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Sampling Recommendations to Minimize Impacts to Wetlands at Site 7 (Calf Pasture Point) at the Former Naval Construction Battalion Center (NCBC) Davisville, North Kingstown, Rhode Island

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ACRONYMS AND ABBREVIATIONS

Aa	Adrian muck
AC	alternating current
AFB	Air Force Base
Ba	beach (soil type mapping code)
CeC	Canton and Charlton fine sandy loams, very rocky, 3 to 15 percent slopes
COC	contaminant of concern
CRMC	Coastal Resources Management Council
CRMP	Coastal Resources Management Plan
CSM	conceptual site model
CVOC	chlorinated volatile organic compound
DCA	dichloroethane
DCE	dichloroethene
DON	Department of the Navy
ESTCP	Environmental Security Technology Certification Program
GPS	global positioning system
ID	inside diameter
ITRC	Interstate Technology and Regulatory Council
LDPE	low-density polyethylene
Mk	Matunuck mucky peat
MMR	Massachusetts Military Reservation
MU	Merrimac-urban land complex
NCBC	Naval Construction Battalion Center
ND	not detected
NS	not sampled
NWI	National Wetlands Inventory
OD	outside diameter
ORV	off-road vehicle
PAL	Project Action Level
PCA	tetrachloroethane
PCE	tetrachloroethene
PDB	passive diffusion bag
PEM	palustrine emergent
PGP	Programmatic General Permit
POW	palustrine open water
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan

RCD	regenerated cellulose dialysis
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RIGIS	Rhode Island Geographical Information System
SOP	Standard Operating Procedures
TCA	trichloroethane
TCE	trichloroethene
UD	Udorthents-urban land complex soil type
USACE	U.S. Army Corps of Engineers
U.S. EPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VC	vinyl chloride
VOC	volatile organic compound

1.0 INTRODUCTION

This report discusses current groundwater sampling techniques and provides recommendations for groundwater sampling methods to minimize associated impacts on the wetlands at Site 7 (Calf Pasture Point) at the Former Naval Construction Battalion Center (NCBC) Davisville, North Kingstown, RI.

1.1 Site History

Volatile organic compounds (VOCs) have been observed in monitoring wells and shoreline piezometers at Site 7. The source of VOCs at the site has reportedly been linked to three distinct disposal incidents between 1960 and 1974; a summary of these historical disposal incidents is included in Section 1.2.3 of the Phase III Remedial Investigation (RI) Report (EA, 1998). Permanent monitoring wells have been installed and continue to be monitored for groundwater elevations and solute concentration data. Temporary piezometers also have been installed during monitoring events to facilitate the collection of groundwater elevation and solute concentration data in the intertidal zone. Regulatory agencies have expressed concern that, if VOCs are discovered migrating toward the shore, there is inadequate opportunity for intervention. Regulators also expressed uncertainty regarding the completeness and representativeness of the Site 7 conceptual site model (CSM), which was based on RI data and information. Because of these concerns, the Navy agreed to install sentinel wells and to perform long-term monitoring of the wells and piezometers. Locations of the monitoring wells and piezometers along with other key features of Site 7 are shown in Figure 1-1.

1.2 Objectives

Several of the monitoring wells and most of the piezometers are located within or close to wetlands present at Site 7. Because of the locations within or near these sensitive areas, the Navy is investigating sampling methods and procedures that will minimize the disturbance of the environment and yet allow collection of the necessary monitoring data. The purpose of this task is to review available alternatives and recommend optimal sampling techniques that are cost-effective and minimize impacts to the wetlands during monitoring events. Options evaluated include various types of sampling vehicles and alternate sampling procedures.

2.0 DESCRIPTION OF SITE ECOLOGY

Calf Pasture Point is bordered on the east by Narragansett Bay and on the southwest by Allen Harbor. The site topography is flat with the exception of a hill formed by a rock outcrop in the center of this area. The site is forested in the north, the center, and along the northwest side. A large swath of early successional-stage vegetation occurs stretching from the outer fringe near Narragansett Bay and Allen Harbor toward the center of the area (DON, 1994). In addition, there are several wetlands on the site, including both freshwater wetlands and tidally influenced salt marshes.

The most recent wetland delineations available are from the Navy's study (DON, 1994). Locations of the individual wetlands identified in this study are shown in Figure 1-1 and each one is described in more detail in Section 2.1. It should be noted that the descriptions of the wetlands in the following sections, including the number, size, and boundaries of individual wetlands, are based on historical information from the 1994 study and may not reflect current conditions. More recent information was obtained from the Town of North Kingston and is also summarized below; however, formal wetland delineations were not available.

2.1 Description of Wetland Plant Communities at Calf Pasture Point

Historical wetland surveys have identified five major wetland areas at Calf Pasture Point (CPP-1 through CPP-5) and five small isolated wetland areas (A through E), each less than 1 acre in size (DON, 1994). The proposed monitoring locations lie within or very near two of the major wetlands (CPP-4 and CPP-5) and near two of the small isolated wetlands (D and E). The plant community and species composition are described below for each of the wetlands. The locations of both sets of wetlands and the existing network of monitoring wells and shoreline piezometers are shown in Figure 1-1.

2.1.1 Wetland CPP-1

Wetland CPP-1 is a 3.1-acre wetland located near the northern edge of the property. This wetland is associated with a narrow intermittent stream that flows beneath Sanford Road from a small pond located off Navy property. The wetland has two contiguous wetland types: a palustrine forested wetland and a palustrine emergent wetland. It is classified as palustrine forested, broadleaf deciduous (PFO1) and palustrine scrub-shrub, broadleaf deciduous (PSS1) on the East Greenwich National Wetlands Inventory (NWI) map.

The forested wetland portion of CPP-1 is a red maple swamp that is dominated by red maple (*Acer rubrum*), northern arrowwood (*Viburnum recognitum*), American bittersweet (*Celastrus scandens*), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), and sedges (*Carex* spp.). Other plants that occur regularly within the red maple swamp include Bebb willow (*Salix bebbiana*), spicebush (*Lindera benzoin*), wild grape (*Vitus* spp.), royal fern (*Osmunda regalis*), and common reed (*Phragmites australis*). The palustrine emergent portion of the wetland is a common reed marsh that consists of a nearly pure stand of common reed.

2.1.2 Wetland CPP-2

Wetland CPP-2 is a 3.5-acre estuarine emergent wetland located near the shore of Narragansett Bay, close to the northern edge of the property, and is connected to Narragansett Bay by a narrow tidal channel and is partially flooded at high tide. This estuarine marsh is classified as PSS1 on the East Greenwich NWI map.

Wetland CPP-2 is composed of two contiguous emergent plant communities. The central portion of the wetland supports a salt marsh/salt meadow complex dominated by salt marsh cordgrass (*Spartina alterniflora*) and salt meadow cordgrass (*Spartina patens*). The periphery of Wetland CPP-2 is dominated by common reed and salt meadow rush (*Juneus gerardii*).

2.1.3 Wetland CPP-3

Wetland CPP-3 is a 6.7-acre palustrine emergent wetland located near the junction of Sanford and Magazine Roads. This wetland occupies an area that was formerly an open water pond, but is naturally being filled in with sediment. A narrow drainage channel connects this wetland to Allen Harbor. This wetland is classified as palustrine open water (POW) on the East Greenwich NWI map.

Wetland CPP-3 is a common reed marsh that consists of a nearly pure stand of common reed. Red maple, Bebb willow, speckled alder (*Alnus rugosa*), poison sumac (*Toxicodendron vernix*), shining rose (*Rosa nitida*), and American bittersweet occur near the wetland/upland boundary.

2.1.4 Wetland CPP-4

Wetland CPP-4 is a 6.7-acre estuarine emergent wetland located along the northern shore of Allen Harbor, west of the terminus of Magazine Road. This wetland occupies most of the intertidal zone along this section of Allen Harbor, as well as a relatively narrow (less than 50-ft wide) strip of the adjacent shoreline. This wetland is not mapped on the East Greenwich NWI map.

Wetland CPP-4 is composed of two contiguous plant communities: a salt marsh and a common reed marsh. The salt marsh community occurs within the intertidal zone and consists of a pure stand of salt marsh cordgrass. The common reed marsh occurs in saturated areas above the intertidal zone and is dominated by common reed, with marsh elder (*Iva frutescens*) forming a relatively dense stand near the wetland upland boundary.

Wetland CPP-4 is a "coastal wetland bordering a Type 3 (High-Intensity Boating) water that is designated for preservation" under Coastal Resources Management Plan (CRMP) (DON, 1994). Because it is designated for preservation, activities within this wetland are strictly regulated by the Coastal Resources Management Council (CRMC), as discussed in Section 3 of this report.

2.1.5 Wetland CPP-5

Wetland CPP-5 is a 2.5-acre estuarine emergent wetland located along the northern shore of Allen Harbor, east of the terminus of Magazine Road. This wetland is very similar to Wetland CPP-4 in its location relative to the intertidal zone, as well as in its plant community and species composition. A narrow band of salt meadow community is located between the salt marsh and the common reed marsh. This salt meadow community is dominated by salt meadow cordgrass, with scattered sea lavender (*Limoncium ashi*) and seaside goldenrod (*Solidago sempervirens*). The East Greenwich NWI map classifies this wetland as an estuarine intertidal flat (E2FL).

Wetland CPP-5 supports a pure stand of salt marsh cordgrass in the intertidal zone. Landward of the intertidal zone is a 10- to 20-ft-wide band of salt meadow, which is dominated by salt meadow cordgrass, but regularly includes fowl bluegrass (*Poa palustris*), sea lavender, seaside goldenrod, and slender glasswort (*Salicornia europaea*). The common reed marsh located landward of the salt meadow community is dominated by common reed, with scattered marsh elder, groundsel tree (*Baccharis halimifolia*), and seaside goldenrod near the wetland/upland boundary. Photographs of the habitat present at several monitoring wells in or near CPP-5 are shown in Appendix A.

Like CPP-4, Wetland CPP-5 is a coastal wetland bordering a Type 3 (High-Intensity Boating) water that is designated for preservation under the CRMP (DON, 1994).

2.1.6 Isolated Wetlands (Wetlands A-E)

Five small isolated freshwater wetlands are present in Calf Pasture Point north of Allen Harbor and east of Magazine Road. These wetlands range in size from 0.1 to 0.8 acre. Four of the wetlands are classified as POW, and the fifth is classified as palustrine emergent (PEM) on the East Greenwich and Wickford Rhode Island NWI maps.

Each of these isolated wetland areas is a common reed marsh. Wetlands A through D support switchgrass (*Panicum virgatum*) as a codominant species. Other plants that occur regularly within these small isolated wetlands include marsh elder, wax myrtle (*Myrica cerifera*), slender rush (*Juncus tenuis*), and Green's rush (*Juncus greenei*).

2.1.7 Recent Wetland Information

The Town of North Kingstown was contacted to determine if recent wetland delineations had been made at the site. Although there were no formal delineations available for the entire site, the Town provided a wetlands map of the entire town prepared in 2002 (Cameron, 2006). The wetland areas identified on the 2002 map are shown in Figure 1-1. The wetlands identified from the 2002 map are much more extensive than those identified from the 1994 delineation studies; however, it should be noted that the 2002 map was developed from interpretation of aerial photographs without on-site confirmation. All of the wetland identified in the 1994 delineation, with the exception of a portion of CPP-1 fall within the wetlands identified on the 2002 map.

In the Calf Pasture Point Master Plan, those segments of the proposed trail that pass through wetlands were identified in Figure W-2 of the Plan (Brian Kent Associates, 2004). The wetlands segments were identified in a site walkover; however, no wetland delineations or vegetation descriptions were available. The wetland sections of the proposed trail are shown in Figure 1-1 of this document. The Master Plan notes that the trail layout was revised to avoid areas standing water to the extent possible, but the extensive wetlands on the southern portion of the site made it impossible to avoid wetlands entirely. The Master Plan also identifies areas of the site that have dense stands of common reed (*Phragmites*), an invasive wetland species. Several of these *Phragmites* stands overlap the wetlands delineated in 1994, as shown in Figure 1-1 and it appears that the extent and density of the *Phragmites* stands has increased since the 1994 study. As a mitigation measure to compensate for wetlands destroyed construction of the trail, the Master Plan proposes that several of the *Phragmites* stands will be removed and restored to native wetland vegetation; however, this mitigation activity as well as the train construction itself is contingent upon approval by the regulators.

2.2 Description of Soil Types at Calf Pasture Point

There are eight soil types mapped for Calf Pasture Point and its immediate vicinity (RIDEM, 2004a; USDA, 1996). These soil types are shown in Figure 2-1. The soil types and their descriptions are presented in Appendix B. Most of Calf Pasture Point is mapped as the Udorthents - urban land complex soil type (UD). The coast of Narragansett Bay is classified as beach (Ba) soil type. Along the western edge of the site, Matunuck mucky peat (Mk) is present on the east side of Stanford Road and Adrian muck (Aa) is present to the west of the road. At the center of the site on the rocky outcrop, soils are mapped as Canton and Charlton fine sandy loams, very rocky, 3 to 15 percent slopes (CeC). The area north of the site, which appears to be a more developed area, is mapped as Merrimac-urban land complex (MU). A small area to the northwest of the site is covered by Quonset gravelly sandy loam, 0 to 3 percent slopes (QoA). Of the eight soil types, Matunuck mucky peat and Adrian muck are the only soil types present at the site that are considered hydric soils (Soil Survey of Rhode Island, http://nesoil.com/ri/)..

2.3 Rare Species and Habitats

A variety of cover types are present at Calf Pasture Point, including productive wetland and woodland ecosystems, and early successional communities. These cover types support a wide diversity of wildlife. Although diverse wildlife populations are present, no federally listed or proposed threatened or endangered species are known to occur regularly in the project area. Two transient species, the bald eagle (*Haliaeetus leucocephalus*) and the peregrine falcon (*Falco peregrinus anatum*), were noted as occasionally found in the region (DON, 1994).

Three species of birds listed by the State of Rhode Island as threatened are known to occur in the area. The grasshopper sparrow (*Ammodramus savannarum*) and upland sandpiper (*Bartramia longicauda*) nest along the grassy portions of the Quonset Point Airstrip. The least tern (*Sterna albifrons*) nests adjacent to the east bulkhead of the Quonset Airstrip. Both of these areas are located more than a mile south of Calf Pasture Point. These species potentially could occur at the site, but are not known to nest on the site.
In the Rhode Island Geographical Information System (RIGIS), maps of Rhode Island Department of Environmental Management (RIDEM) Heritage Program Data for Rare Species Habitats show locations of the estimated habitat and range of rare species and noteworthy natural communities. These maps indicate that no critical habitats or protected areas are located on the site (RIDEM, 2004b). The location of the nearest critical habitats are shown in Figure 2-2.

3.0 REGULATIONS PERTAINING TO ACTIVITIES IN WETLANDS AND COASTAL AREAS

This section reviews the regulations that potentially could apply to monitoring activities occurring in wetlands.

3.1 Coastal Resource Management Council

Activities occurring in wetlands at the Davisville Calf Pasture Point area are regulated primarily by the State of Rhode Island CRMC. CRMC is a state environmental regulatory and management agency responsible for the preservation, protection, development and, where possible, the restoration of the coastal areas of the state. CRMC's regulatory requirements are published in two sets of regulations, the *Coastal Resources Management Program* (CRMC, 1996) and the *Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast* (CRMC, 1999).

The CRMP governs coastal waters and the associated shoreline features. Coastal wetlands are considered shoreline features and are defined as (CRMP, Section 210.3(A)(1.)):

> "Salt marshes and freshwater or brackish wetlands contiguous to salt marshes or physiographical features. Areas of open water within coastal wetlands are considered a part of the wetlands. In addition, coastal wetlands also include freshwater and/or brackish wetlands that are directly associated with non-tidal coastal ponds and freshwater or brackish wetlands that occur on a barrier beach or are separated from tidal waters by a barrier beach."

