species in portions of the restoration area. Additional invasive species control measures for purple loosestrife may be necessary and will be addressed in a long-term invasive species management plan;
- Hybrid cattails are monotypic in areas adjacent to the remediation area but are not dominant within remediation area. Therefore, invasive species management activities are not required for the control of hybrid cattail at this time;
- Supplemental planting of buttonbush has been conducted each year to continue to meet the OOC requirements for at least 25 buttonbush. In 2007, the total number of planted and existing individuals is 34; exceeding the requirement by 9 individuals;
- The stream channel continues to develop and become naturalized. Please refer to photograph 5 (Appendix A);
- Area A is nearly 100% vegetated, unlike during previous monitoring events;
- The restoration area is providing valuable wildlife habitat as emergent marsh; and
- The restoration area is providing flood and water quality protection for the Sudbury River.

The monitoring data collected in 2007 indicate that the wetland remediation project is not meeting the standard for success for areal coverage of native, non-invasive species, and the survivorship of planted stock. These deficiencies can largely be attributed to the continued dominance of barnyard grass and purple loosestrife throughout the remediation area.

Barnyard grass is a summer annual grass that has a Facultative Upland indicator status, therefore, this species is an invasive, non-wetland plant. As illustrated by the reduction in barnyard grass coverage between the 2006 and 2007 growing seasons, this grass can be controlled over time through early season cutting/mowing. As reported previously, the continued cutting of barnyard grass will likely take years to show progress in portions of the remediation area where it dominates, as viable seeds are already present in the soil in great quantities. The documented success in the restoration of wetland hydrology within the restoration area will also likely play a role in the continuing reduction of coverage by barnyard grass.

Purple loosestrife is an erect perennial herb with highly variable growth form and morphology. Established plants can tolerate very different growing conditions, including permanent flooding, low water and nutrient levels. Purple loosestrife spreads to new areas exclusively by seed. Seeds germinate in late spring and early summer in open, sunny places. Plants are long lived, and mature plants may produce more than 2.5 million seeds annually, which remain viable for many years. Once purple loosestrife becomes established in a wetland, it displaces endemic vegetation through rapid vegetative growth and heavy seed production that can eventually lead to a monoculture of loosestrife. Purple loosestrife was observed in the undisturbed wetlands adjacent to the restoration area during the past four growing seasons and has likely been transported to the restoration area via the floodwaters of the Sudbury River.

While there are several areas within the restoration area that have not met the standard for success, based on the survivorship of the original planted species and/or the presence of non-native, invasive species, the hydrologic functions and values of this wetland have been restored. The restoration area is providing valuable wildlife habitat as emergent marsh as well as providing flood and water quality protection for the Sudbury River. The plant community in the restoration area shows significant progress towards meeting the established restoration goals.

The 2007 monitoring activities conclude the fourth year of a five year monitoring program. Consistent with the 2003 Plan and Special Condition 69 of the Commission's OOC, restoration activities will

continue to be evaluated to determine the best alternative to meet the standards for success. Special Condition 69 requires the development of a formal restoration plan for the Commission's approval if the restoration work is not successful after three growing seasons. The restoration plan is currently being prepared and will be submitted to the Commission in early 2008. The restoration plan will supplement the ongoing invasive species management activities conducted in the restoration area during the 2005 through 2007 growing seasons. Over the past four years of vegetation monitoring, wide variability in the dominant invasive species has been observed. This data will be used to develop the site-specific long-term invasive species management and wetland restoration plan.

Upon completion of the 2008 monitoring, a fifth-year monitoring report will be submitted to the USACE, DEP and the Commission for concurrence on the completion of the wetlands remediation and restoration.

