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SAMPLING AND ANALYSIS PLAN AREAS OF CONCERN 563, 569, 570, 578 ZONE E WITH
TRANSMITTAL CNC CHARLESTON SC
10/31/2002
CH2M HILL

AOCs 563, 567, 570, 578 Zone E
SAMPLING and ANALYSIS PLAN (RO)



CH2MHILL

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October 31, 2002

Mr. David Scaturro
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Re: Sampling and Analysis Plan (Revision 0) – AOC 563 and AOCs 569, 570, and 578,
Zone E

Dear Mr. Scaturro:

Enclosed are four copies of the Sampling and Analysis Plan (Revision 0) for AOC 563 and AOCs 569, 570, and 578 in Zone E of the Charleston Naval Complex (CNC). This sampling plan has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

The principal author of this sampling plan is Sam Naik. Please contact him at 770/604-9182, extension 255, if you have any questions or comments.

Sincerely,

CH2M HILL

Dean Williamson, P.E.

cc: Rob Harrell/Navy, w/att
Gary Foster/CH2M HILL, w/att

Sampling and Analysis Plan

**Areas of Concern 563, 569, 570 and 578,
Zone E**

**Charleston Naval Complex
North Charleston, SC**

Prepared for
**U.S. Navy Southern Division
Naval Facilities Engineering Command**

Prepared by
CH2M-Jones

October 2002

1 1.0 Introduction

2 This Sampling and Analysis Plan (SAP) has been developed for Area of Concern (AOC) 563
3 and AOCs 569, 570, and 578 in Zone E of the Charleston Naval Complex (CNC). These sites
4 are included in this SAP as they are in close proximity to each other, and require further
5 sampling to define the nature and extent of chlorinated volatile organic compounds
6 (CVOCs) that were previously detected in the shallow and deep groundwater. Following
7 completion of the field activities, AOCs 569, 570, and 578 will be addressed separately from
8 AOC 563 under the RCRA Facility Investigation (RFI) process.

9 1.1 Background

10 Previous RFI investigations that were conducted at AOC 563 and AOCs 569, 570, and 578
11 indicated the presence of trichloroethene (TCE) and tetrachloroethene (PCE) as chemicals of
12 potential concern (COPCs) in groundwater. CH2M-Jones has prepared this SAP to verify
13 current concentrations of these CVOCs in shallow and deep groundwater and to verify their
14 presence in the vicinity of AOC 563 in areas that were previously not sampled. This
15 investigation is intended to provide information that can be used to make decisions
16 regarding the need for corrective measures at the site.

17 Figure 1-1 illustrates the location of Zone E within the CNC. Figure 1-2 is an aerial
18 photograph of AOC 563 and AOCs 569, 570, and 578 in Zone E.

19 1.2 Organization of the Sampling and Analysis Plan

20 This SAP consists of the following sections, including this introductory section:

21 **1.0 Introduction** — Presents the purpose of the SAP and background information regarding
22 the site.

23 **2.0 Site Background and Conditions** — Provides a brief description of AOC 563 and AOCs
24 569, 570, and 578, and the findings from previous RFI activities.

25 **3.0 Proposed Sampling and Analysis** — Describes the investigative approach and program
26 for delineation of COPCs for the RFI.

27 **4.0 References** —Lists the references used in this document.

28 All tables and figures appear at the end of their respective sections.



-  Fence
-  Railroads
-  Roads
-  AOC Boundary
-  Buildings
-  Zone Boundary

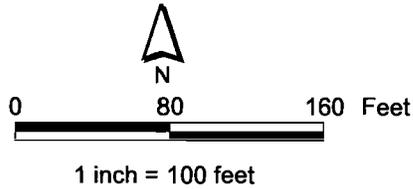


Figure 1-2
Site Map
AOCs 563, 569, 570, and 578
Charleston Naval Complex

1 **2.0 Site Background and Conditions**

2 **2.1 Site Background and Setting**

3 **2.1.1 AOC 563 – Former Building 37, Locomotive House**

4 AOC 563 is former Building 37, a locomotive maintenance house constructed in 1913 and
5 used until 1939. Probable maintenance activities involved petroleum-based lubricants,
6 chlorinated solvents and degreasers, and coal or petroleum fuels. Building 177 is currently
7 on the site of former Building 37. Building 177 is currently being used for storage and
8 equipment maintenance activities in support of the operations by Detyens Shipyards, Inc.
9 The area is zoned for industrial use (M-2).