In addition to regulating activities in "coastal wetlands" as defined above, the CRMC was given responsibility for the protection and management of "freshwater wetlands in the vicinity of the coast" as of August 18, 1999. CRMC and RIDEM have developed a map of the boundary for freshwater wetlands regulated by each agency, which generally follows major roadways. Freshwater wetlands shoreward of the boundary are regulated by CRMC, while those inland of the boundary are regulated by RIDEM. The jurisdictional map for North Kingstown shows that all freshwater wetlands at Calf Pasture Point are regulated by CRMC (Figure 3-1) (http://www.dem.ri.gov/maps/mapfile/wetjuris/nkin_v.jpg). CRMC has published *Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast*, to regulate activities in these freshwater wetlands.

In the sections below, potentially applicable CRMC regulations are discussed first with respect to the groundwater sampling activities and second with respect to construction of roads or trails for access to the wells.

3.1.1 Regulation of Groundwater Sampling Activities

The activities associated with groundwater sampling that could impact wetlands may include driving vehicles through wetlands to access the monitoring locations, foot traffic and hauling equipment to monitoring locations, and clearing of vegetation for access to monitoring locations during sampling. In general, monitoring at most locations at Site 7 will occur at intervals of nine months or longer. The primary concern for these activities is disturbance of the ground surface and vegetation such as ruts caused by vehicles or trampling of vegetation.
Most of the monitoring wells and piezometers are located in coastal wetlands and thus would be covered under the CRMP. The CRMP does not contain specific regulations for well monitoring

activities, driving vehicles in wetlands, or clearing vegetation. However, the Navy potentially could be required to obtain assent from CRMC for these activities based on CRMP Section 100.1 (B) which states that:

> "Council Assents are also required for any other activity or alteration not listed in Table 1, Table 1A, or Table 1B but which (1) has a reasonable probability of conflicting with the Council's goals and its management plans or programs, and/or (2) has the potential to damage the environment of the coastal region."

Other freshwater wetlands at Calf Pasture Point that are not coastal wetlands would be regulated by CRMC's *Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast.* These regulations apply to "freshwater wetlands in the vicinity of the coast, areas within fifty feet (50 ft), riverbanks, and floodplains." CRMP Section 100.4(A) incorporates CRMC's jurisdiction over the freshwater wetlands in the vicinity of the coast and the associated regulations as follows:

> "A Council Assent is required for any project or activity which may alter the character of any freshwater wetland in the vicinity of the coast. Applicants are referred to the CRMC's Rules and Regulations for the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast for specific programmatic requirements."

The *Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast* lists activities that are exempt from regulation (Rule 6.00 Exempt Activities), several of which are relevant to the long-term monitoring activities proposed by the Navy. Under this rule, certain limited activities in freshwater wetlands, in the area of land within fifty feet (50 ft), floodplains or on river banks may proceed without a specific written permit[1] from CRMC; however, the activities must comply with the conditions set forth in Rule 6.01 – General Conditions for Exempt Activities. Exempted activities that may be applicable to the groundwater monitoring activities include:

- Limited Cutting or Clearing of Vegetation (Rule 6.02),
- Site Remediation (Rule 6.08), and
- Monitoring and Research Activities (Rule 6.14).

More detailed descriptions of the specific activities exempted are given in the respective rules cited above. Specific activities allowed under Rule 6.14 and relevant to Calf Pasture Point include:

> A. Installing groundwater monitoring wells to determine the depth to the water table or the extent of subsurface contaminants...
>
> and
>
> D. Clearing footpaths or transect lines no greater than five feet (5 ft) in width to permit wildlife surveys or access to sampling stations or plots.

[1] Under the Navy's CERCLA lead agency authority, the Navy is not required to obtain permits or assent from any regulatory body (i.e., CRMC, USACE, RIDEM) for on-site actions. However, in accordance with CERCLA and the National Contingency Plan, the Navy needs to meet the substantive requirements of applicable regulations during on-site operations.

It should be noted that these monitoring and research activities are permitted (in accordance with Rule 6.01) provided that there is no permanent loss of wetland, and that any soil disturbance is stabilized and the area is allowed to revert to its natural condition.

3.1.2 Regulations for Construction of Roads and Trails

Construction of roads and/or trails at Calf Pasture Point is likely to serve the dual purpose of providing both recreation and access to the monitoring wells. To the extent possible, these roads or trails would be located outside the boundaries of wetlands; however, some construction within wetlands will be necessary for construction of the proposed trails shown in the Final Master Plan. The primary concern for construction of roads/trails is the placement of fill material in a wetland, thus eliminating wetland area and potentially altering flow within the wetlands. These activities would require the Town of North Kingston to obtain permits from CRMC or approvals from other regulatory agencies such as the U.S. Army Corps of Engineers (USACE). The Master Plan indicates that approximately 1.5 acres of wetlands would be filled in construction of the Bay Trail. As compensation for this wetland loss, the Town is proposing to restore several areas of existing wetlands that have been degraded by invasive species, such as *Phragmites*.

As noted above, activities within coastal wetlands would be regulated under the CRMP and activities in other freshwater wetlands would be regulated under *Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast.*

The CRMP Section 100.1(A) states that:

> "A Council Assent is required for any alteration or activity that are proposed for ....(2) shoreline features; and (3) areas contiguous to shoreline features. Contiguous areas include all lands and waters directly adjoining shoreline features that extend inland two hundred (200) feet from the inland border of that shoreline feature. A Council Assent is required for any alteration or activity any portion of which extends onto the most inland shoreline feature or its 200 foot contiguous area. Representative activities are listed in Table 1, Table 1A, and Table 1B."

The CRMP regulations specify requirements based on the "water type" that has been designated for a particular body of water. Allen Harbor has been designated as a Type 3 (High Intensity Boating) Water and the adjacent coastal wetlands are considered "coastal wetlands bordering Type 3 (High-Intensity Boating) waters that are *designated for preservation*" by CRMC (DON, 1994). Because they are designated for preservation, more stringent controls apply to activities in these wetlands.

Most activities listed in the "CRMP Table 1, Type 3 Waters" are prohibited in coastal wetlands. The activities of "Filling, Removal, and Grading of Shoreline Features" and "Construction of Public Roads, Bridges, Parking Lots, Railroad Lines, and Airports" are both listed as "prohibited" in coastal wetlands associated with Type 3 Waters (CRMP, Table 1). These two activities are not prohibited in the 200-ft area contiguous to the coastal wetlands, but could require fairly in-depth documentation of impacts and review in order to receive assent from CRMC (CRMP, Table 1A).

In addition to the activity tables in Section 100 of the CRMP, two other sections of the CRMP relate to activities in coastal wetlands that might be involved in constructing a road or trail at the site. These sections are as follows:

Section 300.2 Filling, Removing, or Grading of Shoreline Features (C)(2):
Filling, removing, or grading on coastal wetlands is prohibited adjacent to Type 1 and 2 waters, and in coastal wetlands designated for preservation adjacent to Types 3, 4, 5 and 6 waters, unless a consequence of an approved mosquito-control ditching project (Section 300.12).

Section 300.12. Coastal Wetland Mitigation (D)(2):
Alterations to coastal wetlands abutting Type 2 waters and coastal wetlands designated for preservation adjacent to Types 3, 4, 5 and 6 waters are prohibited except for minor disturbances associated with:

a. residential docks approved pursuant to the standards set forth in Section 300.4
b. approved construction or repair of shoreline protection facilities and
c. approved mosquito population control programs.

Another section of the CRMP that is potentially relevant to construction of trails in the coastal wetlands is CRMP Section 300.17 - Wetland Walkover Structures. Wetland walkover structures are raised pile-supported facilities which provide passage over a wetland for purposes of providing pedestrian access between areas of upland isolated by the presence of wetland. The CRMC's policy toward these structures is the following (CRMP Section 300.17(C)(1)):

> "It is the policy of the Council to prohibit wetland walkover structures unless it is demonstrated that the structure provides the only reasonable access available to an applicant for access on his/her property for passive recreational pedestrian purposes, and that the wetland will incur significant environmental damage from foot-traffic. In cases where the Council finds that wetlands will not incur significant environmental damage from foot-traffic, dependent on individual site assessments, the Council may deny wetland walkover structures."

If a wetland walkover structure is being considered, the regulations and requirements in Section 300.17 should be reviewed carefully. Because the coastal wetlands in the monitoring areas are "designated for preservation" a more in-depth "Category B" review would most likely be required.

For road or trail construction activities in other freshwater wetlands, *Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast* would apply. Rule 7.01(A) states that:

> "No person, firm, industry..... may excavate; drain; fill; place trash, garbage, sewage, road runoff, drainage ditch effluents, earth, rock, borrow, gravel, sand, clay, peat, or other material or effluents upon; divert water flow into or out of; dike; dam; divert; clear; grade; construct in; add to or take from or otherwise change the character of any freshwater wetland as defined herein, the area within fifty feet (50 ft), a riverbank or floodplain, in any way without first obtaining a permit from CRMC."

3.2 Clean Water Act Section 404 Permits

In addition to the requirements of the CRMC, construction of roads or trails or any other activities that involve placement of dredged or fill material in wetlands are regulated under the

Clean Water Act Section 404 and Section 10 of the Rivers and Harbors Act of 1899 and potentially require an additional permit (see footnote 1) or approval from the USACE. Under the USACE regulations, three categories of requirements are based on the area of wetland that will be filled or experience secondary effects and whether the wetland is freshwater or tidal (USACE, 2002). All projects involving placement of dredged or fill material in wetlands must include "required sequencing" prior to determining the area affected. "Required sequencing" consists of avoidance and minimization of wetland impacts to the maximum extent practicable and mitigation of impacts where necessary to protect the aquatic environment. The following three types of permitting requirements may apply to wetlands in Rhode Island (USACE, 2002):

- Category 1: New fill or excavation discharges and its secondary impacts (e.g., areas drained, flooded or cleared) in less than 5,000 square feet of freshwater wetlands is considered "Category 1," meaning that it must comply with the conditions of the Programmatic General Permit (PGP) for the State of Rhode Island but does not require a separate application or project-specific authorization from USACE.

- Category 2: New fill or excavation discharges and its secondary impacts in 5,000 square feet to one acre of freshwater wetlands and in up to one acre of tidal wetlands is considered "Category 2," meaning that it must comply with the conditions of the PGP for the State of Rhode Island, but USACE must review and approve the activity. It is assumed that another Rhode Island agency (e.g., CRMC or RIDEM) will submit the project for review by USACE so that a separate application to USACE is not needed unless the project is exempt from regulation by the other state agencies. This category requires written approval from the appropriate Rhode Island resource agency, which includes a written authorization from the USACE.

- Individual Permit: New fill or excavation discharges and its secondary impacts in greater than one acre of either freshwater or tidal wetlands require an individual permit from USACE. The application for an individual permit must be submitted directly to the USACE.

4.0 CURRENT GROUNDWATER SAMPLING METHODS

The Long Term Monitoring Program (LTMP) for Site 7 (NewFields, 2000) is conducted in accordance with the methods described in the Quality Assurance Project Plan (QAPP) (EA, 2001). Standard Operating Procedures (SOPs) are contained within the QAPP that describe sampling procedures for monitoring wells and piezometers. These procedures are described in this section.

The site contains a network of existing roads that are likely to be maintained as trails or roads in the future. These roads are useful for accessing different areas of the site, including areas where wells are located (see Figure 1-1). In general, most monitoring wells are located close to existing roads, although some wells are located more than 100 ft and as much as ~307 ft from the nearest road (Table 4-1). All equipment must be transported to each well or piezometer in order for the sampling to take place. Current practice involves transporting sampling equipment to the site with a pickup truck or similar vehicle then using a hand-pulled wagon to access wells located away from the road. Vehicles are driven along Marine Road to the unimproved dirt road that is the main access for Site 7. The sampling equipment is unloaded from the vehicle on the dirt road into small hand-pulled wagons and the sample crew walks from the dirt road to the sampling locations pulling the small wagons loaded with sampling equipment as shown in Figure 4-1. The wells sampled using the hand-pulled wagons are shown on Figure 1-1.

Upon reaching the site of a well or piezometer to be sampled, the appropriate SOP for sample collection is followed.

4.1 Procedure for Sampling Permanent Groundwater Monitoring Wells

Field equipment necessary for groundwater sampling of the monitoring wells includes, but is not limited to, the following:

- Field log book (other applicable documentation)
- Electronic water level measuring device
- Dedicated (i.e., in well) adjustable-rate bladder pump and pump cycle controller
- Cylinder with compressed air (or alternate compressed air source) to operate bladder pump
- Flow measurement apparatus (during purging)
- Flowthrough cell and meter(s) for measurement of water quality parameters
- Turbidity meter (e.g., Hach Nephelometer)
- Decontamination supplies
- Sample containers and sample storage unit (cooler)
- Five-gallon bucket
- 500-gallon poly tank.

Preliminary site activities are as follows. A visual inspection of the well is performed to assess the integrity of the structure (i.e., tampering, damage of any kind). After verification of well condition, the well is unlocked, and a static water level measurement is obtained. A water level indicator is inserted down the well without removing the bladder pump system.

Once a water level is obtained from all wells designated for sampling, field personnel set up equipment necessary to begin the well purging and sampling process. In order to pump groundwater using a bladder pump, a pump cycle controller and a compressed air source is required. The compressed air source used to sample wells at Site 7 is a small cylinder of compressed air. An air line from the compressed air cylinder is connected to the controller with quick-connect fittings.

In each monitoring well, two ¼-inch-diameter polyethylene tubes, which are attached to the downhole dedicated pump, terminate at the well cap. One tube is an air inlet/outlet line and the other is a water line that functions to transport groundwater from the well to the top of the well where it is collected. The air inlet/outlet line is attached directly to the controller using a short piece (approximately 10-ft length) of polyethylene tubing with quick-connect fittings or tubing push couplers. A short piece of clear polyethylene tubing is attached to the water line at the wellhead and to a flowthrough cell with a water quality meter(s) that is mounted inside a 5-gallon bucket so that any purge water is discharged into the bucket.

Once both air and water lines are connected to the controller and water quality meter respectively, the controller can be activated to initiate the pump and start the well purging process. Purging is continued until water quality parameters and the water level in the well stabilize. Depending upon well construction, approximately 3 gallons of purge water can be expected to be generated during the purging of a monitoring well. Water quality parameters and water levels are measured and recorded throughout the purging process. Upon completion of the purging process, groundwater samples are collected into proper bottles/containers and the bottles/containers are labeled and stored in accordance with the QAPP in preparation for shipment to an off-site laboratory for analysis.

4.2 Procedure for Sampling Shoreline Piezometers

The 33 piezometers located along the shoreline at Site 7 are sampled every nine months. Unlike the monitoring wells, however, the piezometers are not permanent features; they are installed and removed for each sampling event. A global positioning system (GPS) is used to accurately locate the piezometer locations so that they are installed in exactly the same location for each event. The piezometers are installed by hand by pushing/driving a section of 1.25-inch-diameter galvanized steel casing with an attached 1-ft section of stainless-steel screen to a depth of approximately 2 to 5 ft below the ground (sediment) surface. The equipment needed for installing and sampling the piezometers includes, but is not limited to, the following:

- Material to construct piezometers, including galvanized pipe with stainless steel screen, 1.25-inch-diameter (1-ft screen)
- Slam bar for installing the piezometers
- Variable rate peristaltic pump (battery powered)
- Electronic water level measuring device
- Flow measurement apparatus
- Flowthrough cell and meter(s) for measurement of water quality parameters
- Turbidity meter (e.g., Hach Nephelometer)
- Decontamination supplies
- Sample containers and sample storage unit (cooler)
- Field log book (other applicable documentation).