- Environmental Resources Management. 2003. "Regulatory Permit Application for Wetland Impacts Resulting from Remediation of Oils, Hazardous Materials in Sudbury River Floodplain Wetlands, Wayland, Massachusetts," 6 February 2003.
- Environmental Resources Management. 2006. "2006 Wetland Restoration Monitoring Report," 15 December 2006.
- New England Hydric Soils Technical Committee. 2004. "Field Indicators for Identifying Hydric Soils in New England, Version 3," 2004.
- U.S. Army Corps of Engineers. 2006. "Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Creation, Restoration, and/or Enhancement of Aquatic Resources, Regulatory Guidance Letter 06-03," 3 August 2006.
- Woodlot Alternatives, Inc. 2004. "The Wetland Remediation Site at the Former Raytheon Facility, Wayland, Massachusetts, 2004 Wetland Restoration Monitoring Report," December 2004.
- Woodlot Alternatives, Inc. 2005. "The Wetland Remediation Site at the Former Raytheon Facility, Wayland, Massachusetts, 2005 Wetland Restoration Monitoring Report," December 2005.

Tables

Table 1
Soil Profile Descriptions
Former Raytheon Facility
Wayland, Massachusetts

Test Pit Designation	Depth	Horizon	Munsell Color	Texture	Redoximorphic Features		Depth to Saturation	Depth to Groundwater	Comments
					Color	Size			
S-1	0"-24"	A/C	10YR 3/1	Sandy Loam	-	-	Surface	Surface	1-5% gravel. Non-native. Original substratum.
	24"-36"	Cg	2.5Y 3/1	Loamy Fine Sand	-	-			
S-2	0"-36"	A/C	10YR 3/1	Sandy Loam	-	-	Surface	Surface	1-5% gravel. Non-native.
S-3	0"-22"	A/C	10YR 3/1	Fine Loamy Sand	-	-	Surface	Surface	1-5% gravel. Non-native. Original alluvial sand.
	22"-36"	Cg	2.5Y 5/2	Loamy Fine Sand	-	-			

Notes:

A - Topsoil. Mineral horizon characterized by an accumulation of humified organic matter mixed with mineral soil matrix.

C - Substratum. Native mineral subsoil.

Cg - Substratum. Strongly gleyed native mineral subsoil.

"Original" indicates soils that were not disturbed by the remedial excavation.

All data collected by ERM on 28 September 2007.

- No redoximorphic features were observed.

Table 3
Summary of Plant Meander Surveys
Former Raytheon Facility
Wayland, Massachusetts

Plant Species	Common Name	Origin	Wetland Indicator Status
<i>Acer rubrum</i>	Red maple	V	FAC
<i>Bidens frondosa</i>	Beggars-tick	V	FACW
<i>Cephalanthus occidentalis</i>	Buttonbush	P	OBL
<i>Dulichium arundinaceum</i>	Three square sedge	P	OBL
<i>Scirpus acutus</i>	Hard stem bulrush	S	OBL
<i>Carex lurida</i>	Lurid sedge	S	OBL
<i>Onoclea sensibilis</i>	Sensitive fern	S	FACW
<i>Eleocharis sp.</i>	Spike rush	V	OBL or FACW+
<i>Polygonum hydropiperoides</i>	Swamp smartweed	V	OBL
<i>Sagittaria latifolia</i>	Common arrowhead	V	OBL
<i>Scirpus cyperinus</i>	Woolgrass	S	FACW+
<i>Typha latifolia</i>	Cattail	V	OBL

Notes:

P = Planted.

S = Seeded.

V = Volunteer.

FAC = Facultative, 34-36% occurrence in wetlands.

FACW = Facultative wetland, 67-99% occurrence in wetlands.

FACW+ = Facultative wetland, greater occurrence than FACW.

OBL = Obligate wetland, greater than 99% occurrence in wetlands.

All data collected by ERM on 23 August 2007.

