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ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) SITE 6A SOUTHERN AREA OFF-SITE WATER SUPPLY NWIRP CALVERTON NY

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TETRA TECH

Engineering Evaluation/Cost Analysis (EE/CA)
SITE 6A - Southern Area Off-Site Water Supply

Naval Weapons Industrial Reserve Plant
Calverton, New York

Engineering Field Activity Mid-Atlantic
Naval Facilities Engineering Command

Contract Number N62470-08-D-1001

Contract Task Order WE08

November 2009

ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)
FOR
SITE 6A - SOUTHERN AREA
OFF-SITE WATER SUPPLY

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
BAT	Best available technology
bgs	Below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action Navy
CMS	Corrective Measures Study
CTO	Contract Task Order
DCA	Dichloroethane
DCE	Dichloroethene
EBCT	Empty bed contact time
EE/CA	Engineering Evaluation/Cost Analysis
ER	Environmental Restoration
FFS	Focused Feasibility Study
FS	Feasibility Study
ft/day	Feet per day
GAC	Granular activated carbon
GOCO	Government-Owned-Contractor-Operated
gpm	Gallons per minute
HSPE	High-Density Polyethylene
IAS	Initial Assessment Study
MCL	Maximum Contaminant Level
msl	Mean sea level
NCP	National Oil and Hazardous Substances Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPW	Net present worth
NWIRP	Naval Weapons Industrial Reserve Plant
NYSDOH	New York State Department of Health
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and Maintenance
PA	Preliminary Assessment
PCE	Tetrachloroethene
POE	Point-of-entry
PRG	Preliminary remediation goal
PRSC	Peconic River Sportsman’s Club

ACRONYMS (continued)

RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment – Sampling Visit
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SCDHS	Suffolk County Department of Health Services
SI	Site Investigation
TBC	To Be Considered
TCA	Trichloroethane
TCE	Trichloroethene
TtNUS	Tetra Tech NUS, Inc.
USDOI	United States Department of the Interior
VOC	Volatile Organic Compound
µg/L	Microgram per liter

1.0 INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) for the Site 6A - Southern Area Off-Site Water Supply at the Naval Weapons Industrial Reserve Plant (NWIRP) in Calverton, New York was prepared by Tetra Tech NUS, Inc. (Tetra Tech) under the comprehensive Long-Term Environmental Action Navy (CLEAN) Contract N62470-08-D-1001, Contract Task Order (CTO) WE08.

This work is part of the Navy's Environmental Restoration (ER) Program, which is designed to identify contamination of Navy and Marine Corps lands and facilities resulting from past operations and to institute remedial actions as necessary, which consists of four distinct stages. Stage 1 is the Preliminary Assessment (PA), which was formerly known as the Initial Assessment Study (IAS). Stage 2 is a Resource Conservation and Recovery Act (RCRA) Facility Assessment-Sampling Visit (RFA), also referred to as a Site Investigation (SI), which augments information collected in the PA. Stage 3 is the RCRA Facility Investigation (RFI) and Corrective Measures Study (CMS), also referred to as a Remedial Investigation (RI) and Feasibility Study (FS) or Focused Feasibility Study (FFS) that characterizes the contamination at a facility and develops options for remediation of the site. Stage 4 is the Corrective Action, also referred to as the Remedial Action, which results in the control or cleanup of contamination at sites. The Navy had determined that an interim removal action may be appropriate for the Southern Area Off-Site Water Supply at NWIRP Calverton. This EE/CA will develop, evaluate, and recommend non-time critical removal actions to provide an alternative water supply to off-site groundwater users. This report has been prepared under Stage 3.

1.1 FACILITY LOCATION

NWIRP Calverton is located in Suffolk County, Long Island, New York, approximately 70 miles east of New York City (see Figure 1-1). The facility is located within the municipality of Riverhead. The facility currently covers approximately 211 acres of the original approximately 6,000-acre facility.

1.2 ACTIVITY BACKGROUND INFORMATION

1.2.1 Facility Layout

Prior to 1997, the facility was bordered by Middle Country Road (Route 25) to the north, agricultural land to the east, River Road to the south, and Wading River Road to the west. Between 1998 and 2007, the majority of the property was transferred out of Navy control. The primary features of the facility were two paved runways. Runway 5-23 was located on the western half of the facility, and oriented southwest to northeast. Runway 32-14 was located on the eastern half of the facility, and oriented southeast to northwest.

NWIRP Calverton currently consists of three separate parcels of land totaling approximately 211 acres. Five Navy ER sites are included within these parcels as follows. The location of the parcels and sites are presented in Figure 1-2.

Parcel A (32 acres)

Site 2 - Fire Training Area

Parcel B1 (40 acres)

Site 6A - Fuel Calibration Area

Site 10B - Engine Test House

Parcel B2 (131) acres

Southern Area

Parcel C (8 acres)

Site 7 - Fuel Depot

1.2.2 Facility History

NWIRP Calverton has been owned by the United States Navy since the early 1950s. At that time, the property was purchased from a number of private owners. The facility was expanded in 1958 through additional purchases of privately-owned land. Northrop Grumman Corporation (previously Grumman Corporation) has operated the facility since its construction (Navy, 1986).

NWIRP Calverton was constructed in the early 1950's for use in the development, assembly, testing, refitting, and retrofitting of Naval combat aircraft. Northrop Grumman was the sole operator of the facility, which is known as a Government-Owned-Contractor-Operated (GOCO) installation. Construction was completed in 1954. The facility supported aircraft design and production at nearby NWIRP Bethpage, which is also operated by Northrop Grumman.

The majority of industrial activities at the facility were confined to the developed area in the central and south central portions of the facility, between the two runways. Industrial activities at the facility were related to the manufacturing and assembly of aircraft and aircraft components. Hazardous waste generation at the facility was related to metal finishing processes, such as metal cleaning and electroplating. The painting of aircraft and components resulted in additional waste generation (Navy, 1986; HNUS, 1992).

Northrop Grumman operations at the facility ended in February 1996. In September 1998, the majority of the land within the developed section of the facility was transferred to the Town of Riverhead for redevelopment. Because of the need for additional environmental investigation and the potential need for remediation, the Navy originally retained four parcels of land within the developed section. In 2007, one of the parcels (Sites 1 and 9) and a portion of a second parcel (Site 10A) were transferred to the Town of Riverhead. The remaining three parcels and associated Navy IR Sites are presented on Figure 1-2.

Approximately 3,000 acres of undeveloped land outside of the fenced areas was transferred to the Veterans Administration and the New York State Department of Environmental Conservation (NYSDEC) in 1999.

1.3 TOPOGRAPHY

NWIRP Calverton is located in an area underlain by permeable glacial material and characterized by limited surface water drainage features. Normal precipitation at the facility is expected to infiltrate rapidly into the soil. Wetland areas and glacially formed lakes and ponds are located south and southwest of the facility. NWIRP Calverton occupies a relatively flat, intermorainal area. The topographic relief at NWIRP Calverton is 54 feet and elevations range from 30 to 84 feet above mean sea level (msl).

1.4 ECOLOGICAL SETTING

NWIRP Calverton is located in the Long Island Pine Barrens, an area characterized by forests dominated by pitch pine (*Pinus rigida*) and oaks (*Quercus* sp.) growing on coarse-textured upland soils. Rainfall leaches rapidly through the soils recharging a vast underlying aquifer, but creating a dry environment at the surface which predisposes the vegetation to periodic wildfires. Where the natural fire cycle has been suppressed by human activity, as it has been since 1952 inside the NWIRP Calverton fence, taller oaks begin to dominate.

Also typical of the Long Island Pine Barrens are coastal plain ponds and isolated shallow ponds with fluctuating levels of acidic, tea-colored water. Emergent wetland communities typically fringe these ponds.

1.5 GEOLOGY AND SOILS

NWIRP Calverton lies within the Atlantic Coastal Plain Physiographic Province. Generally, this region can be characterized as an area of relatively undissected low-lying plains. The Atlantic Coastal Plain is underlain by a thick sequence of unconsolidated deposits. The surface topography has been created or modified by Pleistocene glaciation (Isbister, 1966). The facility is underlain by approximately 1,300 feet of

unconsolidated sediments that consist of four distinct geologic units. These units, in descending order, are the Upper Glacial Formation, the Magothy Formation, the Raritan Clay Member of the Raritan Formation, and the Lloyd Sand Member of the Raritan Formation (McClymonds and Franke, 1972).

Soil boring and sampling activities previously completed at NWIRP Calverton reveal that the sites are predominantly underlain by fine to coarse sediments of probable glaciofluvial origin. Three distinct lithofacies were encountered. The upper lithofacies represent a mixture of soil, fill, and glacial deposits and consist predominantly of silty, fine-grained sand with varying amounts of peat and clay. Fill material, where present, is always associated with the upper lithofacies. The middle lithofacies consist of predominantly fine-grained sand with varying amounts of medium- to coarse-grained sand and pebbles, and are probably representative of undisturbed glacial deposits. The lower lithofacies consist of micaceous, silty clay and may represent the Magothy Formation.

1.6 SURFACE WATER HYDROLOGY

The majority of the facility is located within the Peconic River drainage basin. The eastward-flowing Peconic River is located approximately 1,300 feet south of the facility at its closest point. The Peconic River discharges to Peconic Bay located 8.5 stream miles from the facility.

Major surface water features near the facility include McKay Lake and Northeast Pond. McKay Lake is a man-made groundwater recharge basin located north of River Road, midway along the southern site border. Northeast Pond is located at the northeast corner of the facility. Several small drainage basins exist near the Fuel Calibration Area (Runway Ponds). All of these surface water features are land locked, with the exception of McKay Lake, which has an intermittent discharge to Swan Pond, located 1,500 feet to the south of NWIRP Calverton. Overhead flow from the drainage basins to the Peconic River may also occur periodically.

A number of small wetlands exist on the Calverton facility. The United States Department of the Interior (USDOI), Fish and Wildlife Department classifies the western half of the 2-acre Northeast Pond as palustrine, forested/scrub/shrub/emergent wetland and the drainage basins are classified as palustrine, scrub/shrub/emergent wetland (USDOI, 1980).

1.7 HYDROGEOLOGY

The unconsolidated sediments that underlie NWIRP Calverton are generally coarse-grained with high porosities and permeabilities. These factors create aquifers with high yields and transmissivities.

The Upper Glacial Formation, the Magothy Formation, and the Lloyd Sand are the major regional aquifers. The Upper Glacial and Magothy aquifers are of principle importance in Suffolk County because of their proximity to the ground surface. The Raritan Clay of the Raritan Formation has a very low permeability and acts as a regional confining layer that is believed to minimize the local risk of contamination to the underlying Lloyd Sand aquifer (McClymonds and Franke, 1972). The Lloyd Sand has not been extensively developed due to its depth and the abundant water available in the overlying aquifers.

The Upper Glacial aquifer is widely used as a source of groundwater in Suffolk County. The water table beneath the NWIRP Calverton lies within this aquifer. Porosities in excess of 30 percent have been calculated for the Upper Glacial aquifer in adjoining Nassau County. Hydraulic conductivity is estimated at 270 feet per day (ft/day).

The Magothy aquifer is widely used as a source of groundwater in Suffolk County. The most productive units are coarser sand and gravel. The permeability of the Magothy is high and hydraulic conductivity has been calculated in excess of 70 ft/day.

The Upper Glacial and Magothy aquifers are believed to be hydraulically interconnected and to function as a single unconfined aquifer. Logs from on-site monitoring wells, previous hydrogeologic investigations, and geologic mapping indicate that although clay lenses that may create locally confining and/or perched conditions are present in both aquifers, these lenses are not widespread and do not function as regional aquitards (McClymonds and Franke, 1972; Fetter, 1976).

NWIRP Calverton straddles a regional groundwater divide, with groundwater beneath the northern half of the facility flowing to the northeast, with the Long Island Sound as the probable discharge point for groundwater in the shallow aquifer zones. Groundwater beneath the southern half of the facility flows to the southeast and the Peconic River basin is the likely discharge point. Groundwater along the divide, the location of which can fluctuate, flows to the east.

1.8 CLIMATE AND METEOROLOGY

NWIRP Calverton is located in an area classified as a humid-continental climate. Its proximity to the Atlantic Ocean and Long Island Sound add maritime influences to the classification (NOAA, 1982).

The average annual temperature at the National Oceanic and Atmospheric Administration (NOAA) Riverhead Research Station, located 4.5 miles northeast of the site, is 52.2 °F, with a maximum average monthly temperature of 73.3 °F in July and a minimum average monthly temperature of 30.9 °F in January. Annual precipitation at the Riverhead Research Station averages 45.32 inches. The highest

average monthly precipitation is 4.46 inches, occurring in December. The lowest average monthly precipitation is 2.90 inches, occurring in July. The average annual evapotranspiration rate is 29 inches, resulting in a net annual precipitation rate of 16.32 inches. A 2-year, 24-hour rainfall can be expected to bring 3.4 inches of precipitation (NOAA, 1982; USDOC, 1961).

1.9 REPORT ORGANIZATION

This section provided a brief introduction and a discussion of general facility characteristics. Section 2.0 of the report provides a site description and background for Site 6A and off-site Southern Area. Section 3.0 presents the identification of remedial action objectives (RAOs), applicable or relevant and appropriate requirements (ARARs), and technology screening. Remedial action alternatives are identified and analyzed in Section 4.0 and a comparative analysis of these alternatives is presented in Section 5.0. Conceptual design calculations and cost estimates are presented in the appendices.

2.0 SITE DESCRIPTION AND BACKGROUND

2.1 SITE DESCRIPTION

2.1.1 Site Description and Physical Setting

The Southern Area begins within NWIRP boundaries to the southeast of Site 10B (Engine Test House) and extends off site to the southeast (see Figure 2-1). This area is hydraulically downgradient of Site 10B, Site 6A (Fuel Calibration Area), and the general industrial complex at the facility. Groundwater flow through this area is to the southeast, with the Peconic River being the discharge point.