All 33 piezometers are installed during a period of mid-tide level. During the subsequent low tide, all 33 piezometers then are sampled. After installation of all piezometers is completed, the depth of groundwater in each piezometer is measured and recorded followed by purging and sampling. Purging of the piezometers is conducted using the peristaltic pump to remove at least one piezometer volume of water before sampling. However, as with the monitoring wells, it is preferable to continue purging until water quality parameters and the water level in the well stabilize; therefore, water quality parameters and water level are measured and recorded throughout the purging process. Upon completion of the purging process, groundwater samples are collected into proper bottles/containers and the bottles/containers are labeled and stored in accordance with the QAPP in preparation for shipment to an off-site laboratory for analysis. The piezometers are removed immediately following sampling. Wooden stakes and/or surveyor's pin flags are used to mark the location of each piezometer between sampling events.

5.0 ALTERNATE SAMPLING METHODS

5.1 Alternative Methods for Sampling Permanent Groundwater Monitoring Wells

If the existing roads in the Site 7 area (as shown on Figure 1-1) remain intact, then most wells at Site 7 will be accessible by vehicle. If this is the case, the sampling method that is currently in use, with slight modifications, can be implemented for wells located less than ~150 ft from a road. If a well is located less than 150 ft from a roadway, an air line can be extended from a compressed-air source (e.g., air cylinder, air compressor) that is located on the sampling vehicle (i.e., truck) to prevent having to transport the air source to each well (the cost for 150 ft of airline is approximately $33; see equipment specifications in Appendix C). Currently, a compressed-air cylinder is transported to each well to operate the dedicated bladder pump installed in the well. The air source would be a generator and compressor or a compressed-air cylinder (as currently used). The controller, which is used to regulate the pumping rate, would still have to be transported to the well along with other sampling materials.

For wells that are located further than ~150 ft from an existing or proposed roadway, it will probably be necessary to consider a different sampling approach because extending greater than 150 ft of air line is not practical or cost effective. The proposed alternative sampling methods for reducing the impact of groundwater sampling in the wetlands have been broken down into three categories (1, 2, 3), each containing three variants (A, B, C) for a total of nine options. Table 5-1 defines each option in terms of equipment included and the cost. Each of the three categories incorporates a different method of transportation. Category A incorporates a small off-road vehicle (ORV) with high-flotation tires that minimize compaction for transportation, whereas in Category B, the mode of transportation is a power wagon, and in Category C, a hand-pulled wagon is used. Each variant refers to a particular combination of (a) the source of compressed air used to operate the dedicated bladder pumps, (b) the power supply, and (c) other equipment, if needed. More information on equipment specifications is provided in Appendix C.

The first, and favored, option is Option 1A. In this option, transportation is accomplished with an ORV, the source of compressed air is a 12V-DC portable compressor, and the power supply is a marine battery. The only other added equipment is the charger for the battery (alternatively, most off-road vehicles have a 12V power supply that could be used to supply power to the compressor in lieu of a separate 12V battery. Although this would eliminate the need for a separate battery and battery charger, it would increase the risk of ORV battery failure, which could leave samplers stranded in a remote location). The ORV is the preferred method of transportation because of the distance between wells that must be sampled. This will allow the sampler to simply load the cargo in a centralized area and drive to each well. The ORV could also be useful for conducting other work at the site. The 12V-DC compressor is advantageous because it eliminates the need for a compressed air tank (cylinder) and a generator. The separate marine battery would be capable of running the compressor for a full day of work, after which it would be charged overnight for the next day. Also, using a 12V-DC compressor eliminates the need for fuels, such as gasoline, which are needed when operating a generator. This is desirable not only from a logistical standpoint, but also because it leads to a cleaner work environment with less concern of cross contamination when sampling. Some ORVs are available with an electric engine, which would eliminate the need for liquid fuels (i.e., gasoline, diesel) with this option.

Option 1B is next in order of preference. This option is similar to Option 1A except that the 12V-DC compressor and battery is replaced with a gasoline-powered compressor with a self-contained power source. This is advantageous because it eliminates the need for a separate power supply, such as a generator. Although the compressor does not need a separate power source, it would be necessary for the samplers to keep gasoline on hand to refill the compressor periodically.

The third variant in Category 1 (Option 1C) uses an alternating current (AC) compressor and a generator for the source of compressed air (i.e., this option would use the power from the generator to run the compressor). This option would require the use of a fuel source to be kept on site.

In Category 2, the variants are the same as those described above for Category 1; however, the ORV is replaced with a power wagon. A power wagon is a motorized cart that is powered by a gasoline engine (see Appendix C). The power wagon has the capacity to carry the required equipment for sampling. The sampling personnel would load the equipment into the cargo area and walk behind the power wagon, steering it. The advantage of the power wagon over the ORV is cost; however, the power wagon has less cargo space and would provide less flexibility than the ORV.

The Category 3 equipment transportation method of choice is a standard wagon with pneumatic tires (see Figure 4-1). This requires the sampling personnel to pull the wagon to the wells. The wagon is the least costly option but requires more physical effort on behalf of the sampling personnel and takes more time compared to the options in Categories 1 and 2. The Navy contractor responsible for long-term monitoring currently uses this method to access wells that are located away from the dirt access road.

An additional sampling modification that is not described on the above table involves the use of the QED MP15 MicroPurge® Basics™ Sample Pack, a back-pack mounted sampling system that includes a compressed air supply (5-lb compressed CO_2 cylinder) and a battery (3 "AA" batteries) operated controller that can be connected to any type of bladder pump. When used in conjunction with dedicated bladder pumps, there is no need to carry portable pumps and cleaning supplies; the only additional materials that are needed are: sample bottles, a flowthrough cell to monitor water quality parameters (if required), and a container to collect purge water (if purging is required). With this combination, a complete sampling setup can be carried by a single person to reach wells where trucks and compressor carts cannot go. Although the system is primarily designed for sampling hard-to-reach wells accessible only via foot, it also includes a bypass fitting that allows it to be connected to larger gas cylinders and/or compressors for sampling wells that are easily accessible via truck. More details about the QED MP15 MicroPurge® Basics™ Sample Pack are provided in Appendix C (Equipment Specifications). The cost to purchase this unit is $2,895; or, it can be rented for $100/day, $300/week, or $900/month. Additional CO_2 cylinders can also be rented for $5/day, $15/week, or $45/month (Pine Environmental; telephone 800-301-9663).

5.2 Passive Diffusion Bag Sampling

The passive diffusion bag (PDB) sampling technology has been in use for several years for groundwater monitoring. Compared to the currently employed low-flow purging procedure used to sample wells and piezometers at Site 7, it involves minimal manpower, time, and equipment and, thus, potentially could lessen wetland impacts during sampling. However, the usefulness of PDB sampling at Site 7 is limited at this time for monitoring wells, which must be sampled for metals, because PDBs are not an accepted/proven technique for sampling metals (Appendix D contains a brief summary of metals data in groundwater at Site 7). PDBs may be a useful alternative to dedicated bladder pumps. Also, PDBs may be a viable alternative for sampling the shoreline piezometers, which are monitored only for VOCs. Alternative sampling methods such as PDB techniques may be considered in the future following the 8th round of long-term monitoring but not before that round of sampling is completed. The PDB technique is summarized below.

The PDB technique involves the use of a low-density polyethylene (LDPE) bag filled with deionized water, which acts as a semipermeable membrane that is suspended in a well to passively collect groundwater samples. PDB samplers rely on the passive movement of groundwater from the aquifer or water-bearing zone through the well screen. Soluble chemical species in groundwater will diffuse across the bag material until constituent concentrations within the bag reach equilibrium with concentrations in the surrounding water. Because the pore size of the PDB is about 10 angstroms, sediment does not pass through the membrane, eliminating interferences from turbidity. Typical PDBs are constructed of LDPE shaped as a long narrow tube 18-24 inches in length and capable of being deployed into small diameter wells. The bags can be recovered quickly and are disposable.

Currently, VOCs and both total and dissolved metals are the targeted analyte groups that, in addition to salinity, are monitored in permanent wells at CPP Site 7. VOC compounds include vinyl chloride (VC), 1,1-dichloroethene (1,1-DCE), chloroform, 1,2-dichloroethane (1,2-DCA), benzene, trichloroethene (TCE), total 1,2-dichloroethene (1,2-DCE), 1,1,2-trichloroethane (1,1,2-TCA), tetrachloroethene (PCE), and 1,1,2,2-tetrachloroethane (1,1,2,2-PCA) analyzed by United States Environmental Protection Agency (U.S. EPA) Method 8260B. Target metals include antimony, lead, aluminum, arsenic, beryllium, chromium, iron, nickel, and manganese analyzed using U.S. EPA Methods 3005A, 3020A, 6010B, and 7000. Salinity is analyzed using Method SM 2520B. In addition to the targeted analytes, water quality indicator parameters including pH, conductivity, temperature, dissolved oxygen, and turbidity are measured in the field during well purging. LDPE PDBs have only been shown to be useful for collecting VOCs because of their hydrophobic nature. They are not suitable for inorganic ions and field parameters useful for monitoring natural attenuation. Furthermore, this method has been accepted by the U.S. EPA and by several states as an approved sampling method only for VOCs.

Current research funded by the Environmental Security Technology Certification Program (ESTCP) is being conducted to demonstrate and validate the performance of a recently designed regenerated cellulose dialysis (RCD) diffusion sampler in the field. The RCD, which was developed by the U.S. Geological Survey (USGS), is similar in design to an LDPE PDB; however, it contains a hydrophilic cellulose acetate membrane at each end of the sampler to allow soluble inorganic and all organic contaminants to diffuse into the bag. Because the RCD is still in the field-testing stages, it is not available as an accepted alternate device that can be implemented for sampling of organic and inorganic constituents.

Despite their limitations for sampling monitoring wells, PDBs are a potential alternative sampling method for shoreline piezometers that are currently used for collecting groundwater samples from the beach/shoreline bordering Site 7. The USGS has used diffusion-sampling techniques to sample groundwater (porewater) beneath a pond at the Massachusetts Military Reservation (MMR) on Cape Cod to aid in delineating the area where a VOC plume in groundwater was entering the pond (USGS, 1998). They used two types of diffusion sampling devices: water-to-water diffusion samplers and water-to-vapor diffusion samplers. Water-to-vapor samplers consisted of an empty, uncapped 40-mL glass vial placed inside a plastic sealable bag (e.g., zipper lock or heat sealed), which in turn was then placed inside a second, similar bag. The water-to-water diffusion samplers consisted of a short segment of small-diameter polyethylene tubing filled with deionized water and sealed on both ends (e.g., heat sealed or knotted) and placed inside a small wire cage (e.g., suet cage). Both types of samplers were buried in the pond sediments attached to a surveyor pin flag via a cable tie. The samplers were left in place for a period of time (e.g., one to two weeks) to allow them to equilibrate before they were retrieved for analysis. Upon retrieval, the glass vials were capped directly over top of the inner plastic bag to prevent loss of volatile constituents. The vapor samples were analyzed on site with a mobile laboratory; whereas, the water samplers were placed in a cooler and shipped to an off-site laboratory for analysis of VOCs. Because shoreline piezometers are used at Calf Pasture Point solely for the collection of samples for analysis of VOCs, the use of diffusion sampling techniques is a viable alternative sampling technique for this purpose. The major potential disadvantage of using passive diffusion samplers is that installation and retrieval would have to be conducted on separate trips; however, this is not an issue if local personnel perform the sampling.

Currently, installation, sampling and removal of the 33 shoreline piezometers at Calf Pasture Point requires about 5 days (verbal communication with Robin Clark, EA Engineering, Science, and Technology). Like the shoreline piezometers, the passive diffusion samplers would have to be installed and retrieved for each sampling event; however, installation of passive diffusion samplers likely would be simpler, quicker, and less invasive than installing the piezometers. The USGS has developed two techniques for installing passive-diffusion (water-to-vapor) samplers in sediments in shallow water (up to 4 ft deep). One method, suitable for water less than about 2 ft deep, involves making a hole with a shovel or a hand auger into which the sampler is inserted directly. In loose sediments where there is a potential for hole collapse, a flat shovel is preferred because, after it is inserted into the sediments, it can be pushed forward to create a void space for the sampler (see Figure 5-1). After insertion of the samplers into the hole, the hole is backfilled. Usually, a surveyor's flag is attached to the sampler so it can be easily located for retrieval. Samplers are retrieved by pulling them out of the sediment or by careful digging to expose the samplers.

The other method, which is suitable for water up to 4 ft deep, involves the use of a drive-point assembly consisting of a 72-inch-long, 1¾-inch-outside diameter (OD), 1⅝-inch-inside diameter (ID) steel electrical conduit outer pipe; a 74-inch-long, 1-inch-OD, 1⅜-inch-ID steel electrical conduit inner pipe with an attached drive point; an 80-inch-long, ⅞-inch-OD, ¾-inch-ID polyvinyl chloride (PVC) insertion pipe; a slide hammer; and, the sampler attached to a surveyor's flag (see Figure 5-2). The sampler is installed by advancing (with the slide hammer) the inner and outer pipes together to the desired sampling depth (the inner pipe extends approximately 2 inches below the bottom of the outer pipe); removing the inner pipe to create a hole below the outer casing to accommodate the sampler; inserting the PVC pipe with the sampler attached at the bottom so that the sampler is emplaced into the hole below the outer casing; removing the outer casing to allow sediment to collapse around the PVC pipe and sampler; and removing the PVC pipe to leave the surveyor's flag exposed (see Figure 5-3). Installation in deeper waters has been done with the aid of scuba divers and may also be possible from a boat or barge (USGS, 1998).

More specific details regarding construction of passive diffusion samplers, including installation and retrieval methods in shallow water bodies, are provided in USGS (2002). This report also describes sampling that was conducted by the USGS in shallow water adjacent to Calf Pasture Point and the Allen Harbor Landfill at NCBC Davisville using passive diffusion (vapor) samplers. Because quantitative measurement of aqueous concentrations is of interest, water-to-water diffusion samplers would be preferred over water-to-vapor samplers which require converting vapor-phase concentrations to aqueous-phase concentrations. Water-to-water diffusion samplers are somewhat more difficult to construct and deploy (USGS, 1998); however, the basic process is the same as that described above.

6.0 SUMMARY AND RECOMMENDATIONS

The primary concerns for ecological effects of long-term monitoring are the impacts of these activities on the wetlands at the Calf Pasture Point. Several monitoring wells and most of the piezometers at Site 7 are located within the boundaries of delineated wetlands. Activities at Site 7 that could potentially impact wetlands are primarily regulated by the CRMC, although consultation or review from other agencies such as USACE also may be involved. The CRMP and the *Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast* are the primary regulations governing these activities. Procedures for collection of groundwater samples may require assent from CRMC if these activities are thought to have the potential to damage the wetlands; however, the *Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast* provides an exemption for monitoring activities, assuming that soil disturbance is stabilized and there is no permanent loss of wetlands. Construction of roads or trails in the wetlands will almost certainly require assent from CRMC and may require review and approval from USACE. The regulations for activities in wetlands are fairly extensive and should be reviewed carefully for applicable requirements as plans are developed for the site.

The long-term monitoring program for groundwater at Site 7 requires collecting samples from permanent monitoring wells on a 9-month and 27-month frequency (depending upon the well) and from shoreline piezometers on a 9-month frequency. Well samples are collected and analyzed for both organic constituents (VOCs) and inorganic constituents (metals) whereas piezometer samples are collected and analyzed for VOCs only. The current sampling and analytical protocol is required, at minimum, for a period of five years following the start of the long-term monitoring program (August 2001); consequently, it is not possible at this time to modify the number or frequency of wells/piezometers that are sampled or the target analyte list that is currently employed. Given this consideration, recommendations were made in this report for modifying the current sampling techniques that are used for well and piezometer sampling to reduce potential adverse impacts to wetlands caused by sampling associated with long-term monitoring. Because monitoring requirements differ for the wells and piezometers, different recommendations are made for sampling wells and piezometers.