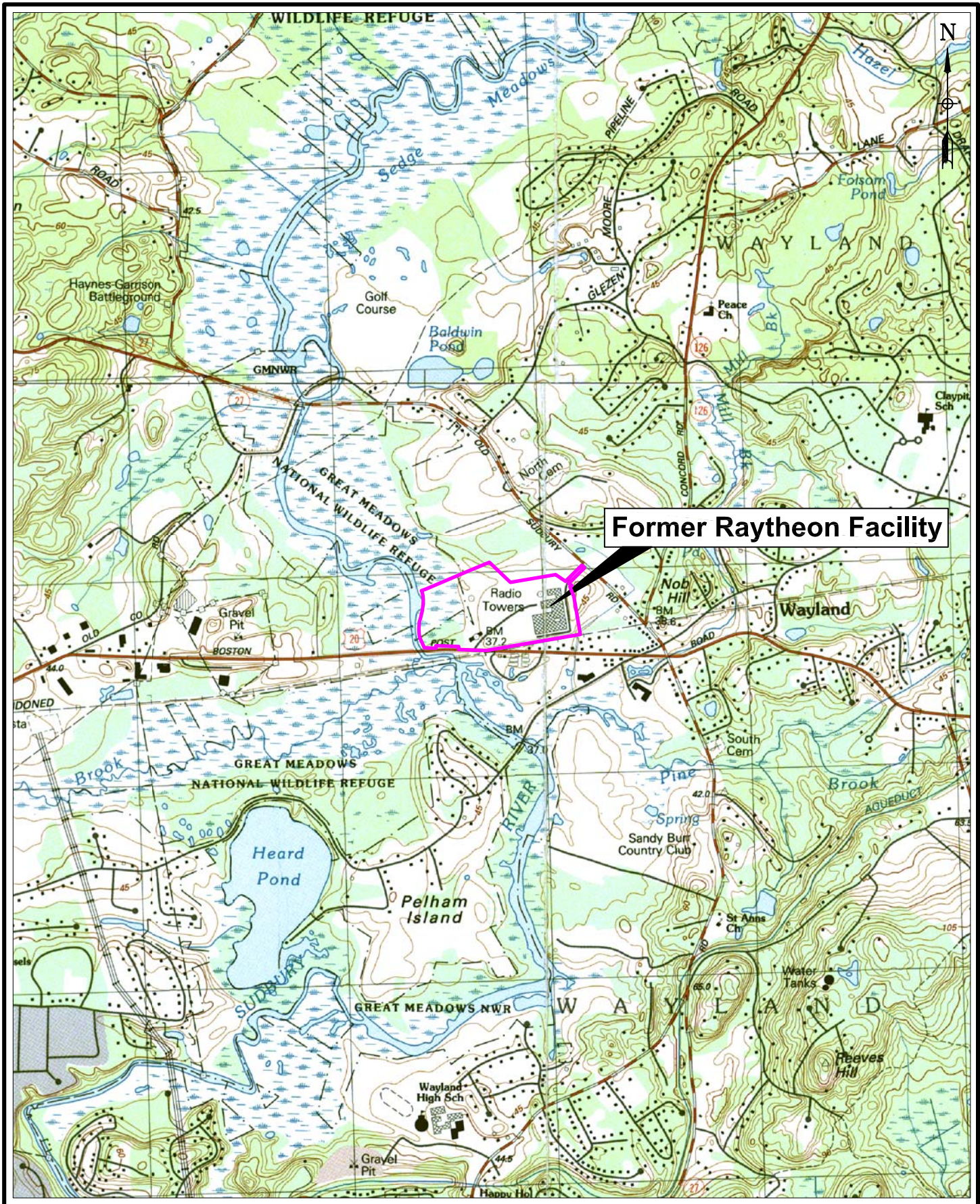
Table 4
Summary of Wildlife Observations On and Adjacent to Site
Former Raytheon Facility
Wayland, Massachusetts