The Southern Area is mostly wooded and includes two shallow ponds near the northern edge. The ponds receive runoff through a drainage swale and culvert from Site 6A. From the late 1980s to the early 1990s, groundwater from Site 6A was discharged into this drainage swale and culvert and into the western pond. As a result, the presence of chlorinated volatile organic compound (VOC)-contaminated groundwater in the Southern Area may be attributable to Site 6A.

The Peconic River Sportsman's Club (PRSC) is located at the southern end of the Southern Area plume. PRSC is located along the banks of an un-named pond created by a dam across the Peconic River. PRSC includes a Main Lodge, Activities Center, a private residence, and pistol, rifle, and archery ranges. Three individual wells provide water to the Main Lodge, Activities Center, and the private residence. A well at the pistol range was shut down because of VOC contamination. Fire protection is provided by a fifth high capacity well.

2.1.2 Site History

In 2001, routine monitoring of PRSC water supplies by Suffolk County Department of Health Services (SCDHS) detected chlorinated solvent-type VOCs in one of the wells on the PRSC property. Based on these detections, the well at the Pistol Range Trailer was shutdown and PRSC installed a granular activated carbon treatment system on the water supply well for the Activity Center in 2007. The other public water supply well (main lodge) at the site was not affected. Based on direction from SCDHS, PRSC started quarterly sampling and analysis of the wells. Private residence and fire suppression wells are also present at the PRSC. In January 2008, the Navy started quarterly sampling and analysis of the four active wells, including sample taps on the granular activated carbon treatment system. Contaminants detected on the PRSC property are consistent with those detected at Site 6A - Southern Area. 1,1,1-Trichloroethane (TCA) and associated degradation products 1,1-dichloroethane (1,1-DCA) and 1,1-dichloroethene (1,1-DCE) were identified in groundwater at Site 6A – Southern Area and groundwater from the Site flows in the direction of the PRSC. In addition, trichloroethene (TCE), TCA,

and related degradation products are present in the McKay permitted outfall and may flow into this area. There are no known or suspected contaminant sources of chlorinated VOCs within PRSC area.

2.1.3 Ecological Setting

Vegetation: The area surrounding the Southern Area supports a grassy turf dominated by upland grasses such as fescues (*Festuca* sp.), panic grass (*Panicum lanuginosum*), and broomsedge (*Andropogon virginicus*), and weedy forbs such as yellow sweet clover (*Melilotus officinalis*), pigweed (*Amaranthus retroflexus*), raspberry (*Rubus* sp.), and plantain (*Plantago lanceolata*). This area was frequently mowed until 1996 while NWIRP Calverton was in active operation, but the grass has been allowed to grow to seed since then. The weedy forbs are typical of lawns and likely were present even when the area was frequently mowed. But their coverage has likely been expanding since 1996.

A narrow strip of oak-pine forest is located southeast of the Southern Area. This forest is typical of course-textured upland soils. It is dominated by oaks (primarily scarlet oak, *Quercus coccinea*, and white oak, *Quercus alba*) and pitch pine (*Pinus rigida*), with a dense shrubby understory of early low blueberry (*Vaccineum vacillans*).

The land overlying the off-site portion of the Southern Area plume between the facility and PRSC is undeveloped and forested. Trees have been thinned in the immediate vicinity of PRSC for roads and parking. Two areas have been cleared for the pistol range and rifle range. The types of vegetation in this area have not been categorized.

Wetlands: There are two shallow ponds on-site and the northwest end of the Southern Area plume. There is a wetland mapped along the southern side of the off-site plume between Swan Pond and the PRSC pond. Another wetland branches off from this to the north near the eastern side of River Road, terminating near the NWIRP boundary. Another wetland is mapped on the eastern side of the PRSC access road. Additional wetlands are mapped along the northern side of the perimeter road near well cluster MW-126. The PRSC pond and Peconic River are mapped wetlands.

Wildlife: When NWIRP Calverton was in active operation, the broad grassy lawns in this area were of little or no value to most wildlife. Now that the lawns have been allowed to go to seed and become mixed with old field forbs such as raspberries, they provide quality habitat for species favoring early old fields such as eastern meadowlark (*Sturnella magna*), upland sandpiper (*Bartramia longicauda*), grasshopper sparrow (*Ammodramus savannarum*), and vesper sparrow (*Pooecetes gramineus*). The forest edges to likely provide suitable habitat for species such as whitetail deer (*Odocoileus virginianus*), northern bobwhite (*Colinus virginanus*), eastern kingbird (*Tyrannus tyrannus*), indigo bunting (*Passerina cyanea*), and song sparrow (*Melospiza melodia*) (Kricher, 1988). Waterfowl and other wildlife typical of areas with

wetlands and open water are expected to occur in the wetlands, although the wildlife in this area has not been categorized.

The NYSDEC Environmental Mapping System indicates that the Southern Area off-site plume is in an area with the potential for Significant Natural Communities, Rare Plants, and Rare Animals.

According to the United States Department of the Interior, Fish and Wildlife Service, no federally listed endangered or threatened species reside within a 4-mile radius of the study area. Transient individuals of endangered species such as the Bald Eagle (*Haliaeetus leucocephalus*) may inhabit the study area.

Information provided by NYSDEC and the New York Natural Heritage program indicated that several New York State endangered and threatened animal species exist within the Southern Area. The most notable, tiger salamander (*Ambystoma tigrinum*), may reside on site in the ponds adjacent to Site 6A. Other species include the northern cricket frog (*Acris crepitans*) and the least tern (*Sterna antillarum*). Additional endangered and threatened plant species inhabit the Calverton facility boundary and may be present in the Southern Area. According to the information supplied by NYSDEC, the wetland areas surrounding the Peconic River, including Swan Pond, include significant habitat for many State endangered and threatened animals and plants. Portions of these wetland areas would be within the off-site portion of the Southern Area plume (TtNUS, 2006).

Aquatic Biota: The aquatic biota in the aquatic habitats has not been categorized.

2.2 SITE CHARACTERISTICS

2.2.1 Geology

The geology at NWIRP Calverton consists of a mixture of sandy and clayey deposits. The upper 120 to 130 feet of subsurface materials consist primarily of fine to medium sand, with thin to thick clayey layers also interbedded within the predominantly sandy deposits.

Minor amounts of fill, consisting primarily of a mixture of sand, silt, and clay, were also found at shallow depths (0 to 6 feet) in some areas. From this depth to approximately 60 feet below ground surface (bgs), fine to medium sand is present. A silty clay layer was encountered at depths of approximately 60 to 90 feet across the site. In the off-site portion of the Southern Area plume, this clay unit appears to pinch out since it was not encountered in the borings drilled near the Peconic River. Underlying this silty clay unit is approximately 40 feet of fine to medium sand. Another silty clay unit was encountered from 130 to 180 feet bgs. This unit appears to be continuous throughout the area.

The geologic units encountered within the study area appear to be generally flat lying, consistent with what would be expected for the glacial deposits on Long Island. The upper contact of the Magothy Formation, being an erosional surface, is expected to be flat lying to undulating, reflecting the former topography, even though the formation itself is known to dip to the south.

2.2.2 Hydrogeology

During the Phase 2 RI (TtNUS, 2001), a focused groundwater investigation was performed in the Southern Area to determine whether the Peconic River was the discharge point for contaminated groundwater (to a depth of 100 feet bgs) that migrated from the facility, or conversely whether some groundwater bypassed the river and migrated to areas further south. The study involved the installation of several well clusters on both sides of the river and in the immediate vicinity of the river, the installation of two staff gauges in the river, and the collection of four rounds of water level data from the wells and staff gauges. Potentiometric surface interpretations based on water level data from the well clusters indicated that the river is the ultimate groundwater discharge point in this area. This was determined since the water levels along the river were lower than water levels for both shallow and deep wells in well clusters located several hundred feet from the river on both sides. Groundwater in the study area was found to be migrating east-southeast towards the river, while on the opposite side of the river, the groundwater flow direction is generally northward towards the river.

Additional groundwater data were collected in 2005 to refine the information collected for the Phase 2 RI. Groundwater was encountered at approximately 10 feet bgs in the off-site portion of the Southern Area plume. Based on the interpretation of the data collected, any groundwater contamination that may reach the Peconic River is expected to discharge to the river and not migrate beyond it to the south.

There are several drinking water wells located at PRSC. The nearest public water supply well is located approximately 0.5 mile west of the PRSC.

2.3 PREVIOUS REMOVAL ACTIONS AND RELEVANT INFORMATION FROM PRIOR INVESTIGATIONS

Investigations of contamination at Sites 6A and 10B lead toward the southeast and prompted investigations of the Southern Area. In 1985 to 1986, the Navy conducted an IAS for Calverton and identified Site 6A as a potential area of concern. In 1987, a groundwater and free product extraction (floating petroleum) system was installed to collect floating free product on the water table. Groundwater and free product extraction continued until 1993. Passive free product recovery continued until 1996 and was then restarted in 2000.

The Navy conducted a SI at Calverton in 1991 to 1992 and confirmed the presence of contamination and recommended that a RI be conducted to delineate the nature and extent of contamination. A RI was conducted at Site 6A from 1994 to 1995. From 1997 to 1998, the Navy conducted a Phase 2 RI at Site 6A. Specific areas addressed included deep groundwater onsite, groundwater at the Engine Test House Area (Site 10B), groundwater near the southern fence and off-site groundwater near the Peconic River.

2.4 REMEDIAL INVESTIGATION AND SUPPLEMENTAL INVESTIGATION RESULTS

The Southern Area is VOC-contaminated groundwater contamination downgradient of Sites 6A and 10B. The groundwater contamination in the Southern Area is believed to have resulted from either intermittent releases at Sites 6A and 10B or from potential overland migration through a series of ditches and ponds in the area. The area was investigated during the Phase 2 RI (TtNUS, 2001) and the Site 6A and Southern Area Supplemental Investigation (TtNUS, 2005a). The investigations were conducted in 1997, 2000, and 2004/2005, and groundwater samples were collected from temporary wells, piezometers, and vertical profile borings during the investigations. The results of the groundwater investigation are summarized below.

The groundwater contaminants in the Southern Area plume consisted of chlorinated VOCs. Other VOCs, including fuel-type chemicals (benzene, toluene, ethylbenzene, and xylene) and other miscellaneous organics are detected periodically. Similar contaminants were detected in groundwater at Site 6A, Site 10B, and the On-Site Southern Area Plume.

Contaminants detected during all three rounds of sampling at the off-site portion of the Southern Area plume included TCA, 1,1-DCA, DCE, and chloroform. Nine contaminants were detected in excess of groundwater quality standards including TCA, 1,1-DCA, 1,2-DCA, 1,2-DCE, cis-1,2-dichloroethene benzene, chloroethane, toluene, and total xylenes. 1,1-DCA was the dominant VOC present in the groundwater, and it was detected at a maximum concentration of 292 micrograms per liter (µg/L) (SA-VPB-114 at 92 feet bgs) in 2004 (TtNUS, 2005). Maximum concentrations of the other contaminants were one to two orders of magnitude lower than the 1,1-DCA maximum concentration. Most of the contaminants detected at concentrations greater than groundwater standards were detected in samples collected near the pistol range area at the PRSC and along Connecticut Avenue (e.g., SA-TW-108, SA-TW-113, SA-VPB-114, and SA-PZ-123I).

Figure 2-2 shows the estimated horizontal extent of the entire Southern Area plume. The off-site portion of the plume is approximately 92 acres (3,991,000 square feet). VOC contamination was generally detected at depths of 60 feet to 90 feet bgs. At 130 feet bgs, there is a silty clay unit that prevents deeper migration of contamination. Using a contaminated aquifer thickness of 30 feet, the area of the plume (92 acres), and a porosity of 0.25, the volume of contaminated groundwater is estimated to be 224 million gallons. The total

masses of chlorinated VOC and other VOC contamination in the Off-Site Southern Area Plume were estimated to be 670 pounds and 120 pounds, respectively (TtNUS, 2006).

The concentrations of contaminants detected in PRSC wells were compared to New York State Department of Health (NYSDOH) Maximum Contaminant Levels (MCLs). 1,1-DCA was detected in one well at concentrations greater than the MCL (5 µg/L). 1,1-DCE was detected one time at a concentration equal to the MCL (5 µg/L); all other detections were less than the MCLs.

2.5 DESCRIPTION OF CURRENT CONDITIONS

As noted previously, PRSC includes a Main Lodge, Activities Center, a private residence, and pistol, rifle, and archery ranges. Main Lodge, Activities Center, and the private residence each have an individual well. Because of groundwater contamination, the well at the Activities Center is provided with a Point-of-Entry (POE) Granular Activated Carbon (GAC) system. A well at the pistol range trailer has been shut down because of VOC contamination. Fire protection is provided by a fifth high capacity well.

Contaminants that have been detected in PRSC wells include 1,1-DCA, 1,1-DCE, cis-1,2-DCE, TCE, vinyl chloride, chloromethane, isopropylbenzene, and methyl tert-butyl ether. The concentration of DCA is greater than the NYSDOH MCL in only one well. The concentrations of contaminants detected in PRSC wells are shown on Figure 2-3.

The estimated typical usage rate of each of the three building water supply wells is 5 to 10 gallons per minute (gpm) with a short term total maximum rate of 10 gpm. The volume of water used has not been measured and is assumed to be 10,000 gallons per month. The output of the fire protection well is estimated to be approximately 500 gpm.

Because of the potential exposure to groundwater contamination at PRSC, alternative groundwater supplies need to be evaluated. Because the fire protection well is only used intermittently and does not present an unacceptable human health exposure risk, no action is proposed for the fire protection well.

3.0 IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES AND TECHNOLOGY SCREENING

The RAOs are developed to provide guidelines for evaluating the removal action and ensuring that the action complies with regulatory requirements. This section provides an evaluation of ARARs, the RAOs and schedule, statutory limits, and discussions of applicable technologies for drinking water supply replacement.