In general, the recommendation for well sampling is to continue using dedicated bladder pumps to collect water samples. Sampling vehicles (trucks) should not be driven off-road to reach wells that are located away from the existing roads because of the potential for causing visible damage (e.g., rutting) to wetland areas. For wells located in close proximity to roads (e.g., <150 ft), an air hose can be extended from the sampling vehicle to the well to avoid having to transport the compressed-air source (required to operate bladder pumps) to the well; other sampling equipment would still have to be transported to the well (i.e., sample bottles, controller for bladder pump, bucket for collecting purge water, flowthrough cell and water-quality meter, water-level indicator). Therefore, for transporting this equipment and for conducting monitoring at wells located more than 150 ft from a road, additional options are provided that include alternative methods for transporting sampling equipment to the wells that are suitable for off-road use. The additional options also include alternative sources of compressed air (battery-operated air compressor, air compressor with self-contained gasoline-powered generator, and a more conventional setup that includes a separate air compressor and gasoline-powered generator) that can be considered in addition to the current method that uses compressed air cylinders.

Because wells must be monitored for metals, the use of passive diffusion sampling techniques is not an appropriate substitute for bladder pumps at this time. However, passive diffusion sampling techniques, specifically PDBs, are recommended for collection of groundwater samples from the off-shore environment bordering Site 7 in lieu of using temporary piezometers for this purpose. The USGS has demonstrated that passive diffusion sampling techniques are a viable sampling technique for collecting shallow groundwater samples in off-shore environments, and the technique requires less labor and materials than drive-point sampling (i.e., piezometer sampling) and thus could lessen adverse impacts to the wetlands at Site 7. The major potential disadvantage of this technique is that it necessitates separate trips to install and retrieve the samplers, whereas the current sampling technique using piezometers is implemented in a single trip; however, this is not an issue because the Navy's long-term monitoring contractor is located close to the site (approximately 1 to 2 hour drive). The PDB technique may be considered for use at this site after the 8th round of long-term monitoring, but not before that round has been completed.

Passive diffusion sampling techniques also may be a potentially viable alternative to bladder pumps for well sampling if/when metals are eliminated from the analytical requirements for wells at this site. The use of passive diffusion sampling methods for monitoring wells could result in substantial time/cost savings for the Navy because the current well sampling method is slow. Typically, only two to three wells are sampled per day using the current sampling method (verbal communication with Robin Clark, EA Engineering, Science, and Technology). Several investigators have demonstrated that passive-diffusion sampling techniques can result in substantial cost savings compared to conventional well-sampling methods. For example, in a presentation to the Interstate Technology and Regulatory Council (ITRC), Don Vroblesky of the USGS reports that groundwater sampling at Hanscom Air Force Base (AFB), MA, costs $44 per sample using passive diffusion bag samplers compared to $72 per sample using the low-flow sampling technique (see http://www.diffusionsampler.org/Library/DocumentList.asp). He also cites work conducted by Parsons Engineering, in which they estimated that well sampling at McClelland AFB, CA, cost $65 per sample using passive diffusion bag sampling, compared to $308 using the micropurge technique and $444 per sample using the conventional purging method. The ITRC developed a cost-estimating model to determine potential cost savings associated with passive-diffusive sampling methods (see http://diffusionsampler.itrcweb.org/keydocuments.asp#19695). Further analysis with this and/or other tools should be conducted before making a decision to implement passive diffusion sampling at Calf Pasture Point.

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FIGURES

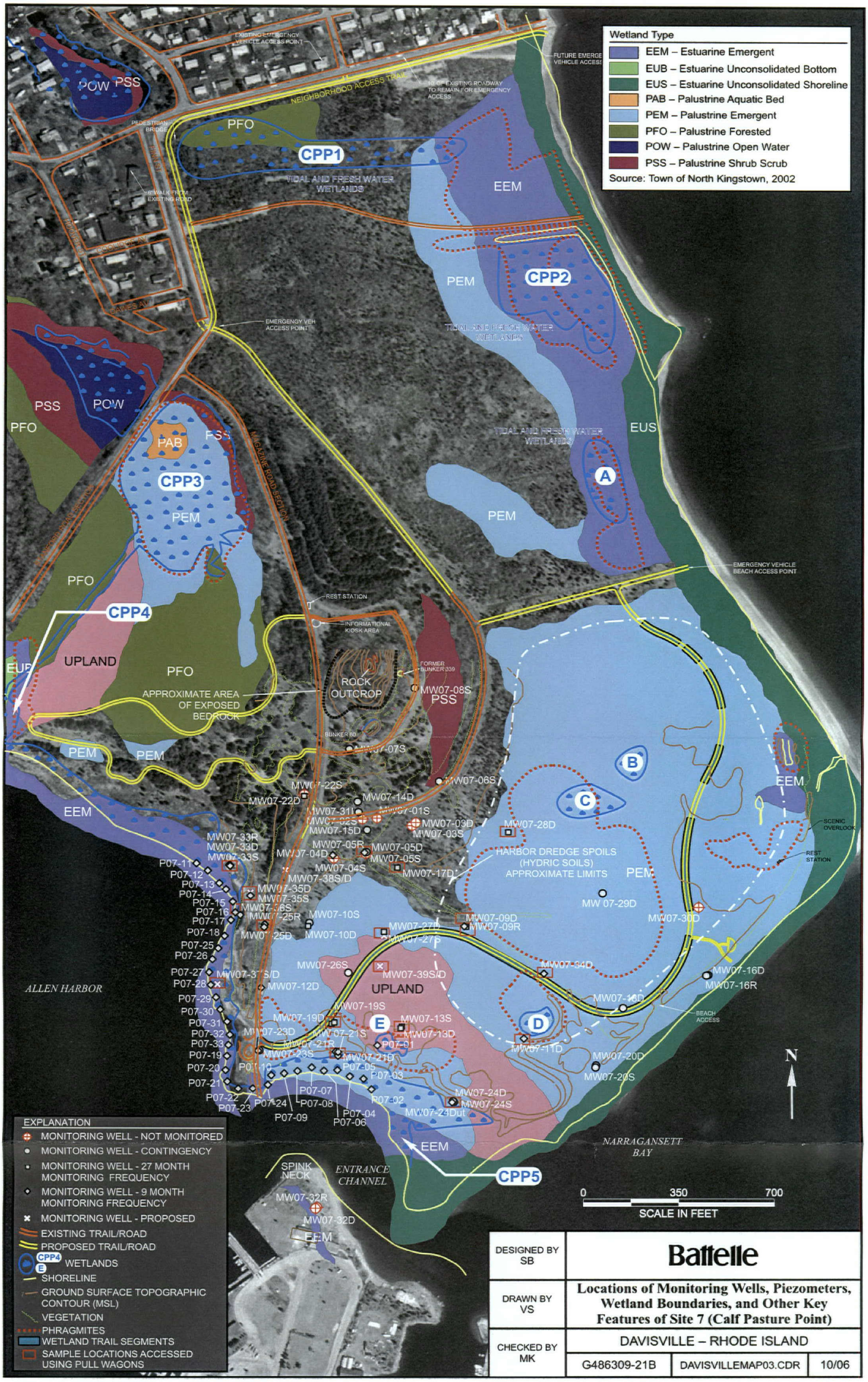

Figure 1-1. Locations of Monitoring Wells, Piezometers, Wetland Boundaries, and Other Key Features of Site 7 (Calf Pasture Point)