10 Materials of concern identified in the *Final Zone E RFI Work Plan, Revision 1* (EnSafe/Allen &
11 Hoshall, 1995) include lubricants, heavy metals, dielectric fluid, petroleum hydrocarbons,
12 chlorinated solvents, and degreasers and coal/coal by-products.

13 **2.1.2 AOCs 569, 570, and 578 – Gas Station and Oil Storage, Former Building 1279; 14 Former Coal Storage Area; Transportation Shop and Garage, Building 25**

15 AOC 569 is a former gas station and oil storehouse previously housed in Building 1279 in
16 Zone E of the CNC. The gas station was constructed in 1944 and consisted of two pumps
17 and two 2,500-gallon underground storage tanks (USTs). In 1986, an additional 3,000-gallon
18 UST was installed. During 1992, the site was demolished and the three USTs were removed
19 by the Navy. During the tank closure activities, the tanks were pumped out and removed
20 and the vent lines were filled. Contaminated soil was excavated and confirmatory soil
21 samples were collected from the tank excavation area. The site was then backfilled with soil
22 and resurfaced with asphalt. These activities are documented in a report titled *Investigation
23 of Underground Contamination, Charleston Naval Shipyard – Building 1279* (LandRec, 1992).

24 As identified in the RCRA Facility Assessment (RFA) documentation, the materials of
25 concern for AOC 569 include petroleum hydrocarbons; benzene, toluene, ethylbenzene, and
26 xylene (BTEXs); polycyclic aromatic hydrocarbons (PAHs); volatile organic compounds
27 (VOCs); and heavy metals. The AOC 569 area is zoned for industrial use. The CNC RCRA
28 Permit identified AOC 569 as requiring a RFI.

29 AOC 570 is a former coal storage area in Zone E of the CNC. The coal storage facility
30 extended from Building 30 to Sixth Avenue and from Carolina Avenue to Hobson Avenue

1 at the CNC. The coal storage area was operated from 1919 to 1941. The RFA identified the
2 materials of concern at AOC 570 to be metals. The AOC 570 area is zoned for industrial use.
3 The CNC RCRA Permit identified AOC 570 as requiring a RFI.

4 AOC 578 consists of a transportation shop and garage in Building 25 in Zone E of the CNC.
5 The structure was built in 1940. The structure was originally used as an automobile garage
6 and more recently as a transportation and appliance maintenance shop. Building 25 recently
7 included various facilities, such as an air-conditioning repair shop, a sheet metal shop, two
8 electric shops, a paint shop, a sign shop, a carpenter's shop, a paper shredding area, an
9 electrical maintenance shop, a tool room, and an emergency supply storage area. Currently
10 Building 25 is used for equipment storage and as a transportation shop by the
11 Environmental Enterprise Group.

12 Material of concern identified in the *Resource Conservation and Recovery Act (RCRA) Facility*
13 *Assessment (RFA) Report* (EnSafe Inc.[EnSafe], 1995) at AOC 578 include petroleum
14 hydrocarbons, BTEXs, PAHs, VOCs, acids, and heavy metals. The AOC 578 area is zoned
15 for industrial use. The CNC RCRA Permit identified AOC 578 as requiring a RFI.

16 The RFI investigations at these sites included soil and groundwater investigations as
17 described in the *Zone E RFI Report, Revision 0* (EnSafe, 1998). An RFI Report Addendum and
18 Corrective Measures Study Work Plan (RFIRA/CMSWP) is in preparation by CH2M-Jones
19 for these sites and will be submitted for regulatory review during November 2002.

20 TCE and PCE have been historically detected in groundwater wells installed at these two
21 sites. The focus of this SAP is to further delineate and verify current concentrations of these
22 CVOCs in groundwater at these sites. This SAP does not include any soil investigations at
23 these sites.

24 **2.2.2 Historic Groundwater Investigations**

25 **AOC 563.** The RFI for AOC 563 included three shallow monitoring wells, E563GW001,
26 E563GW002, and E563GW003- formerly identified as NBCE563001, NBCE563002, and
27 NBCE563003, and one deep monitoring well, E563GW01D - formerly identified as
28 NBCE56301D, installed at the eastern and western ends of AOC 563 inside Building 177.
29 Figure 2-1 shows the locations of these groundwater monitoring wells. Groundwater
30 samples were analyzed for VOCs, SVOCs, metals, cyanide, pesticides/polychlorinated
31 biphenyls (PCBs), chlorides, sulfates, and total dissolved solids (TDS). No duplicate samples
32 were collected at this site.