SCIENTIFIC NAME	COMMON NAME
Amphibians and Reptiles	
<i>Rana clamitans</i>	Green frog
<i>Rana palustris</i>	Pickeral frog
<i>Chelydra serpentina</i>	Snapping turtle
Birds	
<i>Agelaius phoeniceus</i>	Red-winged blackbird
<i>Anas platyrhynchos</i>	Mallard
<i>Anas rubripes</i>	Black duck
<i>Ardea herodias</i>	Great blue heron
<i>Buteo jamaicensis</i>	Red-tailed hawk
<i>Cardinalis cardinalis</i>	Northern cardinal
<i>Charadrius vociferous</i>	Killdeer
<i>Colaptes auratus</i>	Northern flicker
<i>Cyanocitta cristata</i>	Blue jay
<i>Dendroica petechia</i>	Yellow warbler
<i>Dumetella carolinensis</i>	Gray catbird
<i>Egretta thula</i>	Snowy egret
<i>Melospiza georgiana</i>	Swamp sparrow
<i>Melospiza melodia</i>	Song sparrow
<i>Molothrus ater</i>	Brown-headed cowbird
<i>Quiscalus quiscula</i>	Common grackle
<i>Tachycineta bicolor</i>	Tree swallow
<i>Zenaidura macroura</i>	Mourning dove
Mammals	
<i>Odocoileus virginianus</i>	White-tailed deer
<i>Procyon lotor</i>	Raccoon
<i>Sciurus carolinensis</i>	Gray squirrel
<i>Sylvilagus floridanus</i>	Eastern cottontail
Insects	
<i>Enallagma signatum</i>	Orange bluet
<i>Melanoplus</i> sp.	Grasshopper
<i>Sympetrum rubicundulum</i>	Ruby meadowhawk
<i>Vanessa cardui</i>	Painted lady butterfly
Fish	
<i>Ameiurus catus</i> (or similar species)	White catfish

Notes:

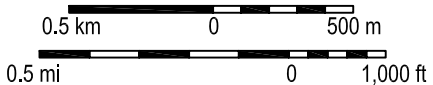
Data is cumulative for the 2004 through 2007 growing seasons.