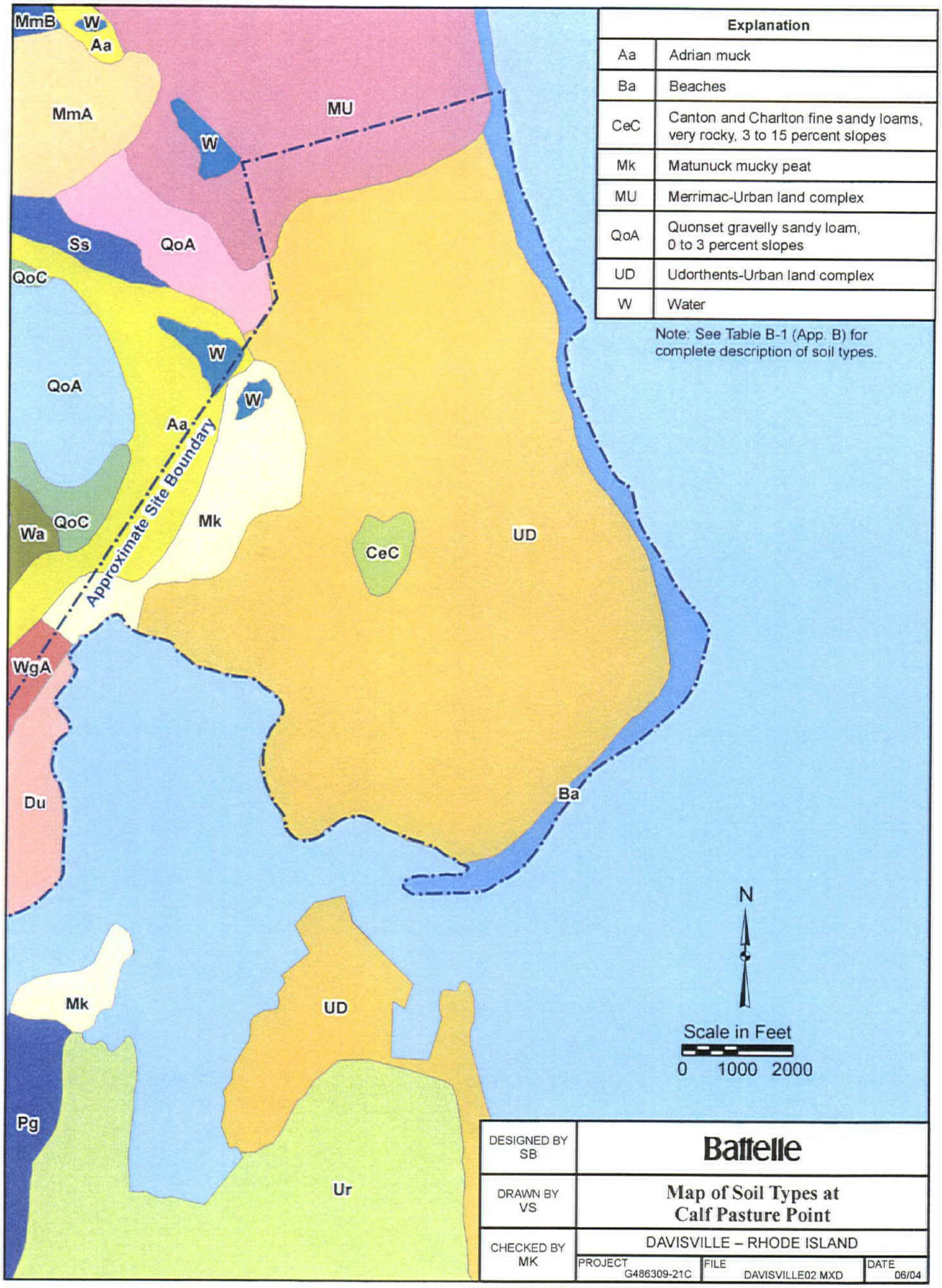

Figure 2-1. Map of Soil Types at Calf Pasture Point

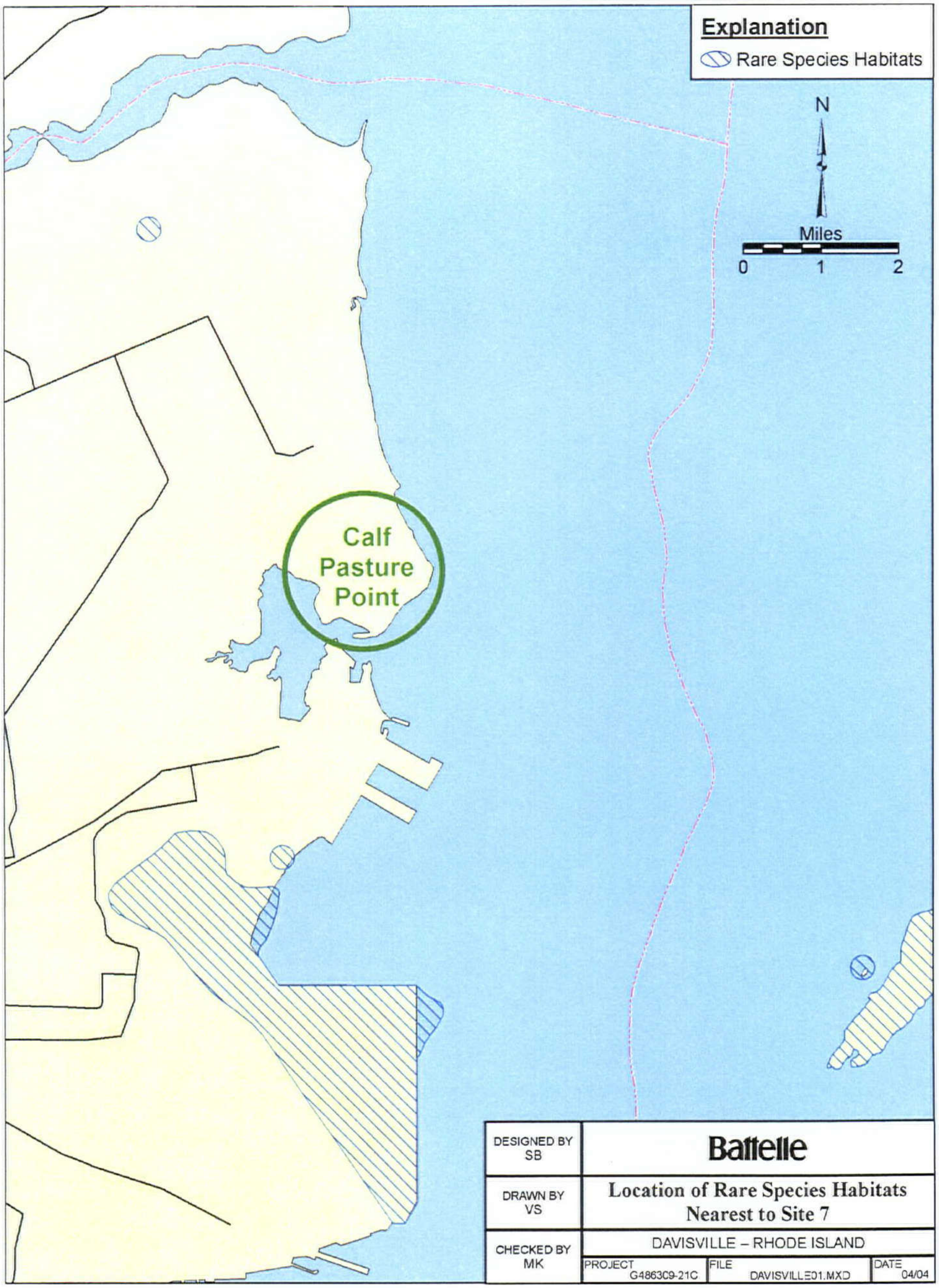

Figure 2-2. Location of Rare Species Habitats Nearest to Site 7

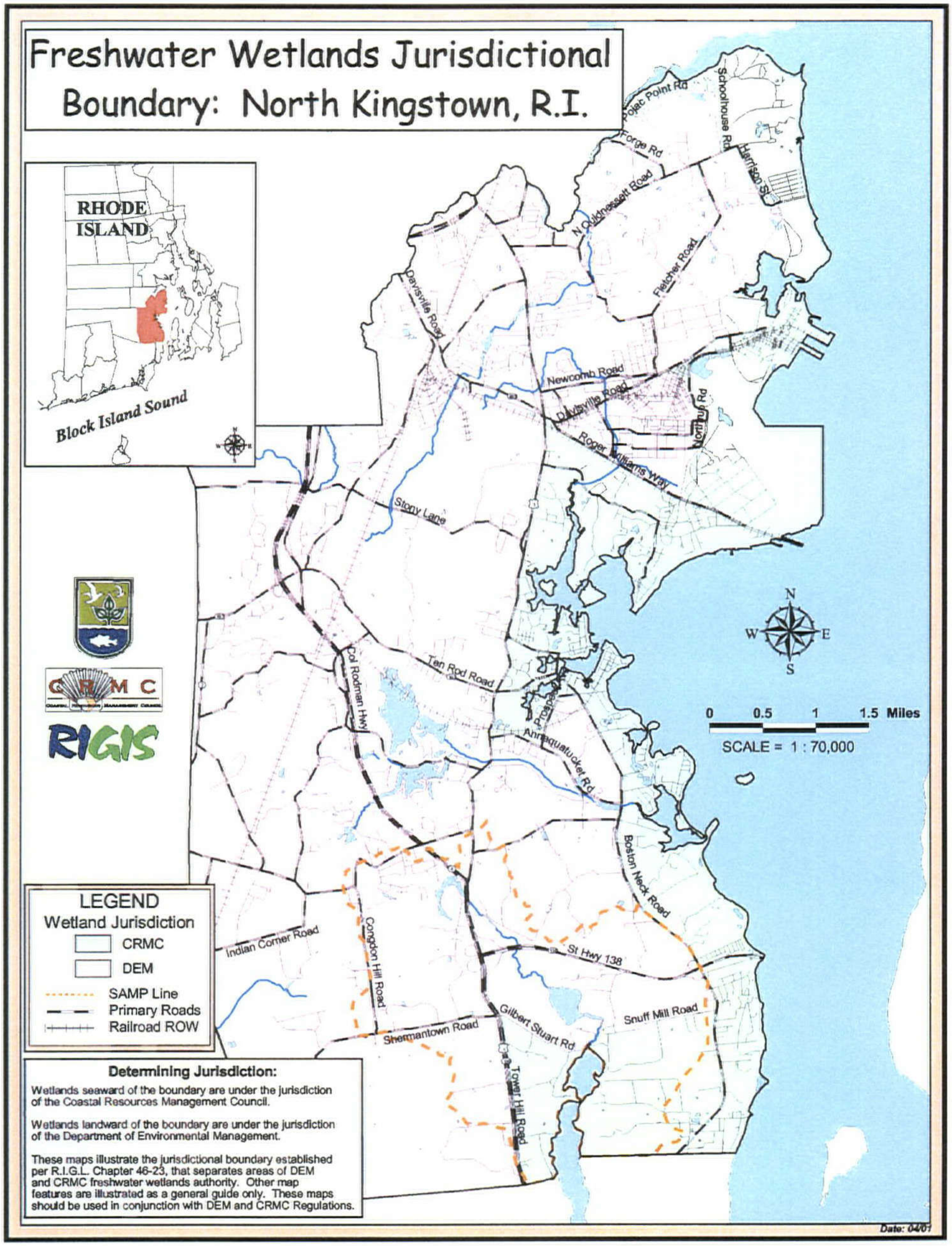

Figure 3-1. Freshwater Wetlands Jurisdictional Boundary for CRMC and RIDEM

Figure 4-1. Use of Hand-Pulled Wagons to Minimize Impacts at Monitoring Wells Located Away from Access Roads

A. *B.* *C.*

Figure 5-1. Installation Method for Passive-Vapor-Diffusion Samplers in Water 0 to 2 ft Deep. (A) passive vapor diffusion sampler secured to wire surveyor flag and tools used for installation, (B) insertion of sampler in space behind flattened surface of steel bar driven into cobble bottom sediments, and (C) passive-vapor-diffusion sampler installed (Source: USGS, 2002).

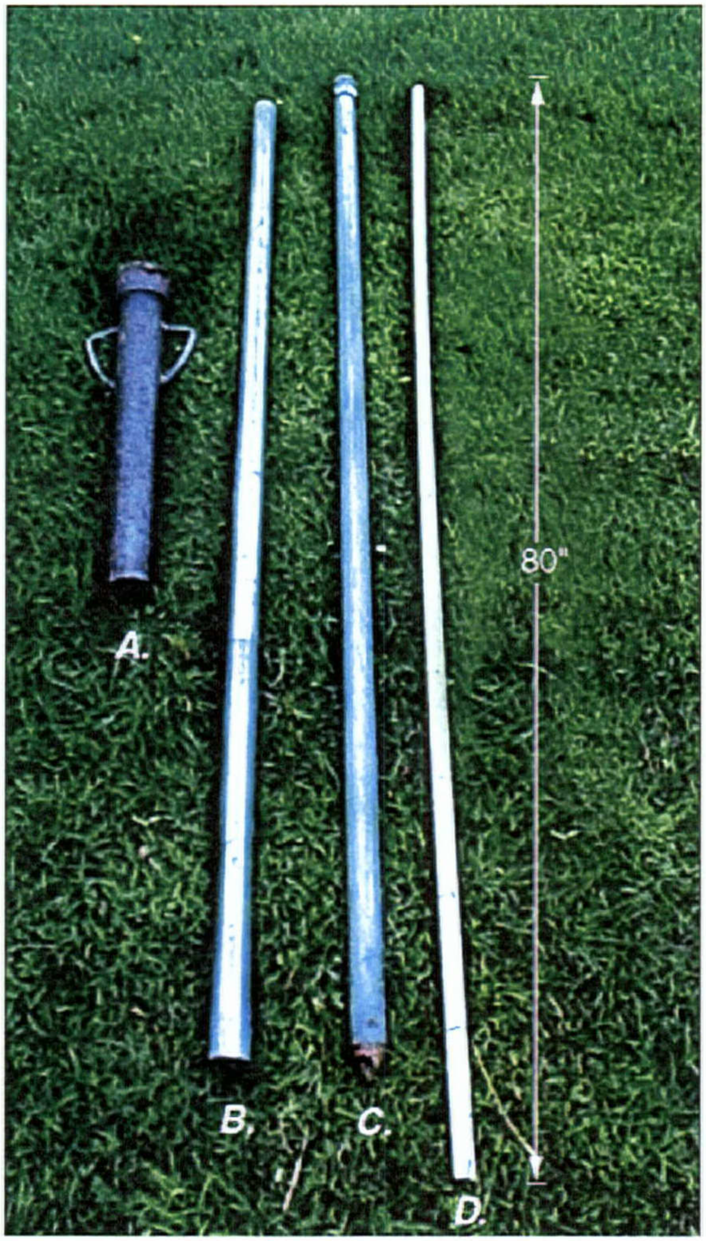

Figure 5-2. Drive-Point Assembly for Installation of Passive-Vapor-Diffusion Sampler in Water 2 to 4 ft Deep in Clayey Silt to Coarse Sand and Gravel Sediments. (A) slide hammer, (B) 1⅝-inch-ID steel electrical conduit, (C) 1⅜-inch-ID steel electrical conduit with machined point, (D) PVC sampler insertion pipe (Source: USGS, 2002).

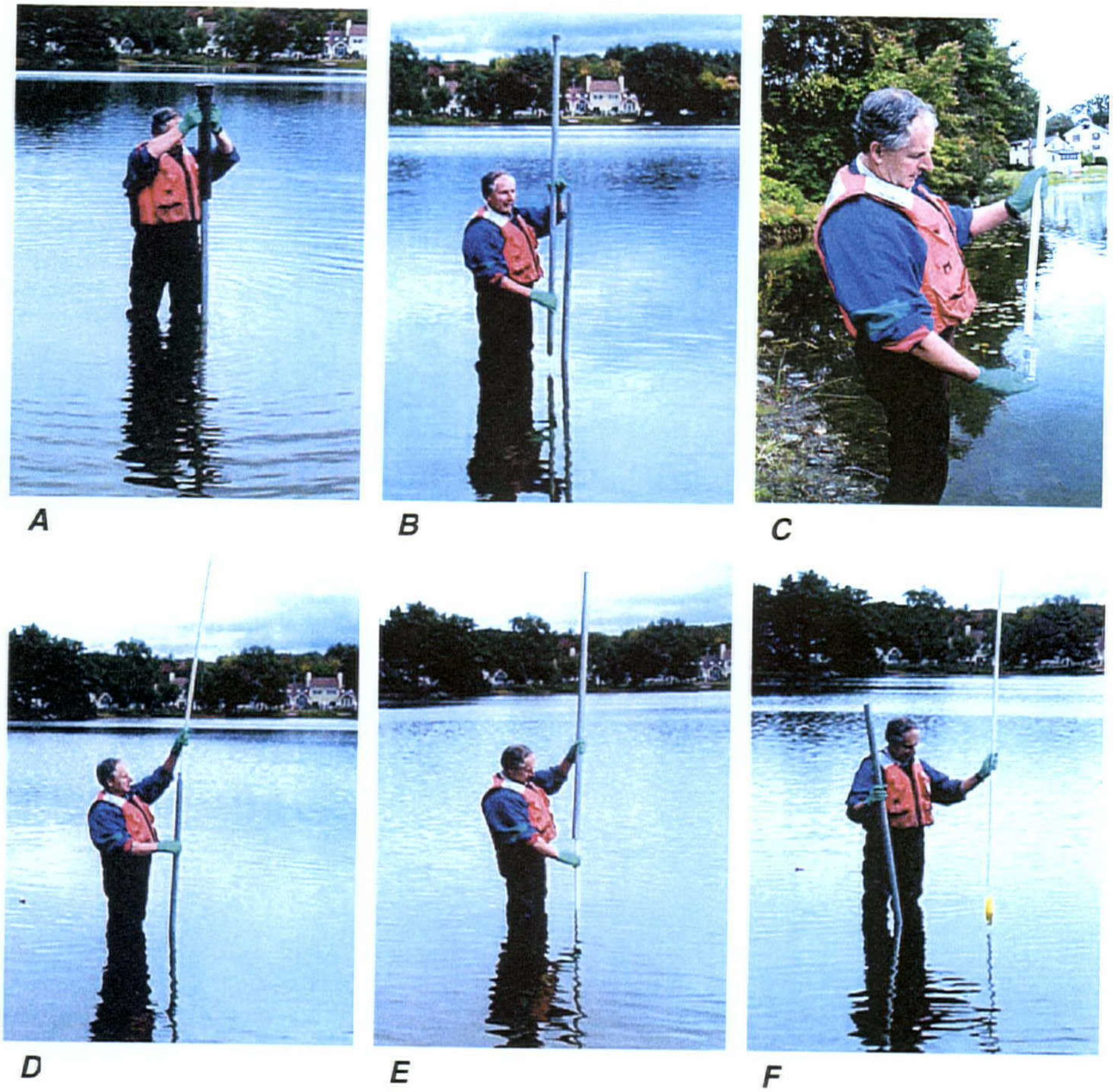

Figure 5-3. Drive-Point Method for Installation of Passive-Vapor-Diffusion Sampler in Water 2 to 4 ft Deep in Clayey Silt to Coarse Sand and Gravel Sediments. (A) 1⅝-inch-ID steel electrical conduit with 1⅜-inch-ID steel insert conduit and 2-inch point driven into pond-bottom sediment with slide hammer, (B) insert pipe removed after driven to desired depth, (C) insertion of passive vapor diffusion sampler to PVC pipe (surveyor flag and wire inserted into pipe with sampler exposed), (D) insertion of PVC pipe with sampler into sediment through 1⅝-inch-ID steel conduit, (E) removal of 1⅝-inch-ID steel conduit, and (F) removal of PVC pipe leaving sampler installed in sediment (Source: USGS, 2002).

TABLES

Table 4-1. Monitoring Wells and Piezometers, Approximate Distance to Nearest Road, and Sampling Frequency

Well	Screened Interval	Approximate Distance to Nearest Road (ft)	Sampling Frequency (months)
MW07-01	S	24	NS
MW07-02	S	17	NS
MW07-03	S	0	NS
MW07-03	D	9	NS
MW07-04	S	17	NS
MW07-04	D	9	9
MW07-05	S	16	NS
MW07-05	D	13	C
MW07-05	R	12	9
MW07-06	S	17	C
MW07-07	S	17	C
MW07-08	S	10	C
MW07-09	D	11	27
MW07-09	R	13	9
MW07-10	S	145	C
MW07-10	D	142	27
MW07-11	D	32	9
MW07-12	D	15	9
MW07-13	S	36	27
MW07-13	D	42	27
MW07-14	D	15	C
MW07-15D	D	23	C
MW07-16	D	213	C
MW07-16	R	207	C
MW07-17	D	14	27
MW07-18	D	20	C
MW07-19	S	18	27
MW07-19	D	17	27
MW07-20	S	266	C
MW07-20	D	259	C
MW07-21	S	129	9
MW07-21	D	133	9
MW07-21	R	135	9
MW07-22	S	15	NS
MW07-22	D	15	27
MW07-23	S	20	C
MW07-23	D	15	9
MW07-24	S	300	C
MW07-24	D	302	C
MW07-24DUT	**	307	9
MW07-25	D	7	9

Well	Screened Interval	Approximate Distance to Nearest Road (ft)	Sampling Frequency (months)
MW07-25	R	7	9
MW07-26	S	11	C
MW07-27	S	36	TBD
MW07-27	D	28	27
MW07-28	D	13	27
MW07-29	D	9	C
MW07-30	D	22	NS
MW07-31	I	15	C
MW07-32	D	NA	offsite
MW07-32	R	NA	offsite
MW07-33	S	185	9
MW07-33	D	182	9
MW07-33	R	181	9
MW07-34	D	13	9
MW07-35	S	80	9
MW07-35	D	83	TBD
MW07-36	S	101	9
MW07-37	S/D	139	TBD
MW07-38	S/D	12	TBD
MW07-39	S/I/D	125	TBD
P07-01	NA	24	9
P07-02	NA	188	9
P07-03	NA	154	9
P07-04	NA	166	9
P07-05	NA	180	9
P07-06	NA	194	9
P07-07	NA	166	9
P07-08	NA	159	9
P07-09	NA	107	9
P07-10	NA	60	9
P07-11	NA	302	9
P07-12	NA	255	9
P07-13	NA	202	9
P07-14	NA	174	9
P07-15	NA	139	9
P07-16	NA	121	9
P07-17	NA	131	9
P07-18	NA	143	9
P07-19	NA	58	9
P07-20	NA	99	9
P07-21	NA	94	9
P07-22	NA	67	9
P07-23	NA	36	9

Well	Screened Interval	Approximate Distance to Nearest Road (ft)	Sampling Frequency (months)
P07-24	NA	51	9
P07-25	NA	157	9
P07-26	NA	170	9
P07-27	NA	174	9
P07-28	NA	164	9
P07-29	NA	143	9
P07-30	NA	106	9
P07-31	NA	57	9
P07-32	NA	29	9
P07-33	NA	35	9

Source: EA, 2003

NS: not sampled.
C: contingency well (not sampled regularly)
TBD: newly installed well (sampling frequency to be determined)
** well is screened in upper portion of the till (D wells are screened in lower portion of the till)
NA: Shoreline piezometers are screened in near-surface sediments approximately 2 to 5 ft bgs
S: shallow screened interval
D: deep screened interval
B: bedrock.