1 During the RFI, each well was sampled four times between 1996 and 1997. Detections in
2 groundwater samples were compared with the U.S. Environmental Protection Agency
3 (EPA) Region III tap water risk-based concentrations (RBCs), maximum contaminant levels
4 (MCLs) and the Zone E background reference concentrations (BRCs) for shallow and deep
5 aquifers. Aluminum, arsenic, lead, and TCE were identified as chemicals of concern (COCs)
6 in shallow groundwater.

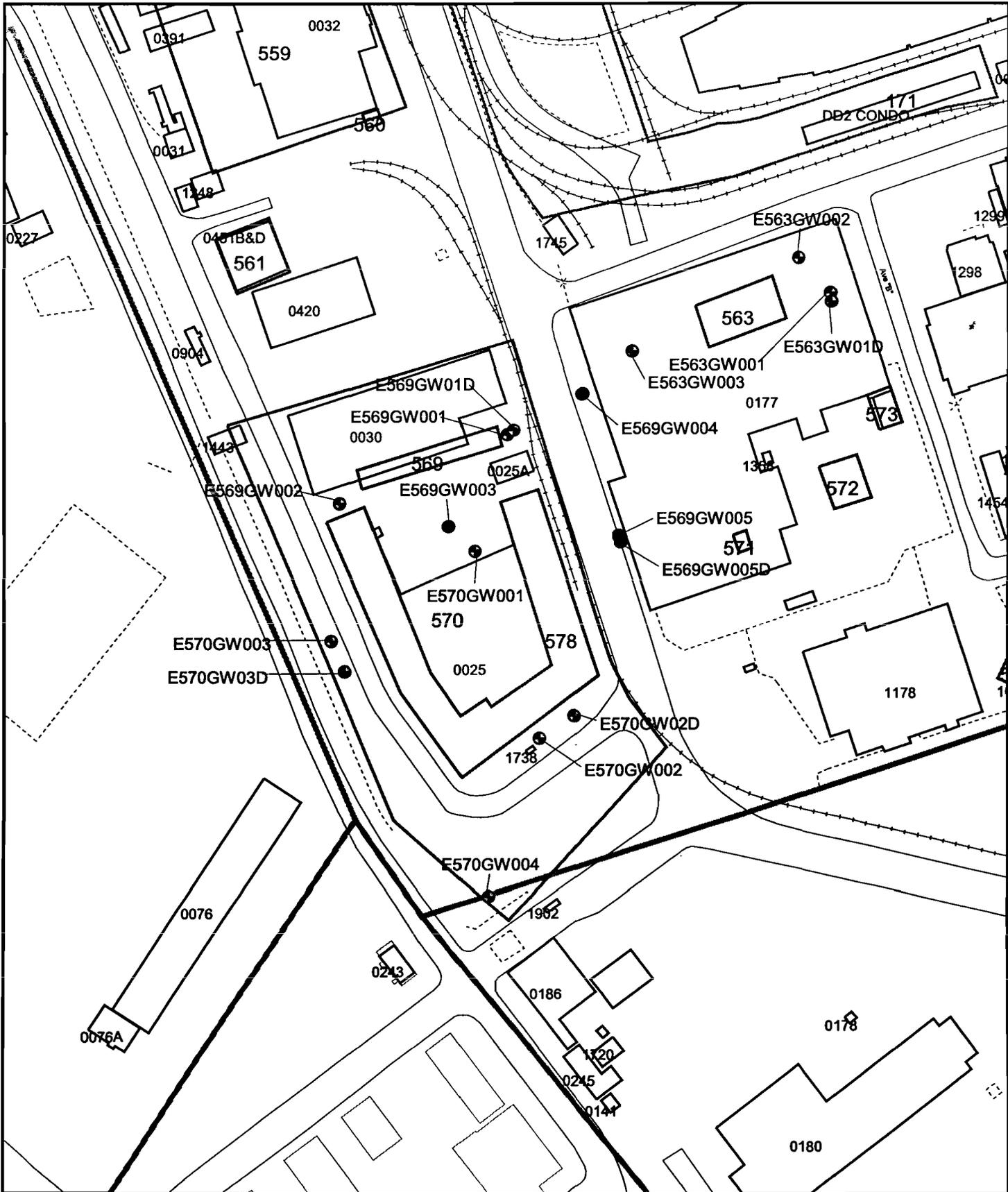
7 **AOCs 569, 570, and 578.** The RFI for AOCs 569, 570, and 578 included nine monitoring wells
8 (six shallow and three deep), as shown in Figure 2-1. The groundwater samples were
9 analyzed for VOCs, SVOCs, metals, chlorides, sulfates, total dissolved solids (TDS), and pH.
10 Two duplicates (one from a shallow monitoring well and one from a deep monitoring well)
11 were collected and analyzed for VOCs, SVOCs, herbicides, hexavalent chromium,
12 organophosphorus pesticides, and dioxins. Detections in groundwater samples were
13 compared with the EPA Region III tap water RBCs, MCLs and the Zone E BRCs for shallow
14 aquifers. Groundwater was sampled during four sampling events during the RFI (plus two
15 subsequent post-RFI sampling events). During the RFI, aluminum, arsenic, beryllium,
16 chloroform, chromium, lead, PCE, TCE, and vanadium were identified as COCs in shallow
17 groundwater. Thallium, TCE, and 1,2-dichloroethene (1,2-DCE) were identified in the RFI
18 report as COCs for deep groundwater.