3.1 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs are used to develop cleanup criteria for the RAOs and to identify removal action technologies. The term ARAR is defined in the National Oil and Hazardous Substances Contingency Plan (NCP) as follows:

- Applicable requirements are generally defined as cleanup standards, standards of control, or other substantive environmental protection requirements promulgated under Federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, or location. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be considered as applicable requirements.

- Relevant and appropriate requirements are defined as cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state environmental or facility siting laws that are not directly “applicable” to a hazardous substance, pollutant, contaminant, remedial action, or location, but address situations sufficiently relevant to those encountered at the site that their use is appropriate. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be considered as relevant and appropriate requirements.

- Any promulgated standard, requirement, criterion, or limitation under a state environmental or facility-siting law that is more stringent than the associated Federal standard, requirement, criterion, or limitation.

Based on the manner in which they are applied during a removal action, ARARs are classified into three categories.

- Chemical-Specific. Chemical-specific ARARs were developed to provide health or risk-based concentration limits. These limits are specific for an individual chemical or group of chemicals. Often, these ARARs are used to determine the extent of site remediation. Chemical-specific ARARs may be concentration-based cleanup goals or may provide the basis for calculating such levels. In cases where no chemical-specific ARAR exists, chemical advisories may be used to develop Removal Action Objectives.

- Location-Specific. Location-specific ARARs are considered in view of natural or man-made site features. These ARARs are intended to limit activities within designated areas.

- Action-Specific. Action-specific ARARs pertain to the implementation of a given remedy. These ARARs control or restrict hazardous substance- or pollutant-related activities. These controls are considered when specific removal activities are planned for a site.

In addition to ARARs, other regulations and guidance may be classified as guidance "To Be Considered" (TBC). TBCs are non-promulgated, non-enforceable guidelines or criteria that may be useful for developing removal actions or necessary for determining what is protective of human health and/or the environment. TBCs are also identified in this section to aid in the evaluation of the removal actions. Potential Federal and state ARARs and TBCs are presented in Tables 3-1 and 3-2, respectively.

Section 121(d)(4) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) identifies circumstances under which ARARs may be waived, including the instance where the selected removal action is an interim remedy and the final remedial action will attain the ARAR upon its completion. As such, the selected removal actions for the site being addressed under this EE/CA do not necessarily need to comply with all identified ARARs.

3.2 REMEDIAL ACTION OBJECTIVES

The Navy has determined that an interim action is to be considered under this non-time-critical removal action. The RAO is as follows:

- Groundwater RAO No. 1: Prevent human exposure (including showering, drinking, and irrigation) to groundwater having contaminants at concentrations greater than groundwater preliminary remediation goals (PRGs) by off-site groundwater users.

For this EE/CA, PRGs are NYSDOH MCLs.

3.3 REMEDIAL ACTION SCHEDULE

Field activities are anticipated to start in 2010 and be completed in 2011.

3.4 STATUTORY LIMITS

The statutory limits for fund-financed removal actions are presented in Section 104(c)(1) of CERCLA. These limits are not applicable because the actions at NWIRP Calverton are not financed by Superfund.

3.5 TECHNOLOGY SCREENING

This section identifies, screens, and evaluates the potential technologies and process options that may be applicable to assemble remedial alternatives for the Southern Area Off-Site Water Supply at NWIRP Calverton. Screening evaluations at this stage generally focus on effectiveness and implementability, with less emphasis on cost.

Effectiveness

Effectiveness is evaluated based on the following criteria:

- Ability of the technology to address the estimated areas or volumes of contaminated medium
- Ability of the technology to meet the goals identified in the RAOs
- Technical reliability (innovative versus well proven) with respect to contaminants and site conditions
- Potential impacts to human health and the environment during implementation

Implementability

Implementability is evaluated based on the following criteria:

- Overall technical feasibility at the site
- Availability of vendors, mobile units, storage, disposal services, etc.
- Administrative feasibility

Cost

Cost is evaluated based on the following criteria:

- Capital costs
- Operation and maintenance costs

3.5.1 No Action

Under a no action alternative, neither a removal action nor periodic maintenance is undertaken at the site.

Effectiveness

No action would not protect human health or the environment because it would allow groundwater users as PRSC to be exposed to unacceptable concentrations of contaminants.

Implementability

No action is technically and administratively feasible at the site. The availability of vendors, mobile units, storage, disposal services, etc. and long-term maintenance and operations requirements are not applicable.

Cost

There are no costs for this technology.

Conclusion

No action is implementable and costs are minimal, but it is not effective. However, no action will be retained as a baseline for comparison to other options.

3.5.2 Institutional Controls

Institutional controls consist of administrative (non-engineering) controls and procedures to limit the use of off-site groundwater. Institutional controls can include such options as deed restrictions and notices, local ordinances, access restrictions, and monitoring. Under institutional controls, no active measures would be conducted to reduce or prevent potential human exposure to contaminated groundwater.

No institutional controls will be included in the EE/CA removal action. Institutional controls will be developed for groundwater as part of the overall remedial action for the Southern Area.

3.5.3 Monitoring

Because no action to address contaminated drinking water would be implemented under this option, users that rely on contaminated groundwater for their drinking water supplies would remain at risk.

Therefore, groundwater from affected supply wells and monitoring wells would be sampled and analyzed to assess the quality of water that is being used and the status of the groundwater contaminant plume.

Groundwater would be monitored periodically to identify potential contaminated groundwater migration patterns and evaluate whether areas downgradient of the site may be affected. Individual supply wells would be monitored to assess the quality of water being used and to alert the responsible agency of the need to enact measures to prevent or mitigate exposures. Although monitoring would not directly limit exposure to contaminants, it could limit potential future exposure by serving as an early warning mechanism.

Effectiveness

Monitoring would not achieve the remedial action objective for protection of human health. Monitoring can only serve as a warning mechanism. Monitoring may be combined with other measures to offer a greater level of protection. Monitoring is a standard procedure that has been used on numerous sites to assess contaminant status and migration patterns. There are no potential impacts to human health or the environment through the implementation of periodic groundwater monitoring.

Implementability

Monitoring would be readily implemented since sampling and analysis techniques are routine. There would be no shortage of equipment or resources to perform sampling.

Costs

No capital costs are associated with monitoring. However, operation and maintenance (O&M) costs would be low to moderate because four wells would need to be assessed for a long duration.

Conclusion

Monitoring would not achieve the RAO because monitoring only indicates whether contaminants are present in groundwater and serves as a mechanism to alert the responsible agency of the need for potential actions. Periodic monitoring of nearby monitoring wells could be a viable means of assessing potential impacts on private drinking water supplies and evaluating whether actions are necessary to prevent exposures. Thus, monitoring will be retained for use with other remedial processes to address contaminated drinking water supplies.

3.5.4 New Common Water Supply

3.5.4.1 New Groundwater Source

Under this option, a common supply well, similar to a community water supply well, would be installed to provide clean water to the four buildings that currently have individual supply wells. There are two approaches to this process: a new well would be drilled into the aquifer near the buildings, and the water treated prior to distribution, or a new well could be drilled deeper or cross-gradient in a portion of the non-contaminated aquifer then piped to the buildings.

Effectiveness

Both supply well options would achieve the RAO since affected users would not use contaminated groundwater. Human-health risks associated with exposure to contaminants in groundwater would be eliminated. However, both options pose potential long-term health risks. An untreated supply of well water could become contaminated over time and present new problems. Such an alternative would require constant monitoring to assess the quality of the water. A treated common supply well would pose less health risk to the users providing that it remains operational and functioning correctly throughout its implementation.

Implementability

The installation of a new treated supply well is implementable. Several drilling companies with appropriate personnel and equipment are available to install new supply wells. Connection of the supply well to existing building plumbing would pose no technical problems. Spent materials such as activated carbon will need to be disposed.

The installation of a new untreated common supply well from an uncontaminated portion of the aquifer is also implementable. Based on the current location of the plume, a well in an uncontaminated portion of the aquifer would have to be located 1,600 to 2,000 feet from the PRSC buildings, or at least 150 feet bgs. Numerous drilling companies with appropriate personnel and equipment are available to install new supply wells. Connection of the supply well to existing building plumbing would pose no technical problems. However, additional investigation of the groundwater deeper or cross-gradient of the contaminated groundwater would be needed to ensure that the water was in compliance with the current ARARs. Piping would have to be installed to distribute the water to the buildings.

Regardless of the type of new supply well installed, long-term operation and maintenance of the well, pumping equipment, and treatment equipment would require legal agreements between the Navy and

PRSC. NYSDOH permit requirements would need to be determined based on the frequency and the number of persons using the water. Ownership of the new supply well could be problematic and would have to be incorporated by deed into the respective property description.

Costs

The cost of a new treated common supply well would be moderate. O&M would be moderate since long-term monitoring would be required to assess the quality of the water and to replace GAC. The cost of a new untreated common supply well from depth or cross-gradient would be low to moderate, depending upon how far the well must be located from the buildings. O&M would also be low since long-term monitoring would be required to assess the quality of the water.

Conclusion

Eliminate the new common supply well as a viable remedial action alternative. The implementability of this option would require consideration of long-term monitoring, willingness of the PRSC to operate a well and treatment system, permit requirements, and the long-term administration of the distribution system and associated costs.

3.5.4.2 New Surface Water Source

Under this option a single water supply would be withdrawn from the Peconic River or the PRSC pond to provide clean water to the four buildings that currently have individual supply wells. Compared to groundwater supplies, surface water supplies typically require more treatment to address potential biological contamination. Treatment would include filtration and disinfection and possibly residual chlorination.

Effectiveness

This option would achieve the RAO since affected users would not use contaminated groundwater. Human health risks associated with exposure to contaminants in groundwater would be eliminated. A surface water supply system would essentially pose no health risk to the users providing that it remains operational and functioning correctly throughout its implementation.

Implementability

The installation of a new common surface water supply system is implementable. Numerous companies with appropriate personnel and equipment are available to design and install a surface water treatment

system. The quality of the surface water would need to be determined and evaluated prior to the design of a surface water treatment system. Connection of a new water supply well to existing building plumbing would pose no technical problems.

Long-term operation and maintenance of the surface water treatment system equipment would require legal agreements between the Navy and PRSC. NYSDOH permit requirements would need to be determined based on the frequency and the number of persons using the water. Ownership of the new treatment system could be problematic and would have to be incorporated by deed into the respective property description.

Costs

The cost of a new common surface water supply system would be moderate. O&M would be moderate for routine monitoring of water quality and maintenance of the filtration equipment, disinfection equipment, and residual chlorination equipment.

Conclusion

Eliminate the new common surface water supply system as a viable remedial action alternative. The implementability of this option would require consideration of long-term operation, willingness of the PRSC to operate a treatment system, permit requirements, and the long-term administration of the distribution system and associated costs.

3.5.5 Extend Municipal Water Supply Line

Potable water would be provided to the PRSC by extending the existing Riverhead Water District water main eastward along Grumman Boulevard and River Road. A water service connection would be installed from the water main to PRSC. No further exposure to contaminated groundwater would occur.

Effectiveness

The water line extension would achieve the RAO since previously affected users would no longer use contaminated groundwater. Human health risks associated with exposure to contaminants in groundwater would be eliminated. Adverse impacts to humans are not anticipated through installation of a water line. Some short-term impacts to the environment related to excavation may occur during construction.

Implementability

The water line extension is implementable, but with moderate technical and administrative difficulties. Extensive excavation would be required to install a supply line at least 4 feet bgs (for protection from freezing and frost damage), and significant lengths of piping would be required to extend the existing water main (approximately 4,400 feet).

The institutional implementability of this option would require consideration of the ease of acquiring property easements, willingness of the municipal supply to enlarge its service, and the long-term administration of the distribution system and associated costs.

Costs

The capital costs for installing a new water line and service connection would be moderate to high, depending on topographic and subsurface features encountered during construction. O&M costs are anticipated to be low.

Conclusion

This option would meet the RAO and would protect human health by providing an uncontaminated source of potable water for the affected property. Capital costs may range from moderate to high, and O&M costs would likely be low. Thus, extending the water line will be retained to address contaminated drinking water supplies.

3.5.6 Point-of-Entry Well Water Treatment

One POE treatment unit is currently in place in the Activities Center. Treatment includes carbon adsorption two GAC filters in series. These units are maintained by PRSC and have been in operation since 2007. Under this technology, new POE treatment units would be installed at each existing well to treat the extracted groundwater, and the existing POE would be maintained. Groundwater pumped from affected wells would be passed through the treatment units at the point of entry into the buildings. Contaminated well water would be treated with GAC. Based on historical well use information, additional treatment, such as filtration is not required.

In this section, treatment technologies for the removal of the contaminants in residential well water are presented. The technologies considered are:

- Carbon adsorption

- Filtration

3.5.6.1 Carbon Adsorption

Activated carbon adsorption is a common physical treatment technology to remove organic compounds from contaminated water. Activated carbon will adsorb many organic compounds to some extent but is most effective for the less polar and less soluble compounds. Removal efficiency exceeding 99 percent is possible depending on the type of organic contaminants present and system operating parameters, such as retention time and carbon replacement frequency. The fundamental principle behind activated carbon treatment involves the physical attraction of organic solute molecules to exchange sites on the internal pore surface areas of the specially treated (activated) carbon grains. As water is filtered through the adsorbent, the organic molecules eventually occupy all the surface sites on the carbon grains. The exhausted or "spent" carbon must then be either regenerated or disposed according to federal RCRA or state regulations.

Typical POE GAC systems include pressure-flow columns in series configuration. Common flow rates range from 0.5 to 10.0 gpm per square foot. Factors such as pH and temperature of the influent, empty bed contact time (EBCT), surface area/volume ratio of the activated carbon, and solubility of the organic compound will affect the carbon adsorption process. The carbon usage is related to the EBCT, contaminant concentrations, desired effluent concentrations, and desired filter life.

GAC is designated a best available technology (BAT) under the National Primary Drinking Water Regulations Implementation (40 Code of Federal Regulations [CFR] 142.62) for a number of VOCs including some detected in site groundwater (TCE, carbon tetrachloride, cis-1,2-DCE, 1,1,1-TCA, and 1,1,2-TCA).