Table 5-1. Alternative Sampling Methods for Permanent Monitoring Wells and Cost Information

Option	Transportation	Air Supply	Power Supply	Other Equipment[1]	Total Capital Cost[2]
			Category 1		
1A	John Deere Gator™ or similar Off-Road Vehicle[3]	12V-DC Compressor	Marine Battery (or self-contained 12V power supply on vehicle)	Battery Charger (for Marine Battery)	---
1A Cost	$10,999 (Diesel) $7,999 (Gas)	$1,495	$370 (for Marine Battery)	$111 (for Marine Battery)	$12,975 (Diesel) $9,975 (Gas) (includes Marine Battery) see footnote 4
1B	Same as 1A	Gas Powered Compressor with self-contained power source	Included on compressor	None	---
1B Cost	Same as 1A	$257	---	---	$11,256 (Diesel) $8,256 (Gas) see footnote 5
1C	Same as 1A	AC Compressor	Generator	air compressor hose	---
1C Cost	Same as 1A	$200	$1,080	$30 (100 ft)	$12,309 (Diesel) $9,309 (Gas) see footnote 6
			Category 2		
2A	DR® Power Wagon	12V-DC Compressor	Marine Battery	Battery Charger	---
2A Cost	$1,844	$1,495	$370	$111	$3,820
2B	Same as 2A	Gas Powered Compressor with self-contained power source	Included on compressor	None	---
2B Cost	Same as 2A	$257	---	---	$2,101
2C	Same as 2A	AC Compressor	Generator	air compressor hose	---
2C Cost	Same as 2A	$200	$1,080	$30 (100 ft)	$3,154
			Category 3		
3A	Pull Cart	12V-DC Compressor	Marine Battery	Battery Charger	---
3A Cost	$230	$1,495	$370	$111	$2,206
3B	Same as 3A	Gas Powered Compressor with self-contained power source	Included on compressor	None	---

Table 5-1. Alternative Sampling Methods for Permanent Monitoring Wells and Cost Information (Continued)

Option	Transportation	Air Supply	Power Supply	Other Equipment[1]	Total Capital Cost[2]
3B Cost	Same as 3A	$257	---	---	$487
3C	Same as 3A	AC Compressor	Generator	air compressor hose	---
3C Cost	Same as 3A	$200	$1,080	$30 (100 ft)	$1,540

1. Consumable materials such as gasoline are not included in cost estimates.
2. Assumes all equipment is purchased unless otherwise noted.
3. The John Deere Gator™ is an example of an off-road vehicle with high-flotation tires; other similar vehicles include, for example, the Cushman® Turf Truckster® (see www.tri-king.com/library/2003%20CSH_Turf_Truckster.pdf) and the Toro® Workman® (see http://www.toro.com/golf/vehicle/workman/index.html)
4. Cost for this option assuming rental of off-road vehicle would be $1,976 plus rental cost (~ $350/wk).
5. Cost for this option assuming rental of off-road vehicle would be $257 plus rental cost (~ $350/wk).
6. Cost for this option assuming rental of off-road vehicle would be $1,310 plus rental cost (~ $350/wk).

APPENDIX A

Photos of Habitat Near Various Calf Pasture Point Monitoring Wells

MW07-35S Looking East

MW07-36S Looking South

MW07-33 Looking North

MW07-33 Looking West

MW07-23 Looking South

MW07-21 Looking East

MW07-24 Looking East

APPENDIX B

Soil Types Present at Calf Pasture Point and Their Descriptions

Table B-1. Soil Types of Calf Pasture Point

Map Unit	Map Unit Name	Soil Map Unit Description from the Soil Survey of Rhode Island
Aa	Adrian muck	This nearly level, very poorly drained soil is in depressions and small drainageways of glacial till uplands and outwash plains. Most areas are oval and range from 2 to 20 acres. Slopes are dominantly less than 2 percent. Typically the surface layer is black muck 20 inches thick. The substratum extends to a depth of 60 inches or more. It is gray fine sand to a depth of 22 inches and grayish brown gravelly sand at a depth of more than 22 inches. Included with this soil in mapping are small areas of poorly drained Ridgebury and Raypol soils and very poorly drained Carlisle, Scarboro, and Whitman soils. Also included are areas in Newport County that are underlain by loamy material. Included areas make up about 10 percent of this map unit. The permeability of this soil is rapid. Available water capacity is high. Runoff is very slow, and water is ponded on some areas. A few areas adjacent to streams are subject to flooding. The surface layer is strongly acid through slightly acid. This soil has a high water table at or near the surface most of the year. Most areas of this soil are in woodland or have a marsh grass and sedge plant cover. The high water table, ponding, and the low strength of the surface layer make this soil unsuitable for community development. If the soil is drained, the organic material in the surface layer shrinks and subsides, lowering the soil surface. Slopes of excavated areas are unstable. This soil is not suited to cultivated crops. It is limited mainly by wetness, and many areas do not have suitable drainage outlets. This soil is suited to wetland wildlife habitat, but wetness makes the soil poorly suited to woodland wildlife habitat or open-land wildlife habitat. Capability subclass is VIw, woodland group is 5w.
Ba	Beaches	These nearly level to gently sloping areas are along the shore of the ocean. They consist of sand dunes or escarpments and of sandy, gravelly, and cobbly areas that are exposed during low tide. Areas are long and narrow and mostly range from 5 to 60 acres. They are unprotected from the ocean and are subject to severe erosion during storms. Slopes range from 0 to 8 percent. Included with this unit in mapping are small areas of Udipsamments, undulating; rock outcrops; and Matunuck soils. Included areas make up about 5 percent of this map unit. Beaches are used intensively for summer recreation activities such as sun bathing and surf fishing. They are not suitable for woodland wildlife habitat or openland wildlife habitat because of daily inundations, but the areas are suited to wetland wildlife species that thrive in saltwater. Capability subclass VIIIw; woodland group not assigned.

Table B-1. Soil Types of Calf Pasture Point (Continued)

Map Unit	Map Unit Name	Soil Map Unit Description from the Soil Survey of Rhode Island
CeC	Canton and Charlton fine sandy loams, very rocky, 3 to 15 percent slopes.	These gently sloping to sloping, well-drained soils are on side slopes and crests of glacial upland hills and ridges. Stones and boulders cover 2 to 10 percent of the surface, and rock outcrops cover up to IC percent. Areas are irregular in shape and mostly range from 3 to 250 acres. The mapped acreage of this unit is approximately 50 percent Canton soils, 30 percent Charlton soils, and 20 percent other soils. The areas of this unit consist of either Canton soils or Charlton soils or both. The soils were mapped together because they have no major differences in use and management. Typically the Canton soils have a surface layer of very dark grayish brown fine sandy loam about 3 inches thick. The subsoil is dark yellowish brown, yellowish brown, and light olive brown fine sandy loam 19 inches thick. The substratum is olive gray and light olive gray gravelly loamy sand to a depth of 60 inches or more. Typically the Charlton soils have a surface layer of very dark brown fine sandy loam about 2 inches thick. The subsoil is 25 inches thick. The upper 15 inches is dark yellowish brown fine sandy loam, and the lower 10 inches is yellowish brown gravelly sandy loam. The substratum is light brownish gray gravelly sandy loam to a depth of 60 inches or more. Included with these soils in mapping are small areas of somewhat excessively drained Gloucester soils, well-drained Paxton and Narragansett soils, and moderately well-drained Sutton soils. Also included are small areas of soils that have slopes of more than 15 percent, small areas of soils where more than 10 percent of the surface is stony, and areas where bedrock is less than 40 inches from the surface. The permeability of the Canton soils is moderately rapid in the surface layer and subsoil and rapid in the substratum. Available water capacity is moderate, and runoff is medium. This soil is extremely acid through strongly acid. The permeability of the Charlton soils is moderate to moderately rapid. Available water capacity is moderate, and runoff is medium. This soil is very strongly acid through medium acid. Most areas of these soils are in woodland, and the soil is suited to trees. A small acreage is cleared and used for pasture. These soils are suitable for community development but are limited by stoniness, bedrock outcrops, and slope. On-site sewage disposal systems need careful design and installation to prevent effluent from seeping to the surface. Stones and boulders need to be removed for landscaping. The use of straw bale sediment barriers, siltation basins, and temporary diversions and quickly establishing plant cover help to control erosion during construction.. Stones and rock outcrops make these soils unsuitable for cultivated crops and severely hinder the use of farming equipment. These soils are suitable for woodland wildlife habitat. Stoniness and rock outcrops limit suitability for openland wildlife habitat, and the soils are too dry to provide wetland wildlife habitat. Capability subclass VIs; Canton part in woodland group 5o, Charlton part in woodland group 4o.

Table B-1. Soil Types of Calf Pasture Point (Continued)

Map Unit	Map Unit Name	Soil Map Unit Description from the Soil Survey of Rhode Island
Mk	Matunuck mucky peat	This nearly level, very poorly drained soil is in tidal marshes and is subject to tidal inundation. Most areas are in salt marshes. Slopes are dominantly less than 1 percent. Typically this soil has a surface layer of very dark gray mucky peat 12 inches thick. The underlying material is gray sand to a depth of 60 inches or more. Included with this soil in mapping are a few small areas of very poorly drained Ipswich soils and small areas of soils with a surface layer 16 to 51 inches thick or less than 12 inches thick. Included areas make up about 5 percent of this map unit. The permeability of this soil is rapid in the surface layer, rapid to very rapid between depths of about 12 and 18 inches, and very rapid at a depth of more than 18 inches. Available water capacity is low. Runoff is very slow, and water is ponded on some areas. The soil is strongly acid through neutral. The daily tidal flooding and a high salt content make this soil unsuitable for most uses except as habitat for saltwater-tolerant wildlife. Capability subclass VIIIw; not assigned to a woodland group.
MU	Merrimac-Urban land complex	This complex consists of well-drained Merrimac soils and areas of Urban land. The complex is on terraces and outwash plains in densely populated areas of the state, mainly in the areas of Providence and Warwick. Areas are irregular in shape and mostly range from 10 to 400 acres. Slopes are mainly about 1 percent but range from 0 to 15 percent. The complex is about 40 percent Merrimac soils, 40 percent Urban land, and 20 percent other soils. The soils and urban land are so intermingled that it was not practical to map them separately. Typically the Merrimac soils have a surface layer of dark brown sandy loam 8 inches thick. The subsoil is yellowish brown and dark yellowish brown sandy loam 17 inches thick. The substratum is light yellowish brown gravelly sand to a depth of 60 inches or more. Urban land consists of areas covered by streets, parking lots, buildings, and other urban structures. Included with this complex in mapping are areas, up to 10 acres in size, of Udorthents, excessively drained Hinckley and Windsor soils, well-drained Agawam and Enfield soils, and moderately well-drained Sudbury and Ninigret soils. Also included are areas of darker colored soils. The permeability of the Merrimac soils is moderately rapid in the surface layer and upper part of the subsoil, moderately rapid to rapid in the lower part of the subsoil, and rapid in the substratum. The available water capacity is moderate. Runoff is slow to medium on the Merrimac soils. The soil is extremely acid through medium acid. This complex is mainly used for home sites, shopping centers, industrial parks, and other urban purposes. The home sites mostly range from 5,000 to 50,000 square feet. On-site septic systems in this complex need careful design and installation to prevent pollution of groundwater. Slopes of excavated areas are commonly unstable. Lawn grasses, shallow-rooted trees, and shrubs require watering in the summer. The use of straw bale sediment barriers and quickly establishing plant cover help to control erosion during construction. Areas of this complex require on-site investigation and evaluation for most uses. Capability subclass and woodland group not assigned.

Table B-1. Soil Types of Calf Pasture Point (Continued)

Map Unit	Map Unit Name	Soil Map Unit Description from the Soil Survey of Rhode Island
QoA	Quonset gravelly sandy loam, 0 to 3 percent slopes	This nearly level, excessively drained soil is on terraces and outwash plains. Areas are irregular in shape and range mostly from 5 to 75 acres. Typically the surface layer is very dark gray gravelly sandy loam about 3 inches thick. The subsoil is dark yellowish brown and light olive brown gravelly loamy sand. The substratum is dark gray very gravelly sand to a depth of 60 inches or more. Included with this soil in mapping are small areas of excessively drained Windsor and Hinckley soils, somewhat excessively drained Merrimac soils, well drained Agawam soils, and moderately well-drained Sudbury soils. Included areas make up about 10 percent of this map unit. The permeability of this soil is moderately rapid or rapid in the surface layer and subsoil and very rapid in the substratum. Available water capacity is low, and runoff is slow. The soil is extremely acid through strongly acid in the surface layer and subsoil and strongly acid through slightly acid in the substratum. This soil is suitable for community development. On-site septic systems need careful design and installation to prevent pollution of groundwater. Slopes of excavated areas are commonly unstable. Lawn grasses, shallow-rooted trees, and shrubs require watering in summer. This soil is suited to trees, but most areas are cleared and used for farming. The main limitation for woodland is droughtiness; seedling mortality is high during dry summers. This soil is suited to cultivated crops. Irrigation is needed. Cover crops and the return of crop residue to the soil help to maintain tilth and organic mailer content. This soil is suited to woodland wildlife habitat and openland wildlife habitat. It is too dry to provide wetland wildlife habitat. Capability subclass IIIs; woodland group 5s.
UD	Udorthents-Urban land complex	This complex consists of moderately well-drained to excessively drained soils that have been disturbed by cuffing or filling, and areas that are covered by buildings and pavement. The areas are mostly larger than 5 acres. The complex is about 70 percent Udorthents, 20 percent Urban land, and 10 percent other soils. Most areas of these components are so intermingled that it was not practical to map them separately. Udorthents are in areas that have been cut to a depth of 2 feet or more or are on areas with more than 2 feet of fill. Udorthents consist primarily of moderately coarse-textured soil material and a few small areas of medium-textured material. Included with this complex in mapping are areas, up to 10 acres in size, of undisturbed soils. Also included are a few areas that are entirely Udorthents. Most cut areas were used as a source of fill material, but in some areas cuts were made in order to level sites for buildings, recreational facilities, and roads. Most of the filled areas were built up and leveled for urban development. In some areas fill has been used to build up recreational areas and highways. The permeability and stability of this unit are variable. The unit requires on-site investigation and evaluation for most uses. Capability subclass and woodland group not assigned.

Source: from Soil Survey of Rhode Island, 1981 (http://nesoil.com/ri/)

APPENDIX C

Equipment Specifications

TRANSPORTATION OPTIONS

New Equipment
Gator™ Utility Vehicles
Traditional Series
- Game: Gator Race
- TH 6x4
- Features
  - Specifications
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Product Selection Tools
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Products By Task
Non-Current Equipment
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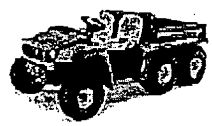
Gator™ TH 6x4



Features

- New Lower List Price: $7,999.00* (U.S.)
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- In-store pickup or delivery available
- Usually available in 3 to 7 days

ADD TO CART

Reliable/Durable
- 675 cc, air-cooled, two cylinder, 4-cycle Kawasaki gasoline engine
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- Heavy duty industrial drive chain (#60) and reinforced hitch channel for extreme hauling and towing capability
- Towing capacity of 1,400 lb (635 kg) on level terrain
- 16-gauge steel, 11.2 cu ft capacity cargo box hauls up to 1000 lb (454 kg)

Stable
- Low center of gravity enhances stability and handling for assurance at higher speeds and on inclines

Ability to Go Anywhere
- Rear wheels provide full-time four-wheel drive for improved traction
- Rear traction assist locks the rear drive wheels together to push through tough spots
- High-flotation tires result in minimal ground impaction
- Top speed of 20 mph (32 km/h)

Easy to Use
- Best-in-class 25 inch (63.5 cm) cargo box load height allows for easy loading and unloading
- Features include high-back seats, cup holders, 12v outlet, glove box, and fuel gauge

New Equipment

Gator™ Utility Vehicles

Traditional Series

- Game: Gator Race
- 6x4 Diesel
  - Features
  - Specifications
  - Attachments
  - Manuals
  - Literature
  - Literature
  - Warranty
  - Build Your Gator 6x4 Diesel
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Product Selection Tools
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Products By Task
Non-Current Equipment
Used Equipment
Product Search
Equipment Quickfind
Product Safety
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Gator™ 6x4 Diesel

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- In-store pickup or delivery available
- Usually available in 3 to 7 days

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- Low center of gravity enhances stability and handling
- Tight, 24.8-ft. turning clearance circle
- 16-gauge-steel, 11.2 cu. ft. capacity cargo box hauls up to 1,000 lb.
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List price: $10,999.00* (U.S.)

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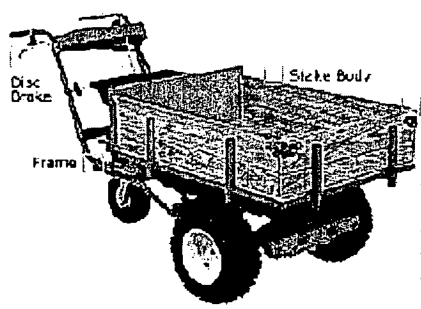

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If you are not satisfied with your DR® within 6 months of your original ship date (30 days for commercial use), we ask that you call us. If we cannot resolve what is causing dissatisfaction, you can return your machine for a complete refund of your purchase price, including shipping and handling both ways (within the contiguous 48 United States and Canada).