19 Three shallow wells, E569GW003, E569GW004, and E569GW005, and one deep well,
20 E569GW05D, were installed and sampled for VOCs by CH2M-Jones during March 2002. The
21 three existing wells, E569GW001, E569GW002, and E570SB001, at AOCs 569, 570, and 578, as
22 shown in Figure 2-1, had not been sampled since 1997. Therefore, the wells were sampled
23 for VOCs during April 2002 as part of the SAP field investigation. Detections in
24 groundwater samples were compared with the MCLs and the Zone E background range for
25 shallow and deep aquifers.

26 **2.3 Summary**

27 Based on an evaluation of the data collected during the RFI and additional sampling events
28 in March and April 2002, and a comparison to COPC screening criteria currently used by
29 the Base Realignment and Closure Act (BRAC) Cleanup Team (BCT), CH2M Jones proposes
30 to collect groundwater samples to further delineate and verify current concentrations of
31 TCE and PCE in the groundwater. The sampling and analysis requirements are discussed in
32 Section 3.0.

- 1 A full evaluation and presentation of the COPC screening against current criteria, as well as
- 2 a COPC/COC refinement analysis, will be provided in a CMS Report after collection and
- 3 analyses of the samples proposed herein.



- Groundwater Monitoring Well (installed March 2002)
- - - Fence
- - - Railroads
- - - Roads
- AOC Boundary
- SWMU Boundary
- Buildings
- Zon Boundary

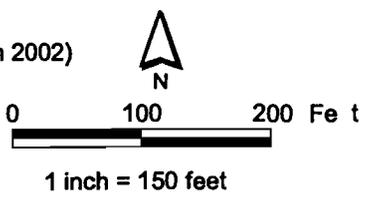


Figure 2-1
 Historical Groundwater Sampling Locations
 AOCs 563, 569, 570, and 578, Zone E
 Charleston Naval Complex

1 **3.0 Proposed Sampling and Analysis**

2 **3.1 Sampling Scope Summary**

3 **3.1.1 AOC 563**

4 Based on an evaluation of the data collected during the RFI, one constituent (TCE) in
5 shallow groundwater requires further delineation. Thus, the additional delineation
6 sampling will focus on VOCs, including potential biodegradation byproducts of TCE.
7 Existing and proposed new wells will be sampled as part of this effort.

8 Figure 3-1 presents the historical groundwater detections of TCE at AOC 563. Figure 3-2
9 presents the historical groundwater detections of PCE at the site.

10 **3.1.2 AOCs 569, 570, and 578**

11 Based on an evaluation of the data collected during the RFI, one constituent (PCE) in
12 shallow groundwater requires further delineation, and one deep groundwater constituent
13 (TCE) requires further delineation. Figures 3-1 and 3-2 present the historical groundwater
14 detections of PCE and TCE at these sites.

15 The additional delineation sampling will focus on PCE and TCE, plus potential
16 biodegradation byproducts of PCE. All other COCs identified in the RFI report are either
17 below current criteria or are considered to be adequately delineated. No new wells are
18 proposed to be installed at this site, but existing wells will be sampled.