Effectiveness

Carbon adsorption is a well-proven, reliable technology to remove organics from aqueous waste streams. Carbon adsorption would be effective in removing many of the organic compounds present in site groundwater. Activated carbon has low sorptive capacities for vinyl chloride, which will not be effectively or efficiently removed (vinyl chloride is the end product of the degradation process of certain chlorinated solvent compounds, including TCE and tetrachloroethene [PCE]).

Implementability

Carbon adsorption would be readily implementable and is currently being used in one building. There are a sufficient number of vendors that provide carbon adsorption units. Carbon units can easily fit inside buildings and are readily plumbed into the existing water lines. Therefore, no external, winterized housing structures need to be constructed. Implementation factors also include planning for regeneration or disposal of the spent carbon. Regeneration services, which are typically conducted off site, are generally provided by the carbon suppliers. Spent carbon would likely require disposal in a RCRA hazardous waste facility. Such facilities are available.

A number of vendors are available who can provide POE GAC units for either commercial/industrial and residential applications.

Costs

Capital costs are low, and O&M costs range from low to high, depending on the carbon usage rate, which is a function of influent contaminant concentration and the sorptive capacities of the contaminants. Highly contaminated waste streams cause carbon to become spent very quickly, necessitating frequent replacement. Waste streams containing compounds with low sorptive capacities will also result in high carbon exhaustion rates. The process becomes expensive because of carbon regeneration or disposal costs and the added "down-time" associated with frequent regeneration or replacement of the carbon. However, the carbon in the existing GAC system has been operating for nearly 2.5 years, and after treating approximately 24,000 gallons, is currently experiencing the first stage of breakthrough. Replacement of the carbon is underway.

Conclusion

Activated carbon adsorption is a readily implementable technology that would effectively remove organic compounds from contaminated drinking water. Based on its effectiveness and low capital costs, this technology will be retained for further consideration as a treatment technology.

3.5.6.2 Filtration

Filtration is a process that uses a porous medium to remove suspended solids from a liquid. It is valuable in water and wastewater treatment for removing suspended solids prior to primary treatment processes or for the final cleaning or polishing of treated effluent. It is effective in removing organic and inorganic contaminants (particularly metals) that are bound to suspended solids in groundwater, often reducing the need for further treatment of these contaminants. Because groundwater is generally free of suspended

solids, filtration would only be needed as a pretreatment step for the GAC to prevent the gradual accumulation of solids.

Liquid filtration may be accomplished by numerous methods including screens, fibrous fabrics (paper or cloth), or beds of granular material. For small POE systems, fibrous cartridge systems are usually used.

Effectiveness

Filtration is widely used to remove particulates and organic matter from water. Filtering systems can be staged to progressively remove smaller materials; many system variations have been designed to reduce clogging and provide easy maintenance.

For treatment of groundwater, filtration would effectively remove suspended solids to meet drinking water criteria and to ensure adequate treatment by processes sensitive to suspended solids presence. Filtration alone would not achieve overall drinking water criteria, but its use would facilitate proper operation of downstream treatment units and complete removal of suspended solids from the treated groundwater. No adverse impacts to human health or the environment are likely to occur.

Implementability

Filtration is a readily implementable technology. Filtration for POE systems are commercially available from a wide variety of manufacturers and can be readily ordered to almost any specification. Filter media will occasionally have to be replaced.

Costs

Capital costs for filtration is low, as are O&M costs. O&M costs may increase slightly if high turbidity in the groundwater requires more frequent filter replacement.

Conclusion

Filtration is an effective and implementable technology to remove suspended solids from water. Filtration will be retained as a process option for POE groundwater treatment and as a safeguard for other treatment processes such as GAC, when needed.

3.6 SUMMARY OF APPLICABLE TECHNOLOGIES

The following table summarizes the identified technologies that will be retained or not retained for consideration.

Remedial Technologies	Retained for Consideration	Not Retained for Consideration
No Action	X	
Institutional Controls		X
Monitoring	X	
New Common Water Supply		X
Extend Municipal Water Line	X	
POE Well Water Treatment	X	

4.0 IDENTIFICATION AND ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

Several remedial action alternatives for the Southern Area Off-Site Water Supply were developed and evaluated. Alternative 1 is the no action alternative. Alternative 2 includes extending the Riverhead Water District water line. Alternative 3 includes installation of POE systems and groundwater monitoring.

The following sections will evaluate these remedial action alternatives based on effectiveness, implementability, and cost.

4.1 ALTERNATIVE 1: NO ACTION

The No Action alternative is evaluated to provide a comparative baseline against which other alternatives can be evaluated. Under this alternative, no remedial action will be taken and the site is left "as is", without the implementation of any remedial, treatment, or other mitigating actions.

Currently, wells at the PRSC are either contaminated or can become contaminated in the future. A POE treatment system is in place on the Activities Center well. Without action, human receptors could be exposed to groundwater contaminated with chlorinated VOCs.

4.1.1 Effectiveness

The No Action alternative would not be effective and would not achieve the RAO. Potential risks to human health at PRSC would remain. Human receptors could be exposed to groundwater contamination.

4.1.2 Implementability

Under the No Action alternative, no remedial action would be taken; therefore, there would not be difficulties or uncertainties associated with implementation.

4.1.3 Cost

There would be no capital or O&M costs associated with this alternative.

4.2 ALTERNATIVE 2: EXTENSION OF MUNICIPAL WATER LINE

Alternative 2 consists of extending the existing Riverhead Water District water main to the east so that potable water service can be provided to PRSC. The existing water main passes through NWIRP

Calverton along the western side of the road to the new entrance gate and terminates just north of Grumman Boulevard, south of the railroad tracks. The existing water main is reportedly 12-inch diameter ductile iron.

An 8-inch diameter ductile iron water line extension would be approximately 4,400 feet long, from its current termination to a point approximately 50 feet east of the line of the PRSC access road. The estimated depth of the pipeline is 4 feet to be below the frost line. To minimize the potential for impacts on wetlands, the pipeline would be installed along Grumman Boulevard and River Road. Fire hydrants would be installed at intervals of 1,000 feet. The new pipeline must pass underneath the new entrance gate road. This would be accomplished by a horizontal boring beneath the road and installation of a steel pipe sleeve. A valve would be installed at the new pipeline termination to allow for future expansion of the system. Figure 4-1 shows the proposed pipeline route. Figure 4-2 shows a schematic of the new piping system, including the tie-in to individual water users.

A water service connection for PRSC would be tapped into the new main near the PRSC access road. A horizontal boring would be used to install the service connection piping under River Road. The line would travel approximately 1,500 feet adjacent to the access road to the PRSC. From there, individual pipelines would branch off to each building currently or formerly supplied with well water (Main Lodge, Activities Center, residence, and pistol range trailer). Because of the long service connection run, 2-inch diameter copper or 2-inch High-Density Polyethylene (HDPE) pipe would be used to minimize the pressure drop. The pipeline diameter would be finalized in the design stage based on a thorough evaluation of the water needs at PRSC and the available water pressure in the Riverhead Water District main. The material of construction of the service connection from the water main to the PRSC buildings will be based on Riverhead Water District codes; however, considering the length of the service connection line and the high cost of copper pipe, HDPE is the preferred material. A backflow preventer would be installed in a vault near River Road, and a water meter would be installed in an underground vault near the PRSC buildings. Alternatively, the water meter would be installed inside one of the PRSC buildings. Individual backflow preventers would also be installed inside each building that has water service. After the new connection is complete, the four existing supply wells would be abandoned.

4.2.1 Effectiveness

Alternative 2 would meet the RAO. Providing an alternative potable water source would permanently prevent exposure to contaminated groundwater beneath the PRSC. Because the PRSC drinking water wells would be taken out of service and abandoned, there would be no possibility of exposure to the contaminated groundwater. There are no anticipated short-term environmental impacts to the public, although traffic will be disrupted on the roads during water line installation. Erosion and sedimentation controls would be used for the pipeline excavations to prevent adverse impacts on the Peconic River.

Short-term impacts to workers and the environment during well abandonment would be controlled. Alternative 2 would comply with all ARARs.

Alternative 2 would be effective in the long term and could be implemented as a permanent remedy to the contaminated water supply problem. Potable water would be provided from an off-site source so there would be no O&M costs.

4.2.2 Implementability

The equipment and services needed for installation of the water main extension and the service connection are readily available. The soils do not present any unusual excavation requirements, and no excavation through rock is required. Installation of the water main and service connection will temporarily disrupt traffic on Grumman Boulevard and River Road. Installation of the pipeline in the road rights-of-way would require permission and/or easements from the Town of Riverhead.

Upon award of this project, design and survey work must be performed for approximately 3 months. Construction could begin within approximately 3 months of completion of the design. Construction time for the water main and service connection would be sequential and is estimated to take 3 months each. Post-construction documents could be completed within another 2 months. Therefore, this alternative could be implemented within approximately 13 months from award date.

4.2.3 Cost

The estimated capital cost is $1,268,000, and the net present worth (NPW) of Alternative 2 is $1,268,000. Calculations are provided in Appendix A and costing information is provided in Appendix B.

The above cost is based on using HDPE for the service connection. If copper pipe is used, the capital cost and NPW are increased by approximately $150,000.

4.3 ALTERNATIVE 3: POE WELL WATER TREATMENT

Alternative 3 would consist of installing POE systems in the Activities Center, Main Lodge, residence, and pistol range trailer at PRSC. Each POE system will consist of a prefilter and two GAC tanks. The existing GAC system in the Activities Center would be used, and a prefilter would be added. Figure 4-3 shows a schematic of a typical POE system.

The suspended solids content of the groundwater is expected to be very low, so a prefilter with a disposable cartridge will be used. The filters would be changed out at 6 month intervals.

Contaminants would be removed from the groundwater using two GAC tanks in series. The GAC would be replaced when breakthrough occurs or every two years. The spent GAC would be regenerated or disposed of at the discretion of the GAC system service provider.

Under an existing monitoring program, monitoring wells upgradient of the water supply wells will be sampled and analyzed annually to monitor the movement of the plume and contaminant loading to the GAC. Higher concentrations of contaminants in the groundwater will require more frequent GAC change-outs. At each POE system, a sample of the untreated water, effluent from the first GAC tank, and effluent from the second GAC tank will be collected quarterly to monitor for contaminant breakthrough.

4.3.1 Effectiveness

Alternative 3 would meet the RAO. Implementation of this alternative would be expected to reduce exposure risks to acceptable levels. Long-term reliability of this alternative would be dependent on the proper operation and maintenance of the treatment units to ensure effective removal of organic contaminants. Alternative 3 would comply with all ARARs.

If contaminant concentrations in the groundwater increase over time, then the treatment systems may need to be upgraded to maintain the same degree of protection. Therefore, long-term monitoring would be required to assess whether additional response actions are needed to mitigate health risks.

Alternative 3 would be effective in the long term and could be implemented as a permanent remedy to the contaminated water supply problem. The proposed treatment systems under this alternative should be capable of achieving the PRGs since the individual treatment components have been demonstrated to be effective in removing the contaminants of concern. O&M of the POE treatment systems would need to be provided indefinitely until the contaminant source control and site remedial actions have been implemented such that the groundwater quality becomes suitable for potable use.

Should a POE treatment system fail at a particular well, there would probably be some short-term exposures to contaminated water supply while the treatment system is repaired or replaced. However, bottled water could readily be provided until repairs or replacement of the treatment systems have been completed in order to prevent ingestion exposures during the short term.

There are no anticipated short-term impacts to the public. Short-term impacts to workers and the environment during POE system sampling would be controlled.

4.3.2 Implementability

The equipment and services needed for installation and service of POE treatment systems are readily available for residential, commercial, and industrial applications. POE treatment systems can be easily constructed since off-the-shelf components are assembled and tailored to each well's level of contamination. Numerous firms are available to perform the sampling and analyses, and to interpret and report the results. Permits are not anticipated to be required under Alternative 3.

The installation of additional water treatment systems may pose some slight difficulty because space would need to be made available in each affected building for the POE equipment, and some minor modifications to pumping and plumbing systems would be required; however, no major obstacles were encountered in the installing the existing system.

The disposal of spent activated carbon is a long-term maintenance requirement for Alternative 3. Spent carbon would need to be collected and returned for regeneration or disposal in a secured solid waste landfill.

Upon award of this project, design work must be performed for approximately 2 months. Construction could begin within approximately 3 months of completion of the design. Construction time for the POE system installations is estimated to take 1 month. Post-construction documents could be completed within another 2 months. Therefore, this alternative could be implemented within approximately 8 months from award date.

4.3.3 Cost

The estimated capital cost is $131,000, and estimated NPW for Alternative 3 is $792,000. Calculations are provided in Appendix A and costing information is provided in Appendix B.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of the three alternatives is presented in this section. Table 5-1 provides a summary of the comparative analysis presented below.

5.1 EFFECTIVENESS

The No Action alternative would not be effective because groundwater users at PRSC would continue to be exposed to contaminants. Alternative 2 (Extend Municipal Water Line) would permanently eliminate the exposure to contaminated groundwater. Alternative 3 (POE Well Water Treatment) would also eliminate the exposure to contaminated groundwater. In Alternative 3, routine analysis of the treated well water would ensure that the POE systems are effectively removing contaminants.

Alternatives 2 and 3 are both technically reliable with respect to contaminants and site conditions. Water line installation and POE system installation are well proven methods to provide alternative water supplies.

There are no short-term impacts to human health from removal activities under Alternative 1. For Alternative 2, exposure of workers during well abandonment would be minimized through the use of proper protective equipment and health and safety standards. For Alternative 3, there is a slight potential for exposure to contaminated groundwater during installation of the POE systems and sampling.