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Your machine is guaranteed for two full years from the original ship date to be free from defects in materials or workmanship in residential use (90 days for commercial use).

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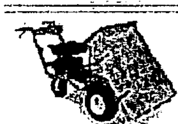
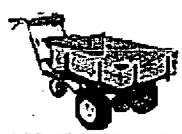
PREV

DR® POWERWAGON™ Models and Pricing

MODEL LINE	ITEM	PRICE
 PRO Package	DR® 6.75HP Pro Pack Powerwagon - w/ POWERED LIFT MORE INFO	~~$2,566.00~~ Sale $2,234.40
 6.75 HP PRO Model	DR® 6.75 HP Pro Powerwagon, Electric-Start WITH Powered Lift MORE INFO	~~$2,348.00~~ Sale $2,113.20
	DR® 6.75 HP Pro Powerwagon, Electric-Start MORE INFO	~~$2,049.00~~ Sale $1,844.10
	DR® 6.75 HP Pro Powerwagon, Manual-Start MORE INFO	~~$1,959.00~~ Sale $1,763.10

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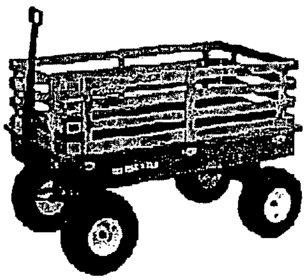

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Ground Water Well Sampling Systems

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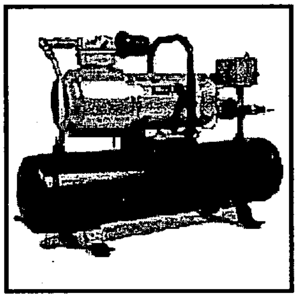

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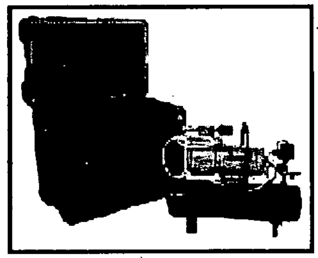

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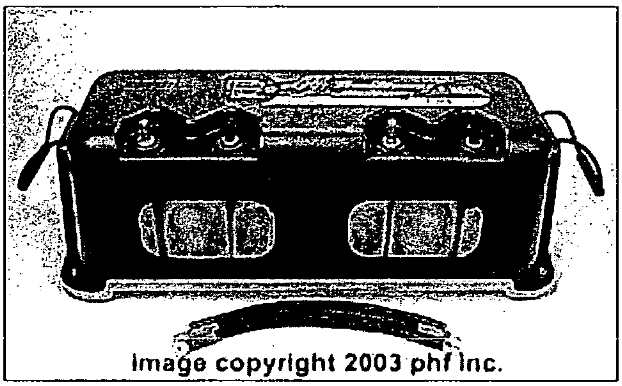
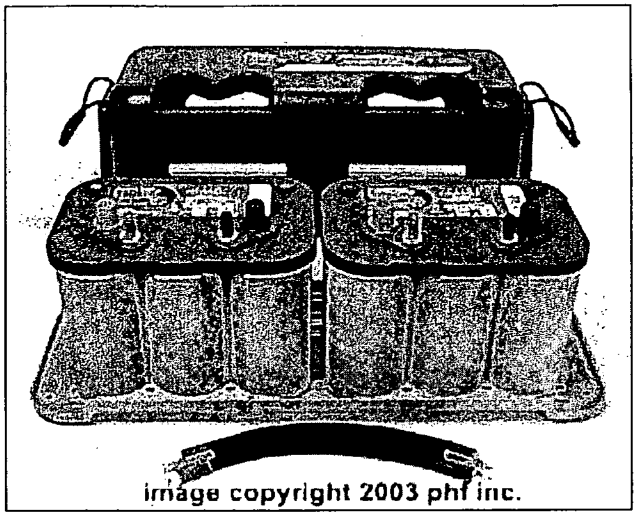
Optima Troll Fury Blue Top Battery, Open View



Above: Optima Troll Fury (Optima Model TF1800.)

Below: Optima Troll Fury (Optima Model TF1800) shown with case open, showing two D34M batteries.

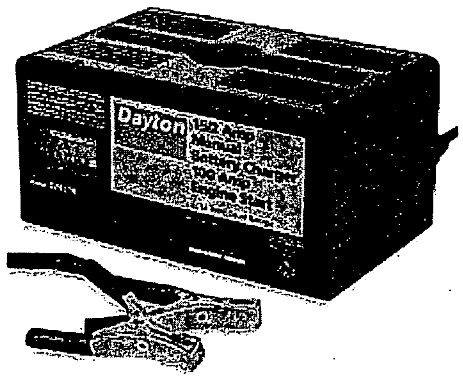


(Note: Optima D31M, D31A and D31T batteries will NOT fit inside a Troll Fury case... the case will only hold 34-series batteries.)

Use Back Buttton to return to previous page *[or click here for info on the Optima Troll Fury Blue Top at 1st Optima Battery home page.]*

GRAINGER
FOR THE ONES WHO GET IT DONE

Print *printed* November 14, 2006



Battery Charger

Battery Charger, UL Rated Current @ 6V 15 Amps, UL Rated Current @ 12V 15/2 Amps, Primary AC Input Current 2.7 Amps, Charge Time for 12V Battery 12-14 Hours, Charge Time for 6V Battery 2-4 Hours, UL Rated Starting Current 100 Amps, Charge Time 2-3 Hours, 6/12 Manual (M) Volts, Taper to Amps 8/1, Overall Height 5 1/8 Inches, Overall Width 9 5/8 Inches, Overall Depth 7 1/4 Inches, 6/12 Manual (M) Volts, Engine Starter with 10 Amps Booster

Grainger Item #	3Z631
Price (ea.)	**$110.95**
Brand	DAYTON
Mfr. Model #	3Z631N
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	18.0
Usually Ships	Today
Catalog Page No.	1281

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Additional Info

- **Battery Chargers and Starters**
- Automatic reset circuit breakers protect against overload and reversed connection damage.
- Large clamps grip securely to top or side battery terminals. Include rugged steel case with convenient carrying handle.

- For 120V, 60 Hz operation, UL Listed
- Color-coded ammeters

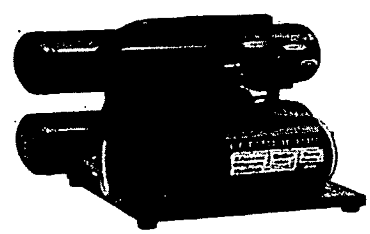
- **Manual 6- and 12-Volt**
- Charging tapers to approx. 1/2 of rated output as power builds in battery.
- Manual battery chargers must be unplugged when charge is complete to prevent damaging battery.

- **No. 3Z631, 15/2/100 Amp**

- 15A, 6V for cars, light-and medium-duty trucks, tractors with 6V systems
- 15A, 12V for cars, light to medium-duty trucks; tractors, vans with 12V systems
- 2A, 12V for motorcycles, snowmobiles, and riding mowers
- 100A engine starting power; spins engine after minimal pre-charging

OPTION "B" EQUIPMENT

[Home > Home Catalog > Compressors > Coleman Powermate CS0200412 125-Psi 2-Gallon Contractor Air Compressor]



Click to Enlarge

Coleman Powermate CS0200412 125-Psi 2-Gallon Contractor Air Compressor

Availability: Usually ships within 7-10 business days

CS0200412 Regular Price: $506.41

One Stop Shop Catalog Price: **$256.98**

Add to Cart

Coleman Powermate CS0200412 125-Psi 2-Gallon Contractor Air Compressor. Best suited for everyday use.

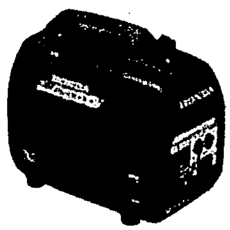
FEATURES:
- Comes fully assembled and ready to use
- "Twin Stack" tank design for easy portability
- Automatic thermal overload protection
- Includes regulator, tank, working pressure gauges, and on/off switch
- Oil-free, low maintenance operation

SPECIFICATIONS:
- MODEL NO. CS0200412
- MAX PRESSURE 95 - 125 PSI
- CFM @ 40 PSI 5.7
- CFM @ 90 PSI 4.0
- MOTOR 2 Peak HP
- VOLTAGE/AMPS 120
- AIR TANK Two-2 Gallon tanks
- PUMP Oil Free Direct Drive
- WEIGHT 60 lbs.
- WARRANTY 2 year

To check on shipping costs for this item, click on the Estimate Shipping Only button below...however, if you wish to place an order for this item you will need to click on the "Add to Cart" button above and then continued shopping OR checkout from there.

OPTION "C" EQUIPMENT

Super Quiet Generator **EU2000*i***



MSRP $1079.95*

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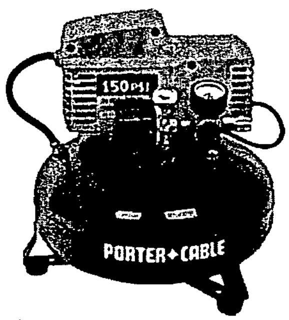
*Manufacturer's suggested retail price. Price excludes applicable taxes. Dealer sets actual selling price.

EU2000*i* Features & Benefits

- Honda Overhead Cam Engine
- Lightweight and Compact
- High Quality, Stable and High Power Output
- Quiet Operation
- Low Fuel Consumption
- Parallel Operation Capability
- Oil Alert®
- Electronic Ignition
- Simultaneous AC/DC use
- Electronic Circuit Breakers
- Inverter (Computer Friendly)
- One Switch for Engine/Fuel Valve On/Off
- USDA-Qualified Spark Arrestor/ Muffler
- Fully Enclosed for Quieter Operation
- EcoThrottle™(load dependent operation)
- 2 Year Residential Warranty
- 1 Year Commercial Warranty

EU2000*i* Specifications

Engine	3.5 HP, Single Cylinder, Overhead Cam, Air Cooled
Displacement	98.5 cc
AC Output	120V 2000W max. (16.7A) 1600W rated (13.3A)
Receptacles	20A 125V Duplex NEMA Plug Number: 5-20P
DC Output	12V, 96W (8A)
Starting System	Recoil
Fuel Tank Capacity	1.1 gallons
Run Time on One Tankful	4 hrs. @ rated load 15 hrs. @ 1/4 load
Dimensions (L x W x H)	20.1" x 11.4" x 16.7"
Noise Level	59 dB @ rated load 53 dB @ 1/4 load
Dry Weight	46.3 lbs.



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Porter Cable Pancake Portable Air Compressor — 6 Gallon, 2 HP Peak, 120 Volt, Model# CPFAC2600P

Durable oil-free pump requires no maintenance. Long-life motor with replaceable brushes starts easily under low-voltage conditions. Built-in automatic thermal overload protection. High Flo air regulator for more work at higher pressure (110 PSI start and 150 PSI stop pressure switch). 6-gallon tank supports heavy usage of stapler, brad and finish nailer. OSHA certified. U.S.A.

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Only $199.99

Guaranteed Lowest Price

Qty 1

ADD TO CART

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Ship Wt. 40.0 lbs

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PORTER·CABLE

DETAILED SPECS | ACCESSORIES | WARRANTY | HELPFUL TOOLS

- Motor: 2 peak HP motor
- Volts: 120Volt/15Amp
- PSI: 3.7 CFM @ 40 PSI; 2.6 CFM @ 90 PSI
- Max PSI: 150 PSI
- Tank Size: 6 gallon capacity tank
- Air Outlet: 1/4in. NPT
- Aluminum Cooling Fans
- Dimensions: 18 1/2in.H
- U.S.A.
- Model CPFAC2600P

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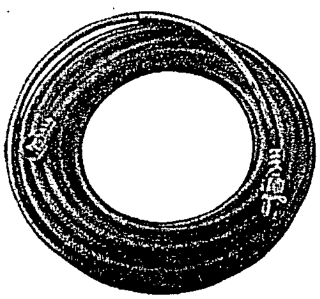

Northern Industrial Tools Air Hose — 3/8in. x 100ft, Green, Urethane

New! High–quality hoses from Northern! A new line of hoses in response to the demand for a greater selection of longer, more durable hoses with higher–quality hose fittings.

Be the first to write a review.

Item# 1586668

Only $29.99

Guaranteed Lowest Price

Qty 1

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Ship Wt. 14.0 lbs

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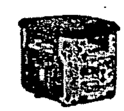
DETAILED SPECS | ACCESSORIES | WARRANTY | HELPFUL TOOLS

- High–quality sub–zero–functioning green urethane
- 3/8 in. x 100 ft.

YOUR RECENTLY VIEWED ITEMS

Item# 159185
Northern Industrial Tools Air Hose Reel With Hose — 3/8in. x 50ft. Hose, Max. 250 PSI

Item# 100033
Porter Cable Pancake Portable Air Compressor — 6 Gallon, 2 HP Peak, 120 Volt, Model# CPFAC2600P



Item# 164063
Coleman Sport Generator — 3.5 HP, 1850 Watt, Gasoline, Model# PM0401856

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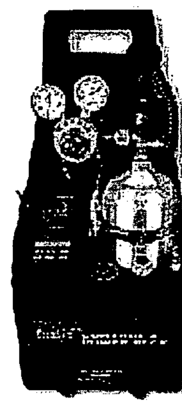
QED MP15 MicroPurge® basics™ Sample Pack

MP15 Digital Control & Power Backpack

The Ultimate in Portable Control and Power for Low-Flow Sampling

The MP15 MicroPurge® Backpack combines advanced low-flow control with the quiet power of a built-in compressed gas source, for the ultimate in portability and ease of use in sampling ground water with bladder pumps.



The MicroPurge® MP15 Controller revolutionizes low-flow ground water sampling with advanced logic control of purge flow and well drawdown. Simple up-down arrow keys increase and decrease purge flow to meet low-flow requirements. Once optimized, settings can be easily recalled in the next round of sampling.

Portable power to sample ground water with any bladder pump

The easy, advanced MicroPurge flow rate and drawdown control features are housed in a molded case along with a lightweight CO_2 cylinder, putting everything you need to operate bladder pumps into one easily portable unit. A standard padded nylon case protects the MP15 MicroPurge control & power pack in transport, provides over-the-shoulder on-site carrying convenience, and even has a hook on the back to let you hang it from the well casing during sampling.

With this combination, a complete sampling setup can be carried by a single person, to reach wells where trucks or even compressor carts can't go.

The 5 lb (2.3 kg) capacity CO_2 cylinder provides hours of sampling power, and is easily refilled. But the MP15 isn't just for remote monitoring wells. Its built-in bypass fitting allows it to be used with larger cylinders or other gas sources, extending your range even more.

The MP15 also offers an easy way to prevent excessive drawdown during purging of monitoring wells, by linking to the optional MP30 Drawdown/Water Level Meter.

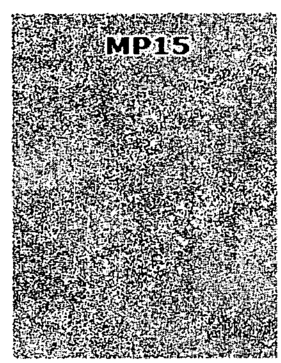
The lightweight, compact MP15 leads the field with genuine MicroPurge low-flow ground water sampling equipment, the most complete line of equipment for low-flow sampling.

QED's MicroPurge groundwater sampling equipment is lighter and more portable, and increases sampling crew productivity. Simplified, sealed electronics are put together in a design that delivers famous QED long term durability and value under true field use conditions.

Simple, stable, repeatable flow rate setting

The MicroPurge basics Controller's six-button keypad is your gateway to the control and power of the most advanced low-flow bladder pump control system ever made. With remarkable ease, you will achieve precise, stable control of low pumping rates, quickly and repeatably, from one sampling event to the next.