19 Figure 3-3 depicts the shallow groundwater contours at these sites, from measurements
20 taken in May 2002.

21 **3.2 Nature and Extent of Contamination of Soil**

22 No further delineation of constituents detected in soil is necessary to complete the RFI.
23 Therefore, no soil sampling events are included in this SAP.

24 **3.3 Groundwater Sampling and Analysis Plan**

25 All investigative work will be performed in accordance with the Comprehensive Sampling
26 and Analysis Plan (CSAP) portion of the *Final Zone E RFI Work Plan, Revision 1*
27 (EnSafe/Allen & Hoshall, 1995).

1 Twelve existing shallow monitoring wells and five deep monitoring wells, some of which
2 showed exceedances of VOCs above their respective MCLs during the initial RFI and April
3 2002 sampling, will be re-sampled to verify current levels of VOCs. Up to five wells will also
4 be sampled for selected monitored natural attenuation (MNA) parameters as shown in
5 Tables 3-1 and 3-2.

6 Six new shallow monitoring wells and two new deep monitoring wells will be installed in
7 the vicinity of AOC 563 and samples will be collected from these new wells in order to
8 verify the presence of VOCs in the vicinity of the site and assess geochemical conditions.
9 Recent measurements of groundwater elevations indicate that the average depth to water at
10 the site is approximately 4 feet below land surface (ft bls). Well screens will be set below the
11 water table. Well installation requests for the proposed new monitoring wells will be made
12 to the South Carolina Department of Health and Environmental Control (SCDHEC) and are
13 attached to this SAP as Attachment A. Figure 3-4 shows the locations of existing and the
14 proposed new wells.

15 **3.4 Health and Safety**

16 CH2M-Jones places significant emphasis on the health and safety of our personnel, our
17 subcontractors, and the local community. Once all personnel have arrived on site as part of
18 the mobilization phase of the SAP, a project briefing and health and safety orientation meet-
19 ing will be held. All work completed as part of this SAP will be performed in accordance
20 with the *CH2M-Jones Site-Specific Health and Safety Plan* (CH2M-Jones, 2000).

21 Personnel working at the site will be required to comply with Level D PPE requirements
22 and additional mercury protection requirements, as specified in the Health and Safety Plan.

23 **3.5 Site Clearance**

24 Groundwater monitoring well locations will be marked or staked in the field using
25 coordinates derived from the CNC Environmental Geographic Information System (EGIS)
26 tool and utilizing Global Positioning System (GPS) equipment.

27 To prepare for the start of onsite operations, CH2M-Jones will notify the necessary agencies
28 and departments regarding planned activities at the project site.

29 CH2M-Jones will examine the site for existing water, electrical, natural gas, telephone, and
30 other utility lines that are potential hazards at the site. Utilities will be clearly marked and
31 identified.

1 **3.6 Waste Management and Disposal**

2 Four waste streams will be generated as part of this SAP: pavement debris, soil cuttings,
3 decontamination wastes, and used PPE. Soil cuttings will be drummed and characterized in
4 accordance with South Carolina Hazardous Waste Management Regulations (South
5 Carolina Department of Health and Environmental Control [SCDHEC] R.61-79.261) and
6 disposed of in accordance with all applicable regulations and permits. Decontamination
7 wastes and used personal protective equipment (PPE) will also be disposed of in accordance
8 with applicable regulations.

9 Pavement debris will be transported offsite for disposal either by asphalt recycling or
10 landfilled as demolition debris. Offsite transportation and disposal will be performed by
11 properly permitted and licensed subcontractors.

12 **3.7 Equipment Decontamination**

13 Decontamination of personnel, sampling and removal equipment, and materials will be in
14 accordance with the *CH2M-Jones Site-Specific Project Health and Safety Plan and AOC 563*
15 *Health and Safety Plan Addendum.*

TABLE 3-1
 Analytical Summary for Supplemental Sampling Activities
 Sampling and Analysis Plan, AOC 563 and AOCs 569, 570, 578, Zone E, Charleston Naval Complex