There are no short-term impacts to the environment from removal activities under Alternative 1. Activities proposed under Alternative 2 would have some affects to the surrounding environment during excavation of both the water main and the service connection. Erosion and sediment controls would be needed to control off-site migration of soil during construction. For Alternative 3, there would be essentially no short-term impacts because all activities occur within existing buildings. Alternative 2 would be the most effective in the long-term because the exposure to contaminated groundwater at PRSC would be eliminated. Alternative 3 would be slightly less effective in the long-term because O&M, such as GAC replacement would be needed indefinitely.

In summary, Alternative 1, No Action, would be ineffective, Alternative 2 would be slightly more effective than Alternative 3.

5.2 IMPLEMENTABILITY

The No Action alternative would be easiest to implement because no action would be taken, and therefore, there would not be difficulties or uncertainties associated with implementation.

The technologies to be utilized for Alternatives 2 and 3 are well-proven. Equipment and construction techniques required to implement both Alternatives 2 and 3 are readily available. Alternative 2 requires acquisition of rights-of-way and/or easements to install the water main along Grumman Boulevard and River Road, to cross River Road, and to cross under the new entrance road. Alternative 3 only needs PRSC to grant access to the Navy to install and later maintain the POE systems.

Alternatives 2 and 3 could each be implemented in approximately one year.

5.3 COST

Detailed cost calculations are provided in Appendix A and costing information is provided in Appendix B. The estimated capital costs and NPW of the alternatives would be as follows:

Alternative	Capital Cost, $	NPW, $
Alternative 1	$0	$0
Alternative 2	$1,268,000	$1,268,000
Alternative 3	$131,000	$792,000

5.4 CONCLUSION

Alternative 2 (Extend Municipal Water Line) would be a permanent remedy that eliminates exposure with no long-term annual costs. This alternative provides the best balance of trade-offs based on the evaluation criteria.

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TABLE 3-1

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
CHEMICAL-SPECIFIC		
Safe Drinking Water Act (42 USC 300) - Maximum Contaminant Level Goals (40 CFR 141.50-141.51) - Maximum Contaminant Levels (40 CFR 141.61-141.62)	Applicable only to groundwater.	Applicable.
Reference Doses, USEPA Office of Research and Development	To be considered requirement in the public health assessment.	To be considered.
Carcinogenic Potency Factors, USEPA Environmental Criteria and Assessment Office; USEPA Carcinogen Assessment Group	To be considered requirement in the public health assessment.	To be considered.
Health Advisories, USEPA Office of Drinking Water	To be considered requirement in the public health assessment.	To be considered.
Clean Water Act (33 USC 1251-1376), Federal Ambient Water Quality Criteria Standards (40 CFR 131)	AWQC may be considered for actions that involve discharge to surface water at Site 2. Discharge to surface waters is not anticipated.	Not applicable.
LOCATION-SPECIFIC		
Clean Water Act Section 401 and 404 (b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230; 33 CFR 320-330)	Section 401 and 404 of the Clean Water Act regulates the discharge of dredged or fill material into U.S. waters, including wetlands. The purpose of Section 401 and 404 is to ensure that proposed discharges are evaluated with respect to impacts on the aquatic ecosystem. No activity that adversely affects a wetland is permitted if a practicable alternative that has less effect is available. If there is no other practicable alternative, impacts must be mitigated.	Potentially applicable.
Groundwater Protection Strategy (USEPA, 1984)	Groundwater beneath and downgradient of the NWIRP site is designated as Class I. Interim SA Off-Site activities are not expected to effect groundwater.	To be considered.

TABLE 3-1

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP CALVERTON, NEW YORK
PAGE 2 OF 3

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
Considering Wetlands at CERCLA Sites (OSWER 9280.0-03)	Wetlands are on or adjacent to the SA Off-Site plume.	Applicable.
Federal Protection of Wetlands Executive Order (E.O. 11990)	Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance natural and beneficial values of wetlands. Wetlands are on or adjacent to the SA Off-Site plume.	Potentially applicable.
The Flood Disaster Protection Act and National Flood Insurance Act (24 CFR 1909)	Areas affected by the SA Off-Site plume are not within a 100 year flood plain, therefore, this act is not applicable.	Not applicable.
Federal Floodplains Management Executive Order (E.O. 11988)	Areas affected by the SA Off-Site plume are not within a 100 year flood plain, therefore, this act is not applicable.	Not applicable.
Endangered Species Act of 1978 (16 USC 1531)	Federal agencies are required to consider the impacts on endangered and threatened species and their critical habitats. No species or habitat of federally listed species were identified at the NWIRP; however, migrating species may occasionally move through the area.	Potentially applicable.
Fish and Wildlife Coordination Act (16 USC 661)	The appropriate state agency and U.S. Fish and Wildlife Service is to be notified of activities which may impact aquatic life. Wetlands are adjacent to the SA Off-Site plume.	Potentially applicable.
Fish and Wildlife Improvement Act of 1978 (16 USC 742a) and the Fish and Wildlife Conservation Act of 1980 (16 USC 2901)	This act requires the consideration of impacts on wetlands and protected habitats. Wetlands are adjacent to the SA Off-Site plume.	Potentially applicable.

TABLE 3-1

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP CALVERTON, NEW YORK
PAGE 3 OF 3

The Archeological and Historic Preservation Act (16 USC Section 469)	Prior to site activities as well as during excavation, actions must be taken to identify, recover and preserve artifacts. Removal activities to take place along existing roads and within existing buildings.	Potentially applicable.
ARAR Citation	**Rationale for Use at NWIRP Site**	**Type of Requirement**
ACTION-SPECIFIC		
Resource Conservation and Recovery Act of 1976 (Amended 1984):		
• Identification and Listing of Hazardous Waste (40 CFR Part 261)	Specific materials at the site can be classifiable as characteristic hazardous wastes. This act may be applicable if wastes are removed from the site.	Potentially applicable.
• LDRs (40 CFR Part 268)	Treatment or disposal of contaminated wastes and/ or disposal of treatment residuals which may be considered hazardous waste would be subject to land disposal restrictions.	Potentially applicable.
• Treatment, Storage, and Disposal of Hazardous Waste (40 CFR Parts 262-265, and 266)	During site restoration, waste generation, transport, and/or treatment, storage, and disposal activities may occur. Soils at the site are not expected to be a hazardous waste.	Potentially applicable.

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
E.O.	Executive Order
LDRs	Land Disposal Restrictions
OSWER	Office of Solid Waste and Emergency Response
USC	United States Code
USEPA	U.S. Environmental Protection Agency

TABLE 3-2

PRELIMINARY STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
CHEMICAL SPECIFIC		
New York Ambient Air Quality Standards (6 NYCRR Parts 256 and 257)	The NWIRP Calverton area is classified as Level II. Particulate standards will be applicable to the site.	Applicable.
New York Public Water Supply Regulations (10 NYCRR Part 5)	Standards would apply to SA Off-Site plume interim actions.	Applicable.
LOCATION-SPECIFIC		
New York Freshwater Wetlands Act (Article 24 and Title 23 of Article 71 of the New York ECL) and New York Freshwater Wetlands Regulations (6 NYCRR Parts 662 - 64)	Activities within or adjacent to a state regulated wetlands requires a permit or letter of approval. State regulated wetlands are adjacent to SA Off-Site plume.	Potentially applicable.
New York Preservation of Endangered, Threatened and Indigenous Species; Species of Special Concern (NYCRR Section 182)	An endangered specie and a special concern specie have been confirmed at the NWIRP Calverton.	Applicable.
New York Regulation for Administration and Management of the Wild Scenic and Recreational Rivers System in New York State Excepting the Adirondack Park (6 NYCRR Part 666)	The Peconic River and some of its tributaries are classified as a Scenic River. SA Off-Site plume activities will occur near wetlands and Peconic River.	Applicable.
New York State, State Environmental Quality Review (Part 617)	SA and SA Off-Site plume are located within an area mapped by NYSDEC as Archeologically Sensitive.	Applicable.
ACTION-SPECIFIC		
New York ECL (New York Consolidated Laws, Chapter 43-B):		
• Air Pollution Control Act (ECL, Article 19)	Provides policy to maintain the quality of air resources of the state. Regulations provided in 6 NYCRR Parts 200 to 257. Although SA Off-Site activity does not involve contaminated material, dust could be generated during excavation.	Potentially applicable.
• New York Solid and Hazardous Waste Management Laws (ECL, Article 27)	Addresses solid and hazardous waste management. Waste GAC may be classifiable as hazardous	Potentially applicable.

TABLE 3-2

PRELIMINARY STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP CALVERTON, NEW YORK

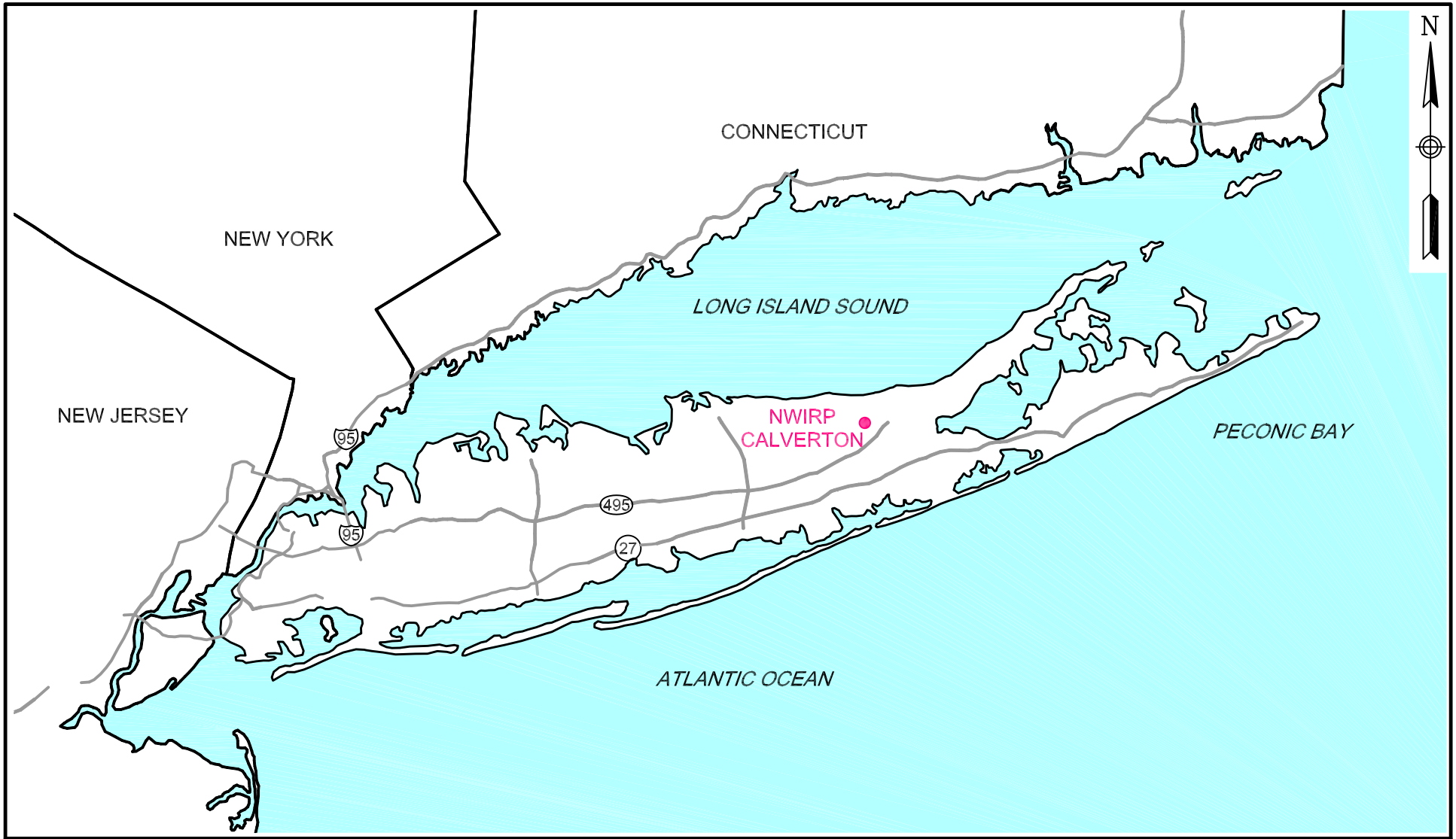
ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
	wastes.	
• Uniform Procedures (ECL, Article 70)	Establishes uniform review procedures for major regulatory programs. Procedures are provided for coordinating permitting for a project requiring one or more NYSDEC permits.	Not applicable.
New York Air Pollution Control Regulations (6 NYCRR Parts 200-202)	Although SA Off-Site activity does not involve contaminated material, dust could be generated during excavation.	Potentially applicable.
New York Waste Transport Permit Regulations (6 NYCRR Part 364)	Off-site transport of contaminated waste or treatment residuals (such as GAC) will require compliance with these regulations.	Potentially applicable.
New York General Hazardous Waste Management System Regulations (6 NYCRR Part 370)	GAC may be a hazardous waste.	Potentially applicable.
New York Identification and Listing of Hazardous Wastes Regulations (6 NYCRR Part 371)	GAC may be a hazardous waste.	Potentially applicable.
New York Hazardous Waste Manifest System Regulations (6 NYCRR Part 372)	Manifests may be required for off-site disposal of residuals.	Potentially applicable.
New York Land Disposal Restrictions Regulations (6 NYCRR Part 376)	Regulates the disposal of contaminated waste. GAC may be a hazardous waste.	Potentially applicable.
New York Rules on Hazardous Waste Program Fees (6 NYCRR Parts 483 and 484)	No hazardous waste program fees are payable related to cleanup, remediation, or corrective action activities. However, waste transporter program fees will be required for off-site disposal of wastes or treatment residuals.	Not applicable.