How the MP15 Works



The 5 lb. CO_2 cylinder provides hours of sampling power, and is easily refilled. But the MP15 isn't just for remote wells. Its built-in bypass fitting allows it to be used with larger cylinders or other gas sources, extending your range even more.

Simple, stable, repeatable flow rate setting

The MicroPurge **basics** Controller's six-button keypad is your gateway to the control and power of the most advanced low-flow sampling system ever made. With remarkable ease, you will achieve precise, stable control of low pumping rates, quickly and repeatably, from one sampling event to the next.

QED's third-generation engineering takes advantage of the opportunity for downsized equipment, which is lighter and more portable, reduces equipment cost and increases sampling crew productivity. Dedicated pump systems make sampling even faster and easier, eliminating the need to carry portable pumps and cleaning equipment to the well. Simplified, sealed electronics are put together in a design that delivers famous QED durability and value.

MicroPurge **basics** controllers can be connected to the MP30 Drawdown Meter for optional Automatic Drawdown Control, an industry first.

Multi-mode digital control

The MicroPurge **basics** Controller gives you three easy-to-use operating modes, to cover every sampling protocol and situation.
MicroPurge Mode easily adjusts low-flow rates with "faster/slower" arrow keys to reach desired rates. You don't have to worry about calculating pump cycles or refill and discharge times.
ID Mode instantly recalls optimized settings previously established for each well, providing precise, consistent performance from event to event.
User Set (MN) Mode provides manual control of pump operation for extreme depths and other special cases.

Backpack portability makes the MP15 a powerful tool for faster, more efficient sampling at remote sites. With alternate air supply fitting, it also works great at closer wells.

Can be used with any dedicated bladder pump system, with the use of simple adapters.

System Specifications:

Model No.	MP15
Dimensions	25-1/2"x12-1/2"x10" (65x32x25 cm)
Weight	27 lbs (12 kg)
Case Material	Polyethylene
Carry Bag	Standard
Backpack Straps	Optional
Keypad	6 Keys
Display	2 Line, 16 Character / LCD Display
Power	3 "AA" batteries
Battery Life	50,000 Cycles @ 70°F (21°C)
Max. Pressure	120 PSI (827.6 kPa)
Max. Pump Depth	250 Feet (76 m)
Operating Temperature	-20 - 150°F (-29 - 55°C)
Cylinder:	5 lbs (2.3 kg) CO_2
Cylinder Life:	Over 3 hours at 75 foot pump depth

Connection to MP30 Drawdown Meter	heavy-duty cable (supplied with MP30)

MP15 Purge Capacity*

Pump Depth (ft)	Purge Time (min)
50	400
100	120
150	90
200	50

*Purge times based on 200 ml/min flow rate, full 5 lb. CO_2 cylinder. See the full graph or consult QED for more detail.

More information on Dedicated Ground Water Sampling

Need Help? Call 1-800-624-2026 Product Specifications

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The World Leader in Air Powered Pumps for Remediation, Landfill and Ground Water Sampling

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APPENDIX D

Summary of Metals Data for Site 7

APPENDIX D
Summary of Metals Data for Site 7

Several inorganic analytes (primarily metals) were historically detected above NCBC Davisville background concentrations, a few of which were detected above MCLs. However, the elevated concentrations were likely due to the sampling techniques, the locations of background wells, and the location/nature of Site 7 soil with respect to the adjacent marine (saline) environment (EA, 1999). Of the elevated concentrations of inorganic analytes identified in Site 7 groundwater, excess cancer risks were associated with arsenic and beryllium, and excess non-cancer risks were associated with arsenic, manganese, chromium, aluminum, and thallium.

None of the groundwater samples from the Phase I, II, and III RI had arsenic detected above the AWQC, and only a single sample (63.5 µg/L) was reported above the MCL of 50 µg/L. The second, duplicate sample from the same well revealed an arsenic level below the MCL. During the Phase III RI, samples were collected from all Site 7 wells and analyzed for TAL metals. Only three metals were detected above the primary or secondary MCLs in groundwater samples: iron, manganese, and thallium. The majority of these detections were below previously established background levels and may be related to natural conditions. The higher detections of iron and manganese do not form a pattern that appears to be associated with the detected high concentrations of CVOCs. Although it is possible for iron, manganese, and arsenic to be mobilized from native aquifer materials due to the presence/degradation of organic chemicals, it does not appear to be a dominant process at Site 7. The ROD also states that metals in shoreline sediment were not attributed to the conditions at Site 7 (EA, 1999).

Based on the information gathered in the three RIs, the Conceptual LTMP developed a monitoring strategy that states that the collected groundwater samples will be analyzed for a list of analytes, including the Site 7 primary COCs. Targeted metals in the list of primary COCs include dissolved and total arsenic, manganese, aluminum, beryllium, chromium, antimony, iron, lead, and nickel. Table D-1 summarizes the dissolved concentrations for the monitored metals for which a regulatory level exists and indicates that antimony, arsenic, and lead exceeded the PAL. The two elevated antimony detections occurred in MW07-04D (located in the source area) and MW07-33S (located 400 ft west of source area). The arsenic detection above the PAL occurred in several wells including MW07-24DUT, MW07-39I, MW07-39S, MW07-13S, and MW07-38D. These wells are in various locations across the western, central and southern portions of the site. Lead concentrations exceeded the PAL in each well during the initial monitoring event in August 2001, but did not exceed the PAL in any sample during the four subsequent events.

In addition to performing metals analyses on groundwater samples, the Conceptual LTMP calls for one sediment sample to be analyzed for targeted metals at the location of the highest previously detected CVOC concentrations. During the February 2003 monitoring event, a sediment sample was collected from piezometer P07-05, which is located due south of source area. Results from the sediment sample indicated the following concentrations: antimony (ND), arsenic (1.6 mg/kg), beryllium (ND), chromium (4.9 mg/kg), and lead (3.3 mg/kg [estimated value]). During the December 2003 monitoring event, a sediment sample was collected from piezometer P07-09, which is located due south of the source area. Results from the sediment sample indicated the following concentrations: antimony (ND), arsenic (ND), beryllium (0.92 mg/kg [estimated value]), chromium (15 mg/kg [estimated value]), and lead (11 mg/L [estimated value]).

According to the Conceptual LTMP, monitoring will be conducted according to rule-based decisions that are outlined in a decision flow diagram. The decision flow diagram indicates that there will be no reduction in the analyte list during the initial 5-year monitoring period, even if a particular primary COC does not exceed the PAL during subsequent monitoring events conducted during this period.

Table D-1. Summary of Dissolved Concentrations for Regulated Metals (Based on Data Collected During Long-Term Monitoring)

Analyte	Action Level (μg/L)	Monitoring Event	Number of Samples	Number of Detections	Number of Detections above Action Level	Maximum Detection (μg/L)
Antimony	6	01 - Aug 2001	16	0	0	ND
		02 - May 2002	26	0	0	ND
		03 - Feb 2003	18	2	2	**25**(1)
		04 - Dec 2003	18	3	0	0.66
		05 – Aug 2004	82	5	0	3.3(2)
		06 – May 2005	60	2	0	3.8(2)
Arsenic	10	01 - Aug 2001	16	0	0	ND
		02 - May 2002	26	2	1	**10.7**
		03 - Feb 2003	18	0	0	ND
		04 - Dec 2003	18	18	3	**19.8**
		05 – Aug 2004	82	39	6	**64.8**
		06 – May 2005	60	1(3)	1	**17.6**(2)
Beryllium	4	01 - Aug 2001	16	0	0	ND
		02 - May 2002	26	0	0	ND
		03 - Feb 2003	18	0	0	ND
		04 - Dec 2003	18	12	0	0.13(2)
		05 – Aug 2004	82	20	0	0.27(2)
		06 – May 2005	60	0	0	ND
Chromium	100	01 - Aug 2001	16	0	0	ND
		02 - May 2002	26	7	0	1.9
		03 - Feb 2003	18	5	0	1.9
		04 - Dec 2003	18	18	0	26.1(2)
		05 – Aug 2004	82	26	0	21.9
		06 – May 2005	60	5	0	4.7(2)
Lead	15	01 - Aug 2001	16	16	16	**60.5**(2)
		02 - May 2002	26	1	0	14.3
		03 - Feb 2003	18	0	0	ND
		04 - Dec 2003	18	17	0	0.44(2)
		05 – Aug 2004	82	3	0	10.8
		06 – May 2005	60	0	0	ND

Note: When duplicate samples are collected, only the more elevated of the two results are included.
Bold highlight indicates maximum detection exceeded action level.
PAL: Project Action Level
(1) = Collected from duplicate sample.
(2) = Estimated value.
(3) = Detection limit (11 ug/L) for one sample exceeded the Action Level

APPENDIX E

Responses to U.S. EPA Review Comments on June 2004 Draft Report

Appendix E

Ms. Christine Williams
U.S. Environmental Protection Agency, Region I
1 Congress Street Suite 1100 (HBT)
Boston, MA 02114-2023

SUBJECT: RESPONSES TO COMMENTS – DRAFT SAMPLING RECOMMENDATIONS TO MINIMIZE IMPACTS TO WETLANDS AT SITE 7 (CALF PASTURE POINT), FORMER NAVAL CONSTRUCTION BATTALION CENTER (NCBC) DAVISVILLE, RI

Dear Ms. Williams:

The Navy's responses to EPA comments on the subject document are provided as enclosure (1). Four copies of the response to comments (RTCs) are provided. Based on these comments and responses, the draft document will be revised and resubmitted as final. Please note that, although this document was not finalized earlier, LTM efforts at Calf Pasture Point have been conducted in accordance with the report's recommendations.

If you have any questions, please do not hesitate to contact the Remedial Project Manager, Mr. Curt Frye, at 215-897-4914.

Sincerely,

Dave Barney
BRAC Environmental Coordinator

Enclosure:
1.Responses to EPA Comments, Draft Sampling Recommendations to Minimize Impacts to Wetlands at Site 7, Calf Pasture Point (June 2004), Former Naval Construction Battalion Center (NCBC) Davisville, RI

Copy to:
Mr. Curt Frye, NAVFAC Midlant
Mr. Brian Balukonis, RIDEM
Ms. Maryellen Iorio, USACE
Ms. Kathleen Campbell, CDW Consultants
Mr. Steven King, QDC
Mr. Jon Reiner, Town of North Kingstown
Ms. Lee Ann Sinagoga, TtNUS Pittsburgh
Mr. Stephen Vetere, TtNUS Boston

Responses to U.S. EPA Review Comments on
Draft Sampling Recommendations to Minimize Impacts to Wetlands
at Site 7 (Calf Pasture Point), Former Naval Construction Battalion Center (NCBC)
Davisville, North Kingstown, Rhode Island

1. *EPA would like to discuss a field test of regenerated cellulose dialysis (RCD) diffusion samplers and water diffusion samplers (PDB) for long term monitoring LTM at Calf Pasture Point (CPP) Solvent Disposal Area (OU8) site 7. Please add to an upcoming BCT meeting agenda, if the Navy proposes to use these methods of sampling.*

   Navy Response: The Navy appreciates the EPA's willingness to consider the use of passive sampling techniques at Site 7; however, the Navy has decided to continue to performing groundwater sampling through the 8^{th} long-term monitoring event using the current methods that were established in the Final Quality Assurance Project Plan for Long-Term Monitoring of Site 07 (Calf Pasture Point), Naval Construction Battalion Center,) North Kingstown, Rhode Island (EA, 2001). The Navy may initiate discussions about alternate sampling methods following the 8^{th} sampling event.

2. *Changes to the LTM sampling program should be documented. The CPP quality assurance project plan (QAPP) (July 01, attachment 3) in Section 3.8 states that purge water will be containerized in 55 gallon drums and then consolidated into a 200 to 1000 gal tank for batch treatment then tested for VOCs prior to disposal. Since there are several "paths" across CPP and between wells that are located within wet areas & wetlands, the Navy has changed these procedures to minimize impacts to those areas. I understand smaller buckets are used to containerize purge water & other liquid waste at the effected wells and a vehicle may only be driven in dry areas. I also understand that a wagon is used in wetland areas to mobilize the required sampling equipment and derived waste containers (DW). Please provide a map which indicates which of the current paths the Navy drives vehicles over and which paths the hand drawn wagons are currently being used. Please also provide change pages to the SOP (s) to document current procedures for OU-8-LTM.*

   Navy Response: Recommendations for the LTM program are provided in the report. Currently, the LTM contractor (ECC) accesses the Site 7 area by driving their vehicles along Marine Road to the unimproved dirt road that is the main access for Site 7. They do not, and have not, driven off this dirt access road. The contractor unloads the sampling equipment from the vehicle on the dirt road into small hand pulled wagons (see photos in Figure 4-1). The LTM crew walks from the dirt road to the sampling locations pulling the small wagons loaded with sampling equipment and has never driven their vehicles off the dirt access road. The LTM contractor plans to continue the practice of using hand pulled wagons to mobilize sampling equipment to the wells at Site 7 from the dirt road. Locations sampled using the wagons are shown on the map in Figure 1-1, along with the pathways and trails present at CPP.

3. *The costs listed on table 5-1 are most likely low. The Navy currently has very few linear feet of dry stable roads to utilize at the site. The Town's proposed roads may not be available for a few years.*

   Navy Response: As discussed in the text (page 14), the sampling methods presented on Table 5-1 are for wells that cannot be reached with the standard sampling vehicle (i.e., truck, van). The costs on Table 5-1 are capital costs and were not intended to reflect the labor associated with implementing these alternate methods.

   As described above in Comment #2, the LTM contractor currently drives a truck on the existing dirt road to access the site and uses hand-pulled wagons for transporting sampling equipment to wells located off the existing dirt road.

   The Master Plan for the site indicates that the primary trail constructed at Calf Pasture Point (the Bay Trail) will be 10 to 12 ft wide and is designed to accommodate truck-size vehicles including occasional use by monitoring well drilling rigs. The trails will have a crushed stone base and a stone-dust surface. A schedule for construction of trails has not been determined.

4. *EPA will coordinate with the CRMC to perform a site visit to evaluate the Navy's description of the wetland and non-wetland located wells prior to agreeing with this report on sampling recommendations.*

   Navy Response: Please note that the report does not specify which wells are located in wetland and non-wetland areas. Rather, the sampling recommendations provided in the report provide general guidelines that can be implemented after a determination is made as to which wells are located in wetland areas versus non-wetland areas.

   The Navy had previously thought that the town of North Kingstown was preparing an updated wetland delineation map for Calf Pasture Point that could be used to finalize sampling recommendations for each well. However, an updated wetland delineation has not been prepared to date. Therefore, sampling recommendations should be based on current knowledge and on historical wetlands delineations.

   The most recent description/survey of the wetlands at the site is provided in the Final Environmental Impact Statement for Disposal and Reuse/Redevelopment of the Former Naval Construction Battalion Center, Davisville, Rhode Island (Department of the Navy, 1994). The document was the primary reference used to develop the report on sampling recommendations to minimize impacts to wetlands.

   More recently in 2004, as part of the development of the Site Master Plan, a consulting firm (Natural Resource Services, Inc.) conducted a survey at Calf Pasture Point to determine the area of wetlands that would be impacted by construction of the proposed trail network and prepared a map showing the portions of the trail that would be located in wetland areas (Figure W-2 in the Master Plan). In addition, NRS also identified areas that are suitable for constructing wetlands to offset the loss of wetland area due to trail construction and provided a map showing these areas with respect to the monitoring wells at the site (Figure W-3 in the Master Plan). It should be noted that it is not clear whether the survey conducted by NRS constituted a formal wetland delineation according to USACE guidelines, because the figure shows the location of invasive species. During preparation of the Master Plan, an aerial photo was taken and used for the purpose of wetlands delineation. However, a large-scale photo was used to zoom in and delineate the wetlands at Calf Pasture Point, and no ground truthing was used to confirm the delineation. Because of the uncertainty associated with the wetlands delineation in these maps, the original 1994 delineation was used.