Figures



Former Raytheon Facility

Scale 1:25,000




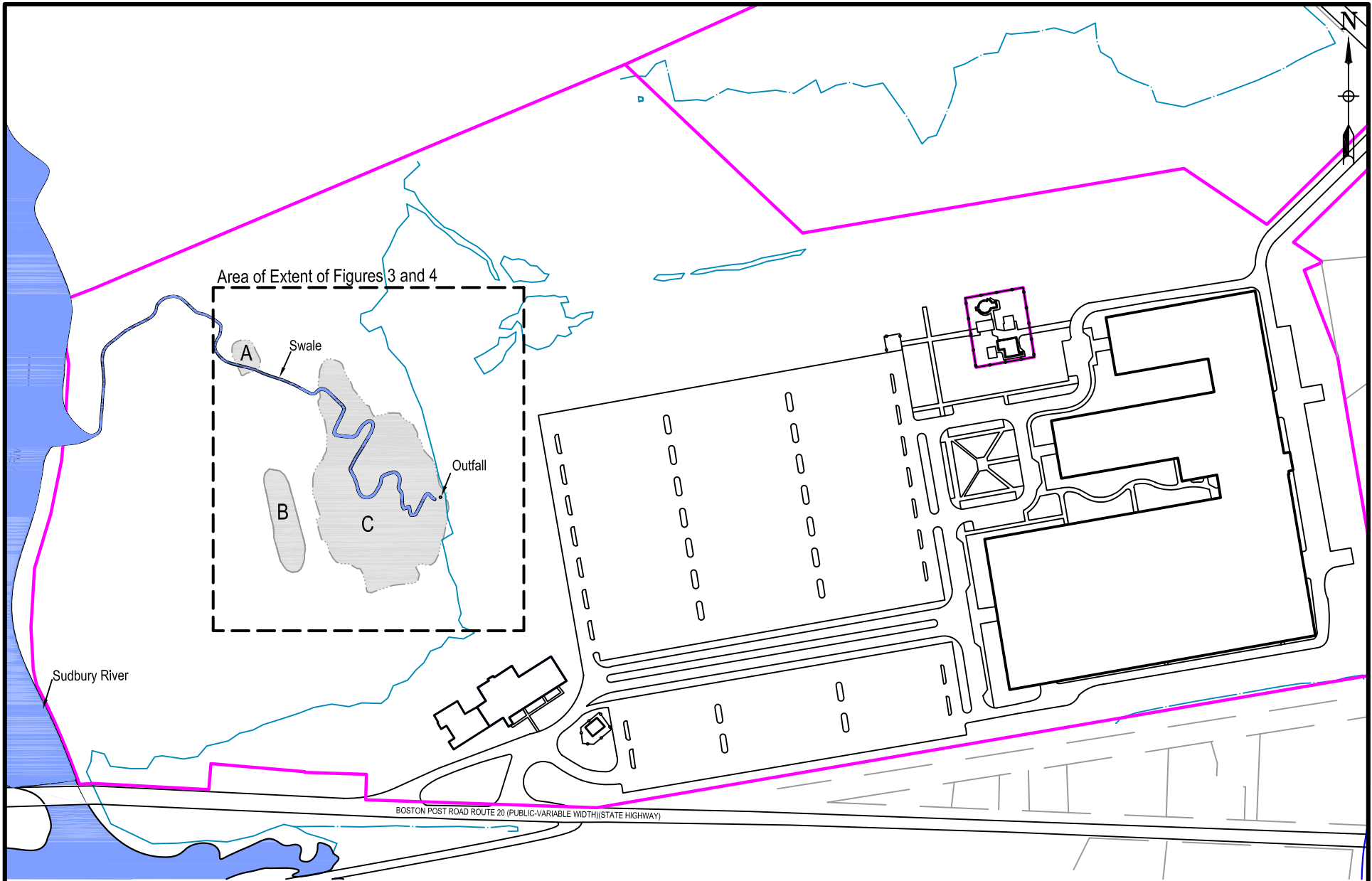
Legend	
	Subject Property Line

Figure 1 - Site Locus Map
Former Raytheon Facility - Wayland, MA





Area of Extent of Figures 3 and 4

A

Swale

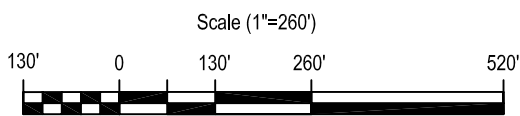
B

C

Outfall

Sudbury River

BOSTON POST ROAD ROUTE 20 (PUBLIC-VARIABLE WIDTH)(STATE HIGHWAY)



Scale (1"=260')






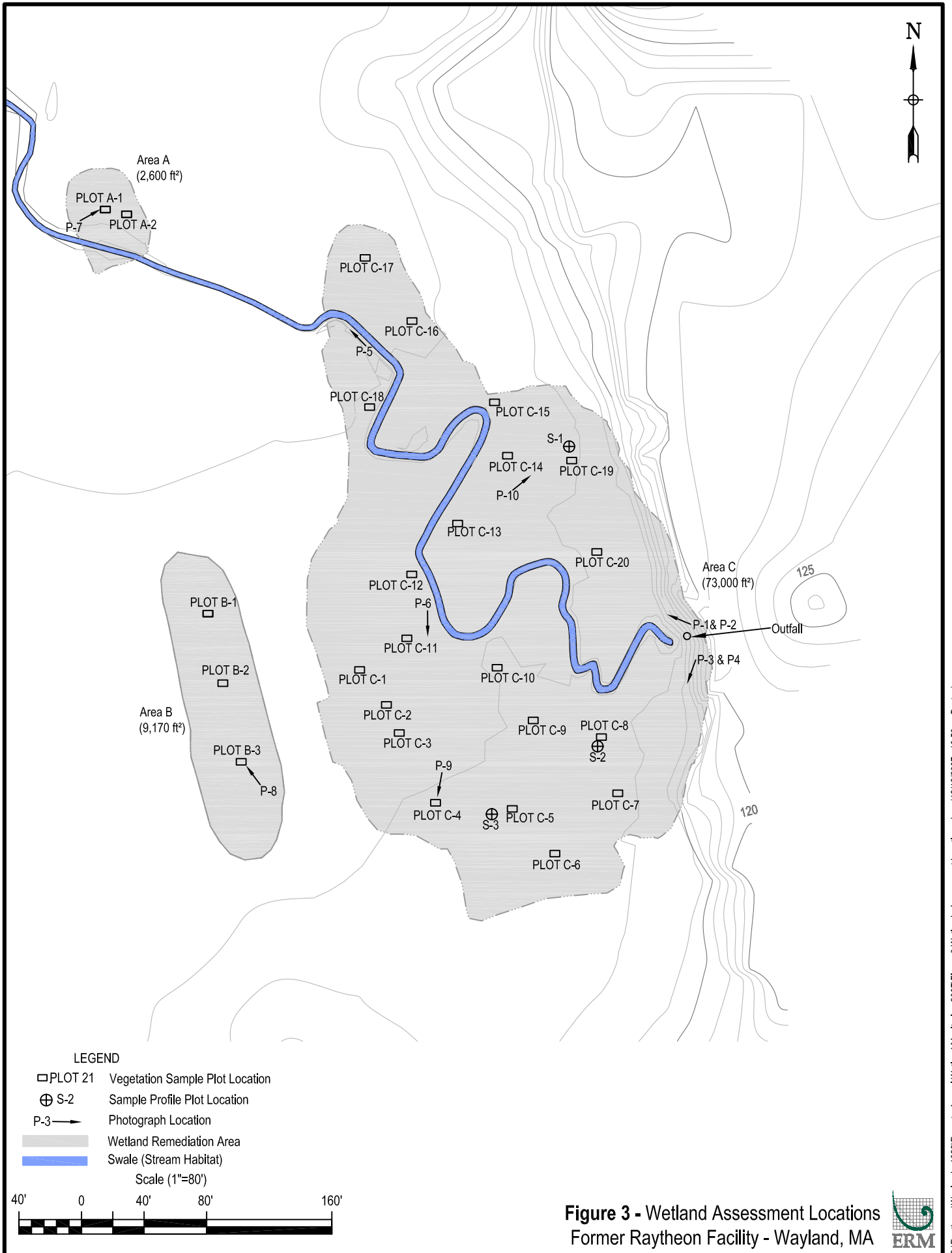
- Legend**
-  Existing Building
 -  Delineated Wetland Boundary
 -  Site Boundary (Approximate)
 -  Wetland Remediation Area
 -  Swale (Stream Habitat)