ECL Environmental Conservation Law
NYCRR New York Codes, Rules and Regulations
NYSDEC New York State Department of Environmental Conservation

TABLE 5-1

SUMMARY OF COMPARISON OF REMOVAL ACTION ALTERNATIVES
SOUTHERN AREA OFF-SITE WATER SUPPLY
NWIRP CALVERTON, NEW YORK

Evaluation Criteria	Alternative 1 – No Action	Alternative 2 –Extension of Municipal Water	Alternative 3 – POE Well Water Treatment
Effectiveness	No reduction in potential risks to human health. PRSC well users could be exposed to groundwater contaminants. No short-term impacts.	Exposure to contaminated groundwater would be permanently eliminated. Short-term exposure to contaminants during well abandonment. Disruption to traffic flow during water main installation. No O&M requirements.	Exposure to contaminants in groundwater would be eliminated by treatment. Treatment systems must be maintained indefinitely. Potential for exposure to contaminated groundwater during POE system installation and groundwater sampling.
Implementability	No Action to implement.	Equipment and construction techniques are readily available. Rights-of-way and/or easements along public road would be needed to construct water main extension.	Equipment and construction techniques are readily available. Navy would require access to PRSC for installation and maintenance of POE systems.
Cost	Capital Cost $0 NPW $0	Capital Cost $1,268,000 NPW $1,268,000	Capital Cost $131,000 NPW $792,000



0 15 30

SCALE IN MILES

TETRA TECHNUS, INC.

GENERAL LOCATION MAP
NWIRP CALVERTON
CALVERTON, NEW YORK

SCALE	NOT TO SCALE
FILE	112G02045CM02
REV	0
DATE	09/30/09
FIGURE NUMBER	FIGURE 1–1

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LEGEND

RETAINED PARCEL

POND

0 1,600 3,200

SCALE IN FEET

TETRA TECHNUS, INC.

SITE LOCATION MAP
NWIRP CALVERTON
CALVERTON, NEW YORK

SCALE	AS NOTED
FILE	112G02045CM02
REV	0
DATE	10/05/09
FIGURE NUMBER	FIGURE 1–2

112G02045\0510\112G02045GM01.DWG 10/05/09 MKB

N

PROPERTY BOUNDARY

FUEL CALIBRATION AREA SITE 6A

ENGINE TEST HOUSE SITE 10B

RUNWAY 32–14

GRUNMAN BLVD.

RIVER ROAD

PECONIC RIVER SPORTSMAN'S CLUB ACCESS ROAD

PECONIC RIVER

SWAN POND

PECONIC RIVER SPORTSMAN'S CLUB

POND

CONNECTICUT AVENUE

RESTRICTED DIRT ROAD

LEGEND

- PROPERTY LINE
- FENCE
- TREELINE
- RAILROAD
- WATER

0 600 1,200

SCALE IN FEET

TETRA TECH NUS, INC.

SITE LAYOUT SOUTHERN AREA NWIRP CALVERTON CALVERTON, NEW YORK

FILE	SCALE
112G02045GM01	AS NOTED
FIGURE NUMBER	REV / DATE
FIGURE 2–1	0 / 10/05/09

112G02045\0510\112G02045GM04.DWG 10/05/09 MKB

N

FC-MW-08-S
FC-MW-03-S
FC-MW-04-S
FC-MW-07-S
PROPERTY BOUNDARY
FUEL CALIBRATION AREA
ENGINE TEST HOUSE
ET-MW03S
ET-MW02S
ET-MW01S
RUNWAY 32-14
SA-CAL3
GRUNMAN BLVD.
SA-CAL4
SA-MW-126D
SA-MW-126I
SA-MW-126S
SA-MW-127S
SA-MW-127I
SA-MW-127D
SA-MW-129S
SA-MW-129I
SA-MW-129D
SA-MW-128S
SA-MW-128I
SA-MW-128D
1000
500
50
5
RIVER ROAD
PECONIC RIVER SPORTSMAN'S CLUB ACCESS ROAD
SA-PZ-122D
SA-PZ-122I
SA-PZ-122S
SA-PZ-120S
RIVER ROAD
PECONIC RIVER
SA-SW-204
SA-SD-204
SA-SW-125
SA-SD-125
SA-PZ-125
SA-PZ-123I
SA-PZ-123II
SA-PZ-123S
SA-SD-124
SA-SW-124
SA-PZ-124
RESTRICTED DIRT ROAD
SA-SW-201
SA-SD-201
SA-PZ-118S
SA-PZ-118I
SWAN POND
POND
CONNECTICUT AVENUE

LEGEND

- MONITORING WELL LOCATION
- SURFACE WATER SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- WATER SAMPLE LOCATION
- PROPERTY LINE
- FENCE
- TREELINE
- RAILROAD
- WATER
- VOC ISOCONTOUR (ug/L)

NOTES:
1. CONTOUR INTERVALS ARE IN ug/L.
2. TOTAL CHLORINATED VOC DATA FROM 2008 NAVY DATA (JAN-FEB AND JULY-AUG) AND 2008 SUFFOLK COUNTY HEALTH DEPARTMENT DATA (MAY-JUNE-JULY).
3. THE HIGHEST VOC CONCENTRATION FROM EACH WELL CLUSTER WAS SELECTED FOR THE ISOCONCENTRATION CONTOURS.

0 600 1,200
SCALE IN FEET

TETRA TECH NUS, INC.

2008 TOTAL CHLORINATED VOCs ISOCONCENTRATION MAP SOUTHERN AREA NWIRP CALVERTON CALVERTON, NEW YORK

FILE	SCALE
112G00903GM18	AS NOTED
FIGURE NUMBER	REV / DATE
FIGURE 2-2	0 / 10/05/09

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N

CA-PRSC-04	Jan 2008	June 2008	Aug 2008	Dec 2008	Mar 2009	June 2009
VOCs	–	–	–	–	–	–

CA-PRSC-03	Jan 2008	June 2008	Aug 2008	Dec 2008	Mar 2009	June 2009
VOCs	–	–	–	–	–	–

CA-PRSC-02-01	Jan 2008	Jan 2008 (Duplicate)	June 2008	Aug 2008	Dec 2008	Dec 2008 (Duplicate)	Mar 2009	June 2009	June 2009 (Duplicate)
1,1–Dichloroethane	12	12	7	13	12	12	12	12	12
1,1–Dichloroethene	–	5 J	4	4	5	5	3.3 J	3.6 J	3.5 J
1,2–Dichlorethane	0.5 J	0.6 J	0.6 J	–	0.4 J	0.4 J	–	–	–
1,2–Dichloroethylene (total)	2 J	1 J	2 J	1 J	1 J	1 J	–	–	–
cis–1,2–Dichloroethene	2 J	1 J	2	1 J	1 J	1 J	–	1.3 J	1.3 J
Trichloroethene	0.8 J	0.8 J	0.7 J	0.6 J	0.9 J	0.9 J	–	–	–
Vinyl Chloride	–	–	1 J	–	–	–	–	–	–
Benzene	–	–	–	–	0.3 J	0.3 J	–	–	–

CA-PRSC-02-02	Jan 2008	June 2008	Aug 2008	Dec 2008	Mar 2009	June 2009
1,1–Dichloroethane	–	–	–	0.4 J	–	1.1 J
1,2–Dichloroethane	–	–	0.8 J	–	–	–
Isopropylbenzene	2 J	–	1	0.6 J	–	–

CA-PRSC-02-03	Jan 2008	June 2008	June 2008 (Duplicate)	Aug 2008	Dec 2008	Mar 2009	June 2009
Chloromethane	0.8 J	–	–	–	–	–	–
Isopropylbenzene	–	–	0.4 J	1	–	–	–
Methyl tert–butyl ether	0.7 J	–	–	–	–	–	–

CA-PRSC-01	Jan 2008	June 2008	Aug 2008	Dec 2008	Mar 2009	June 2009
Napthalane	–	–	–	–	–	3.4

FIRE SUPPRESSION WELL

PRIVATE RESIDENCE

ACTIVITY CENTER

PECONIC RIVER SPORTSMAN'S CLUB

MAIN LODGE

POND

CONNECTICUT AVENUE

LEGEND

- WATER SAMPLE LOCATION
- PROPERTY LINE
- FENCE
- TREELINE
- RAILROAD
- WATER

NOTE:
–: NON–DETECT
BLANK INDICATES RESULT IS NON–DETECT
SAMPLE RESULTS FOR ORGANICS ARE REPORTED IN ug/L.

0 100 200
SCALE IN FEET

TETRA TECH NUS, INC.

GROUNDWATER ANALYTICAL RESULTS
SOUTHERN AREA
PECONIC RIVER SPORTSMAN'S CLUB
NWIRP CALVERTON
CALVERTON, NEW YORK

FILE	SCALE
112G02045GM03	AS NOTED
FIGURE NUMBER	REV / DATE
FIGURE 2–3	0 / 10/08/09

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N

PROPERTY BOUNDARY

FUEL CALIBRATION AREA SITE 6A

ENGINE TEST HOUSE SITE 10B

RUNWAY 32–14

EXISTING WATER MAIN

TIE INTO EXISTING WATER MAIN

GRUNMAN BLVD.

NEW 8–INCH DUCTILE IRON WATER MAIN

TERMINATE END FOR FUTURE EXTENSION

RIVER ROAD

PECONIC RIVER

PECONIC RIVER SPORTSMAN'S CLUB ACCESS ROAD

NEW SERVICE CONNECTION 2–INCH COPPER OR HDPE

PRIVATE RESIDENCE

FIRE SUPPRESSION WELL

ACTIVITY CENTER

PECONIC RIVER SPORTSMAN'S CLUB

RESTRICTED DIRT ROAD

MAIN LODGE

SWAN POND

POND

CONNECTICUT AVENUE

LEGEND

- PROPERTY LINE
- FENCE
- TREELINE
- RAILROAD
- WATER
- EXISTING WATER MAIN
- PROPOSED WATER MAIN EXTENSION
- PROPOSED SERVICE CONNECTION

NOTE: 1. FIRE HYDRANTS TO BE LOCATED AT SPACING OF 1,000 FEET.

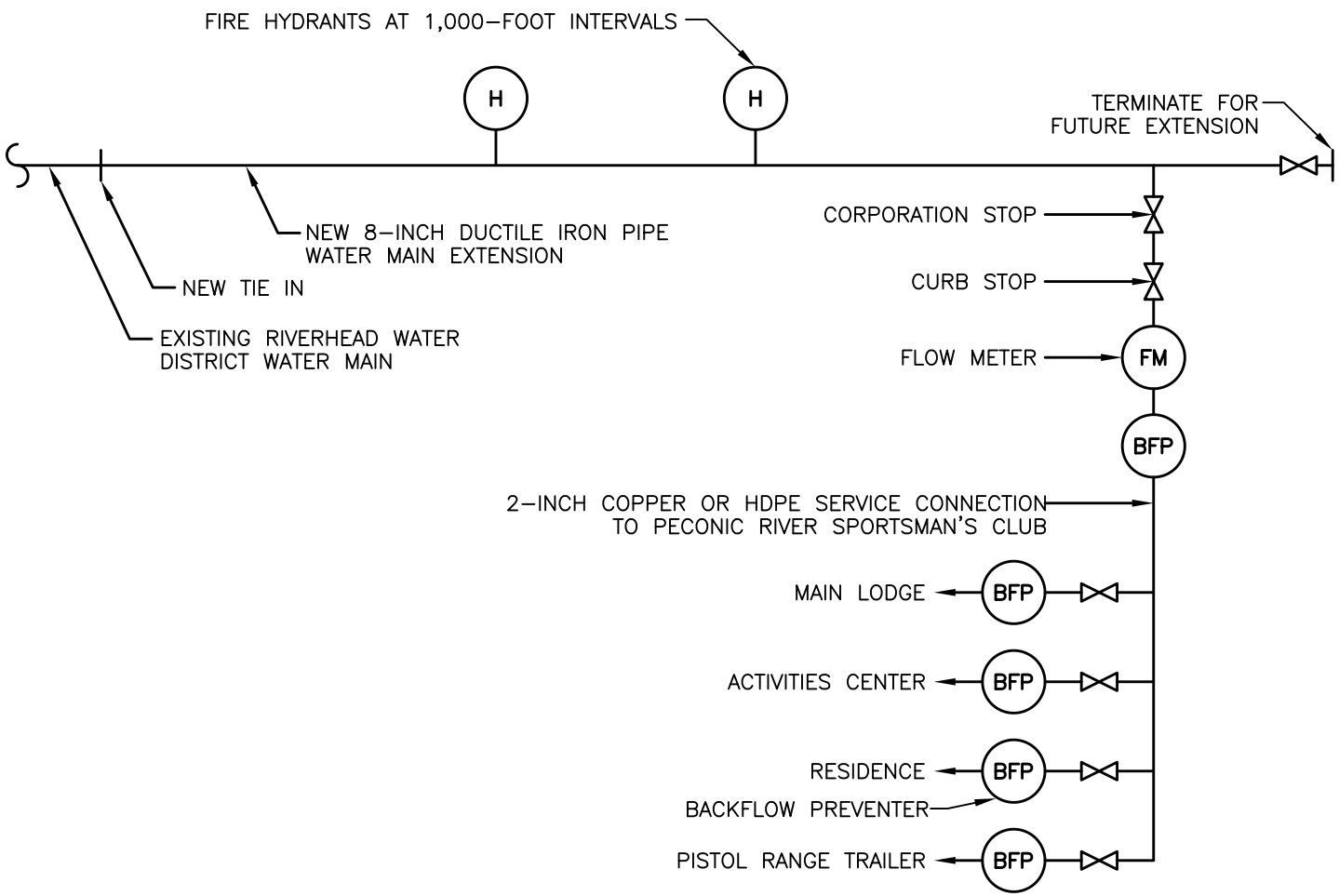
0 600 1,200

SCALE IN FEET

TETRA TECH NUS, INC.

ALTERNATIVE 2 – MUNICIPAL WATER LINE EXTENSION ROUTE SOUTHERN AREA OFF–SITE WATER SUPPLY EE/CA NWIRP CALVERTON CALVERTON, NEW YORK

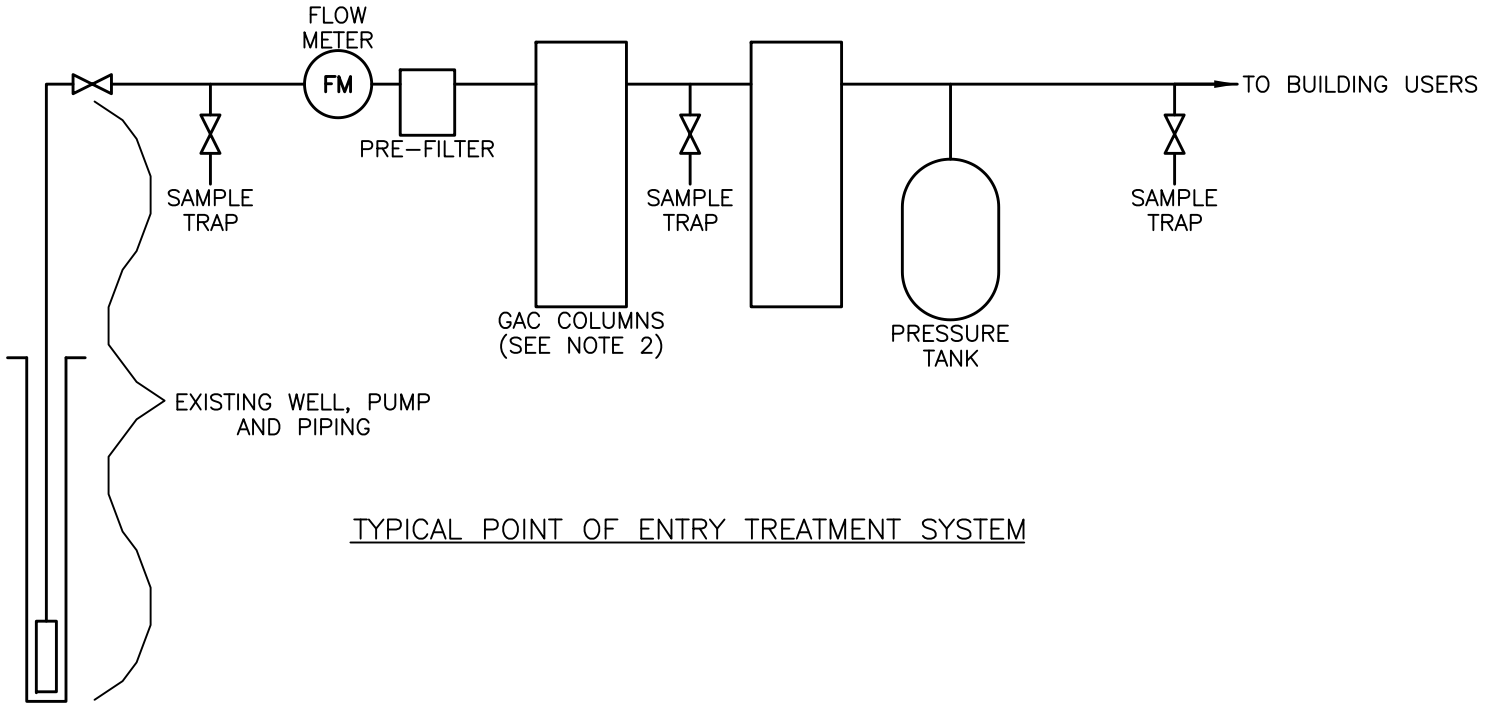
FILE	SCALE
112G02045GM02	AS NOTED
FIGURE NUMBER	REV / DATE
FIGURE 4–1	0 / 10/05/09



TETRA TECH NUS, INC.

ALTERNATIVE 2-MUNICIPAL WATER LINE EXTENSION SCHEMATIC
SOUTHERN AREA OFF-SITE WATER SUPPLY
NWIRP CALVERTON
CALVERTON, NEW YORK
EE/CA

SCALE	NOT TO SCALE
FILE	112G02045CM01
REV	0
DATE	10/08/09
FIGURE NUMBER	FIGURE 4-2



TYPICAL POINT OF ENTRY TREATMENT SYSTEM

NOTES:
1. POE TREATMENT SYSTEMS TO BE INSTALLED IN MAIN LODGE, ACTIVITIES CENTER, RESIDENCE AND PISTOL RANGE TRAILER.
2. EXISTING GAC COLUMNS IN ACTIVITIES CENTER TO BE USED.

TETRA TECH NUS, INC.

ALTERNATIVE 3–POE TREATMENT
SYSTEMS SCHEMATIC
SOUTHERN AREA OFF–SITE WATER SUPPLY
NWIRP CALVERTON
CALVERTON, NEW YORK
EE/CA

SCALE	NOT TO SCALE
FILE	112G02045CM02
REV	0
DATE	10/08/09
FIGURE NUMBER	FIGURE 4–3

APPENDIX A

CALCULATIONS

Tetra Tech NUS			*STANDARD CALCULATION SHEET*
CLIENT: NAVFAC Mid-Atlantic NWIRP Calverton Southern Area Off-Site Water Supply EE/CA	FILE No:	BY: JWL	PAGE: 1 of 2
SUBJECT: Water line extension and service connection		CHECKED BY:	DATE: 10/20/09

Purpose: Summarize information about Riverhead Water District water line extension and preliminary sizing of service connection to Peconic River Sportsman's Club (PRSC).

Water Main

The existing water main is reportedly 12-inch diameter ductile iron pipe. The line passes through NWIRP and follows the western side of the north-south road that leads to the New Gate on Grumman Blvd. The line terminates north of Grumman Blvd and is assumed to be south of the railroad.

The line of the extension is assumed to go east and follow the rights-of-way of Grumman Blvd and River Road. This route will avoid wetlands, although parts of the new pipeline will be near mapped wetlands. For estimating purpose, the extension will be terminated about 50 feet east of the line of the PRSC access road.

The new extension is assumed to match the existing: 8-inch diameter DIP with fire hydrants every 1,000 feet. At shut-off valve will be installed at the new termination to allow for future expansion of the water system.

The New Gate road crossing will require jacking pits, horizontal boring, and a pipe sleeve.

Using a site map, the length of the new pipeline is 4,400 feet.

Based on NOAA and NFPA maps, the frost depth is 3 to 4.5 feet deep, so for estimating purposes, a depth of 4 feet is assumed.

Service Connection

One service connection will be made to provide water to all buildings at PRSC. Based on the site drawings, the service connection will be about 1,500 feet long. The River Road crossing will require jacking pits, horizontal boring, and a pipe sleeve.

The instantaneous peak flow rate is assumed to be 30 gpm and the normal maximum about 20 gpm. The service connection will be either copper or HDPE, although HDPE is preferred because of the high cost of copper.

For copper pipe, the pressure drop through 1,500 feet at 30 gpm for different diameters is as follows:

Diameter, inches, type K	ΔP, psi/foot	ΔP, psi
2	0.009	13.5
2.5	0.003	4.5
3	0.001	1.5

Similarly, for HDPE, the pressure drop through 1,500 feet at 30 gpm for different diameters is as follows:

Diameter, inches	ΔP, psi/100 feet	ΔP, psi
1.5	2.5	37.5
2	0.71	10
3	0.112	1.7

Pressure drop per foot from engineeringtoolbox.com. For this estimate, assume 2-inch pipe will be used. For estimating, assume 100 feet from corporation stop on the main to the curb stop is copper, and the rest of the pipe is HDPE.

The total pressure drop for the service connection during peak flow of 30 gpm:

Component	ΔP, psi
Piping	13.5
Main backflow preventer	10 – 15
Water meter	3 – 5
Miscellaneous fittings	2
Building backflow preventer	10 - 15
Total	27 - 50

Need to confirm available Riverhead Water District pressure. Pressure tanks may need to be retained in the buildings for short term peak use.

TABLE 6. Pressure Loss of Water Due to Friction in Types K, L and M Copper Tube (psi per linear foot of tube)

FLOW, GPM	NOMINAL OR STANDARD SIZE, INCHES																							
	1/4			3/8			1/2			3/4			1			1 1/4			1 1/2			2		
	K	L	M	K	L	M	K	L	M	K	L	M	K	L	M	K	L	M	K	L	M	K	L	M
1	*0.138*	*0.118*	N/A	*0.036*	*0.023*	*0.021*	*0.010*	*0.008*	*0.007*	*0.002*	*0.001*	*0.001*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
2			N/A	0.130	*0.084*	*0.075*	*0.035*	*0.030*	*0.024*	*0.006*	*0.005*	*0.004*	*0.002*	*0.001*	*0.003*	*0.001*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
3			N/A	0.275	0.177	0.159	*0.074*	*0.062*	*0.051*	*0.014*	*0.011*	*0.009*	*0.003*	*0.003*	*0.001*	*0.001*	*0.001*	*0.001*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
4			N/A				0.125	0.106	0.086	*0.023*	*0.018*	*0.015*	*0.006*	*0.005*	*0.004*	*0.002*	*0.002*	*0.002*	*0.001*	*0.001*	*0.001*	*0.000*	*0.000*	*0.000*
5			N/A				0.189	0.161	0.130	*0.035*	*0.027*	*0.023*	*0.009*	*0.007*	*0.006*	*0.003*	*0.003*	*0.002*	*0.001*	*0.001*	*0.001*	*0.000*	*0.000*	*0.000*
10			N/A							0.126	0.098	0.084	*0.031*	*0.027*	*0.023*	*0.010*	*0.010*	*0.009*	*0.004*	*0.004*	*0.004*	*0.001*	*0.001*	*0.001*
15			N/A										0.065	0.057	0.049	*0.022*	*0.020*	*0.018*	*0.009*	*0.009*	*0.008*	*0.002*	*0.002*	*0.002*
20			N/A											0.096	0.084	0.037	0.035	*0.031*	*0.016*	*0.015*	*0.014*	*0.004*	*0.004*	*0.004*
25			N/A													0.057	0.052	0.047	*0.024*	*0.022*	*0.021*	*0.006*	*0.006*	*0.005*
30			N/A													0.079	0.073	0.066	0.034	0.031	0.029	*0.009*	*0.008*	*0.008*
35			N/A																0.045	0.042	0.039	*0.012*	*0.011*	*0.010*
40			N/A																0.058	0.054	0.050	*0.015*	*0.014*	*0.013*
45			N/A																		0.062	*0.018*	*0.017*	*0.016*
50			N/A																			0.022	0.021	0.020
60			N/A																			0.031	0.029	0.028
70			N/A																			0.042	0.039	0.037
80			N/A																					
90			N/A																					
100			N/A																					
120			N/A																					
140			N/A																					
160			N/A																					
180			N/A																					
200			N/A																					
250			N/A																					
300			N/A																					
350			N/A																					
400			N/A																					
450			N/A																					
500			N/A																					
550			N/A																					
600			N/A																					
650			N/A																					
700			N/A																					
760			N/A																					
1000			N/A																					
2000			N/A																					

NOTES:

1. Fluid velocities in excess of 5-8 feet per second are not recommended.
2. Friction loss values shown are for the flow rates that do not exceed a velocity of 8 feet per second.
3. Highlighted and italicized friction loss values indicate flow rates that are between 5 feet and 8 feet per second.

FLOW, GPM	NOMINAL OR STANDARD SIZE, INCHES																							
	2 1/2			3			4			5			6			8			10			12		
	K	L	M	K	L	M	K	L	M	K	L	M	K	L	M	K	L	M	K	L	M	K	L	M
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
30	0.003	0.003	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	0.004	0.004	0.004	0.002	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.005	0.005	0.005	0.002	0.002	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45	0.006	0.006	0.006	0.003	0.003	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.008	0.007	0.007	0.003	0.003	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.011	0.010	0.010	0.005	0.004	0.004	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
70	0.014	0.014	0.013	0.006	0.006	0.005	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
80	0.019	0.017	0.016	0.008	0.007	0.007	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90	0.023	0.022	0.020	0.010	0.009	0.009	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100	0.028	0.026	0.025	0.012	0.011	0.010	0.003	0.003	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
120			0.035	0.017	0.016	0.015	0.004	0.004	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
140				0.022	0.021	0.019	0.006	0.005	0.005	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
160				0.028	0.026	0.025	0.007	0.007	0.006	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
180							0.009	0.008	0.008	0.003	0.003	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
200							0.011	0.010	0.010	0.004	0.003	0.003	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
250							0.016	0.015	0.015	0.006	0.005	0.005	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
300									0.021	0.008	0.007	0.007	0.003	0.003	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
350										0.010	0.010	0.009	0.004	0.004	0.004	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
400										0.013	0.012	0.012	0.006	0.005	0.005	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
450										0.017	0.015	0.015	0.007	0.006	0.006	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000
500													0.008	0.008	0.008	0.002	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000
550													0.010	0.009	0.009	0.003	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000
600													0.012	0.011	0.011	0.003	0.003	0.003	0.001	0.001	0.001	0.000	0.000	0.000
650														0.013	0.012	0.004	0.003	0.003	0.001	0.001	0.001	0.001	0.000	0.000
700																0.004	0.004	0.004	0.001	0.001	0.001	0.001	0.001	0.001
760																0.005	0.004	0.004	0.002	0.001	0.001	0.001	0.001	0.001
1000																0.008	0.007	0.007	0.003	0.002	0.002	0.001	0.001	0.001
2000																						0.004	0.004	0.004

NOTES:

4. **Table 6** is based on the Hazen-Williams formula: $P = \frac{4.52Q^{1.85}}{C^{1.85} d^{4.87}}$.