Figure 2 - Site Plan
Former Raytheon Facility - Wayland, MA





LEGEND

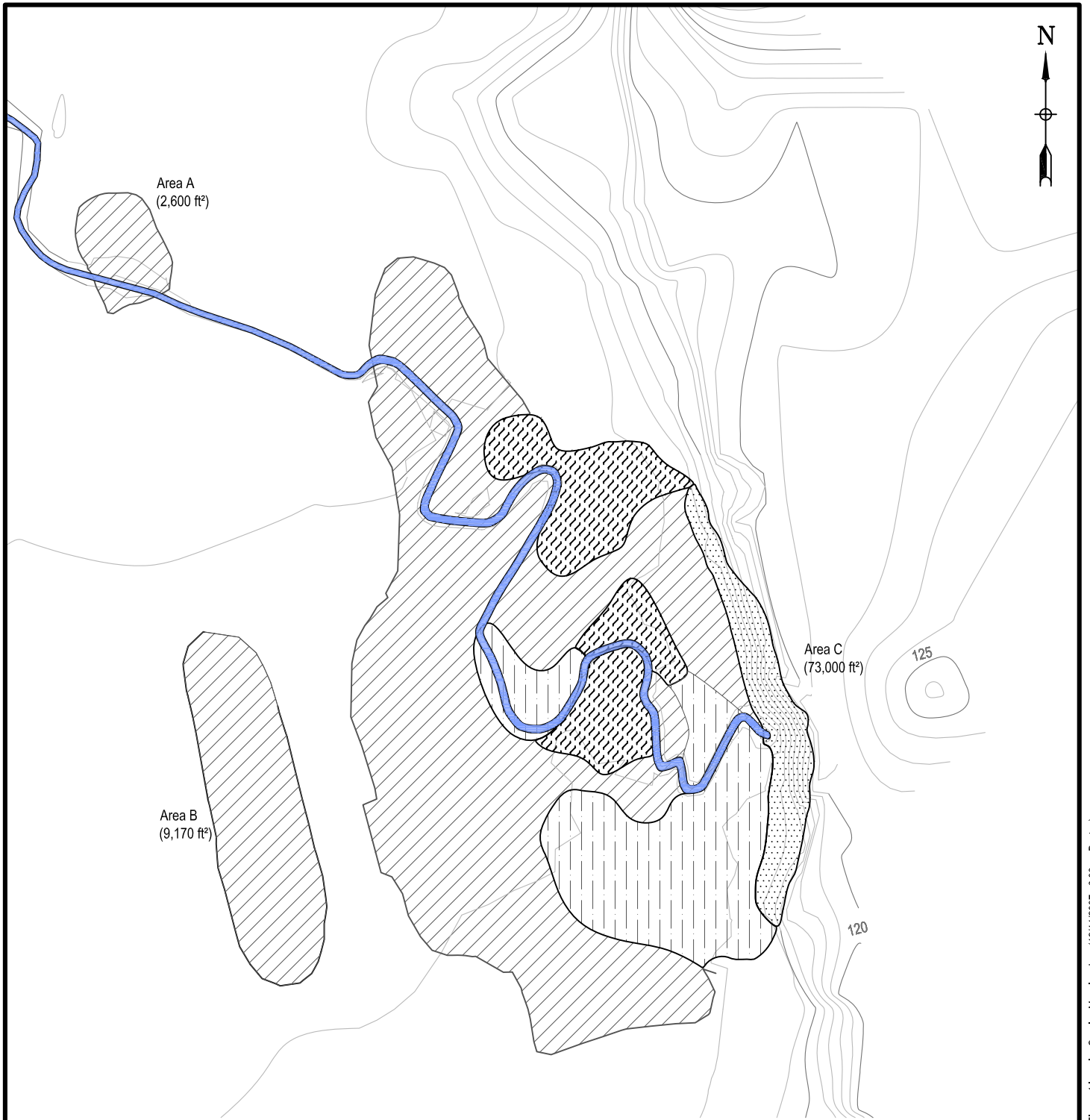
- PLOT 21 Vegetation Sample Plot Location
- ⊕ S-2 Sample Profile Plot Location
- P-3 → Photograph Location
- ▨ Wetland Remediation Area
- ▬ Swale (Stream Habitat)