Where:

P= friction loss, psi per linear foot
Q= flow, g.p.m.
d= average I.D., in inches
C= constant, 150

APPENDIX B

COST ESTIMATES

NWIRP CALVERTON
Calverton, New York
Southern Area Off-Site Water Supply EE/CA
Alternative 2: Extend Municipal Water Line
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans including Permits	400	hr			$37.00		$0	$0	$14,800	$0	$14,800
1.2 Connection Fee	1	ls		$500.00			$0	$500	$0	$0	$500
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Service Connection Mobilization/Demobilization	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
2.3 Driller Mobilization/Demobilization	1	ls	$1,500.00				$1,500	$0	$0	$0	$1,500
3 FIELD SUPPORT											
3.1 Office Trailer	3	mo				$375.00	$0	$0	$0	$1,125	$1,125
3.2 Field Office Equipment, Utilities, & Support	3	mo		$470.00			$0	$1,410	$0	$0	$1,410
3.3 Storage Trailer	3	mo				$99.00	$0	$0	$0	$297	$297
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	$1,250.00				$1,250	$0	$0	$0	$1,250
3.5 Construction Layout Survey	8	day	$1,675.00				$13,400	$0	$0	$0	$13,400
3.6 Site Superintendent	40	day		$109.00	$384.64		$0	$4,360	$15,386	$0	$19,746
3.7 Underground Utility Clearance	1	ls	$7,500.00				$7,500	$0	$0	$0	$7,500
4 WATER MAIN											
4.1 Ductile Iron Pipe, 8" dia.	4,400	lf	$100.00				$440,000	$0	$0	$0	$440,000
4.2 Horizontal Boring	100	lf	$470.00				$47,000	$0	$0	$0	$47,000
4.3 Horizontal Boring Jacking Pits	2	ls	$8,650.00				$17,300	$0	$0	$0	$17,300
5 SERVICE CONNECTION											
5.1 Trench/Backfill, 5' deep	1,500	lf			$1.45	$3.59	$0	$0	$2,175	$5,385	$7,560
5.2 Pipe Bedding	1,500	lf		$0.77	$0.20	$0.37	$0	$1,155	$300	$555	$2,010
5.3 Polyethylene Pipe, 2" dia.	1,400	lf		$2.76	$1.35		$0	$3,864	$1,890	$0	$5,754
5.4 Service Connection (vault, bfp, meter, stops)	1	ls	$30,000.00				$30,000	$0	$0	$0	$30,000
5.5 Back Flow Preventers - Buildings	4	ea		$300.00	$60.00		$0	$1,200	$240	$0	$1,440
5.6 Valves	4	ea		$400.00	$65.00		$0	$1,600	$260	$0	$1,860
5.7 Building Polyethylene Pipe, 2" dia.	400	lf		$2.76	$1.35		$0	$1,104	$540	$0	$1,644
5.8 Building Fittings, 25 each building	100	ea		$27.60	$13.50		$0	$2,760	$1,350	$0	$4,110
5.9 Misc Building Plumbing Improvements	4	ea	$1,500.00				$6,000	$0	$0	$0	$6,000
5.10 Site Restoration	1	ls	$2,500.00				$2,500	$0	$0	$0	$2,500
6 WELL ABANDONMENT											
6.1 Well Removal, 4 each @ 100'	400	lf	$8.00				$3,200	$0	$0	$0	$3,200
6.2 Disposal/Restoration/Decon//Misc	4	ea	$200.00				$800	$0	$0	$0	$800
7 POST CONSTRUCTION DOCUMENTS											
7.1 Completion Report	150	hr			$37.00		$0	$0	$5,550	$0	$5,550
Subtotal							$571,450	$18,953	$42,491	$10,862	$643,756
Overhead on Labor Cost @ 30%									$12,747		$12,747
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$57,145	$1,895	$4,249	$1,086	$64,376
Tax on Materials and Equipment Cost @ 4%								$758		$434	$1,193
Total Direct Cost							$628,595	$21,606	$59,487	$12,383	$722,071
Indirects on Total Direct Cost @ 20%											$144,414
Profit on Total Direct Cost @ 10%											$72,207
Subtotal											$938,692
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$938,692

NWIRP CALVERTON
Calverton, New York
Southern Area Off-Site Water Supply EE/CA
Alternative 2: Extend Municipal Water Line
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Potable Water Fees	See Note 1										$0
Contingency on Total Field Costs @	20%										$187,738
Engineering on Total Field Cost @	15%										$140,804
TOTAL CAPITAL COST											**$1,267,234**

NOTE 1: Water fees are offset by savings on electricity for pumps and GAC replacement costs for existing systen

NWIRP CALVERTON
Calverton, New York
Southern Area Off-Site Water Supply EE/CA
Alternative 2C: Extend Municipal Water Line (All Copper)
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans including Permits	400	hr			$37.00		$0	$0	$14,800	$0	$14,800
1.2 Connection Fee	1	ls		$500.00			$0	$500	$0	$0	$500
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Service Connection Mobilization/Demobilization	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
2.3 Driller Mobilization/Demobilization	1	ls	$1,500.00				$1,500	$0	$0	$0	$1,500
3 FIELD SUPPORT											
3.1 Office Trailer	3	mo				$375.00	$0	$0	$0	$1,125	$1,125
3.2 Field Office Equipment, Utilities, & Support	3	mo		$470.00			$0	$1,410	$0	$0	$1,410
3.3 Storage Trailer	3	mo				$99.00	$0	$0	$0	$297	$297
3.4 Utility Connection/Disconnection (phone/electric)	1	ls	$1,250.00				$1,250	$0	$0	$0	$1,250
3.5 Construction Layout Survey	8	day	$1,675.00				$13,400	$0	$0	$0	$13,400
3.6 Site Superintendent	40	day		$109.00	$384.64		$0	$4,360	$15,386	$0	$19,746
3.7 Underground Utility Clearance	1	ls	$7,500.00				$7,500	$0	$0	$0	$7,500
4 WATER MAIN											
4.1 Ductile Iron Pipe, 8" dia.	4,400	lf	$100.00				$440,000	$0	$0	$0	$440,000
4.2 Horizontal Boring	100	lf	$470.00				$47,000	$0	$0	$0	$47,000
4.3 Horizontal Boring Jacking Pits	2	ls	$8,650.00				$17,300	$0	$0	$0	$17,300
5 SERVICE CONNECTION											
5.1 Trench/Backfill, 5' deep	1,500	lf			$1.45	$3.59	$0	$0	$2,175	$5,385	$7,560
5.2 Pipe Bedding	1,500	lf		$0.77	$0.20	$0.37	$0	$1,155	$300	$555	$2,010
5.3 Polyethylene Pipe, 2" dia.	0	lf		$2.76	$1.35		$0	$0	$0	$0	$0
5.4 Copper Pipe, 2" dia	1,400	lf		$28.50	$3.05		$0	$39,900	$4,270	$0	$44,170
5.5 Service Connection (vault, bfp, meter, stops)	1	ls	$30,000.00				$30,000	$0	$0	$0	$30,000
5.6 Back Flow Preventers - Buildings	4	ea		$300.00	$60.00		$0	$1,200	$240	$0	$1,440
5.7 Valves	4	ea		$400.00	$65.00		$0	$1,600	$260	$0	$1,860
5.8 Building Copper Pipe, 2" dia.	400	lf		$28.50	$3.05		$0	$11,400	$1,220	$0	$12,620
5.9 Building Fittings, 25 each building	100	ea		$285.00	$30.50		$0	$28,500	$3,050	$0	$31,550
5.10 Misc Building Plumbing Improvements	4	ea	$1,500.00				$6,000	$0	$0	$0	$6,000
5.11 Site Restoration	1	ls	$2,500.00				$2,500	$0	$0	$0	$2,500
6 WELL ABANDONMENT											
6.1 Well Removal, 4 each @ 100'	400	lf	$8.00				$3,200	$0	$0	$0	$3,200
6.2 Disposal/Restoration/Decon//Misc	4	ea	$200.00				$800	$0	$0	$0	$800
7 POST CONSTRUCTION DOCUMENTS											
7.1 Completion Report	150	hr			$37.00		$0	$0	$5,550	$0	$5,550
Subtotal							$571,450	$91,025	$47,251	$10,862	$720,588
Overhead on Labor Cost @ 30%									$14,175		$14,175
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$57,145	$9,103	$4,725	$1,086	$72,059
Tax on Materials and Equipment Cost @ 4%								$3,641		$434	$4,075
Total Direct Cost							$628,595	$103,769	$66,151	$12,383	$810,897
Indirects on Total Direct Cost @ 20%											$162,179
Profit on Total Direct Cost @ 10%											$81,090
Subtotal											$1,054,166
Health & Safety Monitoring @ 0%											$0

NWIRP CALVERTON
Calverton, New York
Southern Area Off-Site Water Supply EE/CA
Alternative 2C: Extend Municipal Water Line (All Copper)
Capital Cost

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Total Field Cost											$1,054,166
Potable Water Fees See Note 1											$0
Contingency on Total Field Costs @ 20%											$210,833
Engineering on Total Field Cost @ 15%											$158,125
TOTAL CAPITAL COST											**$1,423,124**

NOTE 1: Water fees are offset by savings on electricity for pumps and GAC replacement costs for existing systen

CLIENT:	NWIRP CALVERTON	JOB NUMBER:	112G02045.0000.0510
SUBJECT:	Southern Area Off-Site Water Supply EE/CA		
BASED ON:		DRAWING NUMBER:	
BY: TJR Date: 10-2009	CHECKED BY: Date:	APPROVED BY:	DATE:

Alternative 3 - POE Treatment Systems

Annual Cost

Sampling (POE Wells)
Labor & Materials
Assume 16 hours to collect 3 samples at 4 POE systems, local, four times a year

1 person @ $80.00 per hour for 16 hours =	$1,280
Misc supplies, travel, copying, IDW disposal, etc. =	$800
report @ $100.00 per hour for 24 hours =	$2,400
	$4,480 per event

Analytical, per round for 30 years
Collect 3 water samples from 4 POE systems and analyze for VOCs.

	cost each	number	total	
samples	$140	12	$1,680	
2 duplicates & 1 trip blank	$140	3	$420	
			$2,100	per event

GAC Change Out
change every two years, 4 units @ $1,500 each unit

Prefilter
change every 6 months, 4 units @ $20 each unit

NWIRP CALVERTON
Calverton, New York
Southern Area Off-Site Water Supply EE/CA
Alternative 3: POE Treatment System
Capital Cost

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Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans including Permits	400	hr			$37.00		$0	$0	$14,800	$0	$14,800
1.2 Prepare LUCs	100	hr			$37.00		$0	$0	$3,700	$0	$3,700
2 MOBILIZATION AND DEMOBILIZATION AND FIELD SUPPORT											
2.1 Mobilization/Demobilization	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
2.2 Site Superintendent	15	day		$109.00	$384.64		$0	$1,635	$5,770	$0	$7,405
3 POE SYSTEM											
3.1 Prefilter/GAC	3	ea	$5,000.00				$15,000	$0	$0	$0	$15,000
3.2 Prefilter	1	ea	$1,000.00				$1,000	$0	$0	$0	$1,000
3.3 Misc Building Plumbing Improvements	4	ea	$1,500.00				$6,000	$0	$0	$0	$6,000
4 POST CONSTRUCTION DOCUMENTS											
4.1 Completion Report	75	hr			$37.00		$0	$0	$2,775	$0	$2,775
Subtotal							$23,000	$1,635	$27,045	$0	$51,680
Overhead on Labor Cost @ 30%									$8,113		$8,113
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$2,300	$164	$2,704	$0	$5,168
Tax on Materials and Equipment Cost @ 4%								$65		$0	$65
Total Direct Cost							$25,300	$1,864	$37,862	$0	$65,026
Indirects on Total Direct Cost @ 20%											$13,005
Profit on Total Direct Cost @ 10%											$6,503
Subtotal											$84,534
Health & Safety Monitoring @ 0%											$0
Total Field Cost											$84,534
Contingency on Total Field Costs @ 20%											$16,907
Engineering on Total Field Cost @ 35%											$29,587
TOTAL CAPITAL COST											**$131,028**

NWIRP CALVERTON
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Southern Area Off-Site Water Supply EE/CA
Alternative 3: POE Treatment System
Annual Cost

Item	Item Cost every year	Item Cost every 2 years	Notes
Sampling: POE Wells	$17,920		Collect 3 samples from 4 POE systems four times a year.
Analysis/Water	$8,400		Analyze water samples from POE systems.
GAC Change Out		$6,000	Change every two years, 4 units.
Prefilter Change Out	$160		Change every six months, 4 units.
Subtotal	$26,480	$6,000	
Contingency @ 10%	$2,648	$600	
TOTAL	**$29,128**	**$6,600**	

NWIRP CALVERTON
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Southern Area Off-Site Water Supply EE/CA
Alternative 3: POE Treatment System
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.7%	Present Worth
0	$131,028		$131,028	1.000	$131,028
1		$29,128	$29,128	0.974	$28,362
2		$35,728	$35,728	0.948	$33,874
3		$29,128	$29,128	0.923	$26,891
4		$35,728	$35,728	0.899	$32,116
5		$29,128	$29,128	0.875	$25,495
6		$35,728	$35,728	0.852	$30,450
7		$29,128	$29,128	0.830	$24,172
8		$35,728	$35,728	0.808	$28,870
9		$29,128	$29,128	0.787	$22,918
10		$35,728	$35,728	0.766	$27,372
11		$29,128	$29,128	0.746	$21,729
12		$35,728	$35,728	0.726	$25,952
13		$29,128	$29,128	0.707	$20,601
14		$35,728	$35,728	0.689	$24,605
15		$29,128	$29,128	0.671	$19,532
16		$35,728	$35,728	0.653	$23,328
17		$29,128	$29,128	0.636	$18,519
18		$35,728	$35,728	0.619	$22,118
19		$29,128	$29,128	0.603	$17,558
20		$35,728	$35,728	0.587	$20,970
21		$29,128	$29,128	0.572	$16,647
22		$35,728	$35,728	0.556	$19,882
23		$29,128	$29,128	0.542	$15,783
24		$35,728	$35,728	0.528	$18,850
25		$29,128	$29,128	0.514	$14,964
26		$35,728	$35,728	0.500	$17,872
27		$29,128	$29,128	0.487	$14,188
28		$35,728	$35,728	0.474	$16,945
29		$29,128	$29,128	0.462	$13,451
30		$35,728	$35,728	0.450	$16,066
				TOTAL PRESENT WORTH	**$791,108**