Scale (1"=80')



Figure 3 - Wetland Assessment Locations
Former Raytheon Facility - Wayland, MA



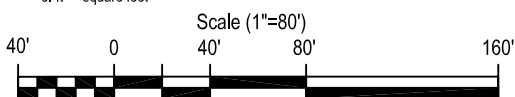


Legend

- Stream Habitat (Includes Non -Invasive Vegetative Communities in Stream Channel) - 2,940 SQ.FT
- Wetland Communities: Native, Non-Invasive Dominant Species - 53,700 SQ.FT
- Wetland Communities: More Than 25% Areal Coverage of Invasive Species (Purple Loosestrife) - 14,150 SQ.FT
- Wetland Communities: More Than 25% Areal Coverage of Invasive Species (Barnyard Grass) - 9,330 SQ.FT
- Upland Communities: Less Than 25% Areal Coverage of Invasive Species - 4,650 SQ.FT.
- 5' Topographic Contour
- 1' Topographic Contour

Notes:

1. Vegetative Communities were Field Estimated by ERM on 9/28/07.
2. Stream Segment in Area A is Vegetated.
3. ft² = square feet



**Figure 4 - Invasive Species Mapping
Former Raytheon Facility - Wayland, MA**



Appendix A
Photographs



Photograph 1 - Area C looking northwest from base of outfall (7/13/07).
Note flooded conditions.



Photograph 2 - Area C looking northwest from above outfall (8/23/07).
Note dense vegetation.



Photograph 3 - Area C looking southwest from above outfall (8/13/07).
Note abundant purple loosestrife.



Photograph 4 - Area C looking southwest from above outfall following
invasive species management activities (8/23/07).



Photograph 5 - Northern end of Area C looking west along stream channel (8/13/07). Note pickerel weed and stream bank development.



Photograph 6 - Central portion of Area C looking south (8/13/07). Note vegetative diversity.



Photograph 7 - Vegetation Plot A-1 (8/23/07).



Photograph 8 - Vegetation plot B-3 (8/23/07).



Photograph 9 – Vegetation Plot C-4 (8/23/07). Note vegetative diversity.



Photograph 10 – View of northeast portion of Area C, where barnyard grass still dominates the vegetative cover (8/23/07).