Sample ID	Number of Sample Locations	Analytes
Groundwater		
Existing shallow monitoring wells	12 locations	
E563GW001		VOCs
E563GW002		VOCs
E563GW003		VOCs, Iron, ORP, DO, Mn, pH, Temperature, Conductivity
E569GW001		VOCs, Iron, ORP, DO, Mn, pH, Temperature, Conductivity
E569GW002		VOCs, Iron, ORP, DO, Mn, pH, Temperature, Conductivity
E569GW003		VOCs
E569GW004		VOCs
E569GW005		VOCs, Iron, ORP, DO, Mn, pH, Temperature, Conductivity
E570GW001		VOCs
E570GW002		VOCs
E570GW003		VOCs
E570GW004		
Existing deep monitor wells	5 locations	
E563GW01D		VOCs
E569GW01D		VOCs
E569GW05D		VOCs
E570GW02D		VOCs
E570GW03D		VOCs, Iron, ORP, DO, Mn, pH, Temperature, Conductivity
New shallow monitoring wells:	6 locations	VOCs, Iron, ORP, DO, Mn, pH, Temperature, Conductivity
E563GW004		
E563GW005		
E563GW006		
E563GW007		
E563GW008		
E563GW009		

TABLE 3-1
 Analytical Summary for Supplemental Sampling Activities
 Sampling and Analysis Plan, AOC 563 and AOCs 569, 570, 578, Zone E, Charleston Naval Complex

Sample ID	Number of Sample Locations	Analytes
Groundwater		
New deep monitoring wells:	2 locations	VOCs, Iron, ORP, DO, Mn, pH, Temperature, Conductivity
E563GW04D		SW-846
E563GW07D		8260
DO	Dissolved oxygen	
Mn	Manganese	
ORP	Oxidation reduction potential	
VOC	Volatile organic compound	

TABLE 3-2
 Analytical Methods and Data Use
 Sampling and Analysis Plan, AOC 563 and AOCs 569, 570, 578, Zone E, Charleston Naval Complex

Analysis	Method	Comments	Data Use	Field or Fixed-Base Laboratory
VOCs	SW-846 8260B	Determine extent of chlorinated VOC contamination.	Data will be used to evaluate potential remedial approach(es) to be field-tested as part of pilot study	Fixed-base
Dissolved Oxygen (DO)*	DO Meter calibrated in the field according to the supplier's specifications		Concentrations < 0.5 mg/L generally indicate an anoxic pathway	Field
Total iron and manganese	SW-846 ICP 6010			
Ferrous Iron [FE(II)] and soluble manganese	SW-846 ICP 6010		May indicate an iron-reducing environment	Field
Oxidation Reduction Potential (ORP)	ASTM Method A2580B	Measurements made with electrodes and meter; protect sample from oxygen. Report results against the hydrogen electrode (Eh) by adding a correction factor specific to the electrode used	The ORP of groundwater reflects the relative oxidizing or reducing nature of the groundwater system. ORP is influenced by the nature of the biologically mediated degradation of contaminants, and may range from 800 mV (oxygenated) to less than -400 (strongly reducing)	Field
pH	Field probe with direct-reading meter calibrated in the field according to the supplier's specifications		Aerobic and anoxic processes are pH-sensitive; abiotic reduction of chromium is pH - sensitive	Field
Temperature	Field Probe with direct-reading mater			Field
Conductivity	E120.1/SW-846 Method 9050, direct meter reading		General water quality parameters used as a marker to verify that	Field

TABLE 3-2
 Analytical Methods and Data Use
Sampling and Analysis Plan, AOC 563 and AOCs 569, 570, 578, Zone E, Charleston Naval Complex

Analysis	Method	Comments	Data Use	Field or Fixed-Base Laboratory
Hydrogen	Equilibration with gas; determined with reduction gas detector (Microseeps)	site samples are obtained from the groundwater system	Determine terminal electron accepting process. Under biotic conditions, hydrogen may act as an electron donor	Fixed-Base
mg/L milligram per liter				

TABLE 3-3
 Coordinates for Proposed Sampling Locations
Sampling and Analysis Plan, AOC 563 and AOCs 569, 570, and 578, Zone E, Charleston Naval Complex

New Sample ID	Northing	Easting
New Groundwater Monitor Wells to be Installed, Developed and Sampled		
E563GW004	375,555	2,316,978
E563GW005	375,704	2,316,874
E563GW006	375,759	2,316,999
E563GW007	375,754	2,317,058
E563GW008	375,826	2,317,192
E563GW009	375,623	2,317,131
E563GW04D	375,555	2,316,978
E563GW07D	375,754	2,317,058

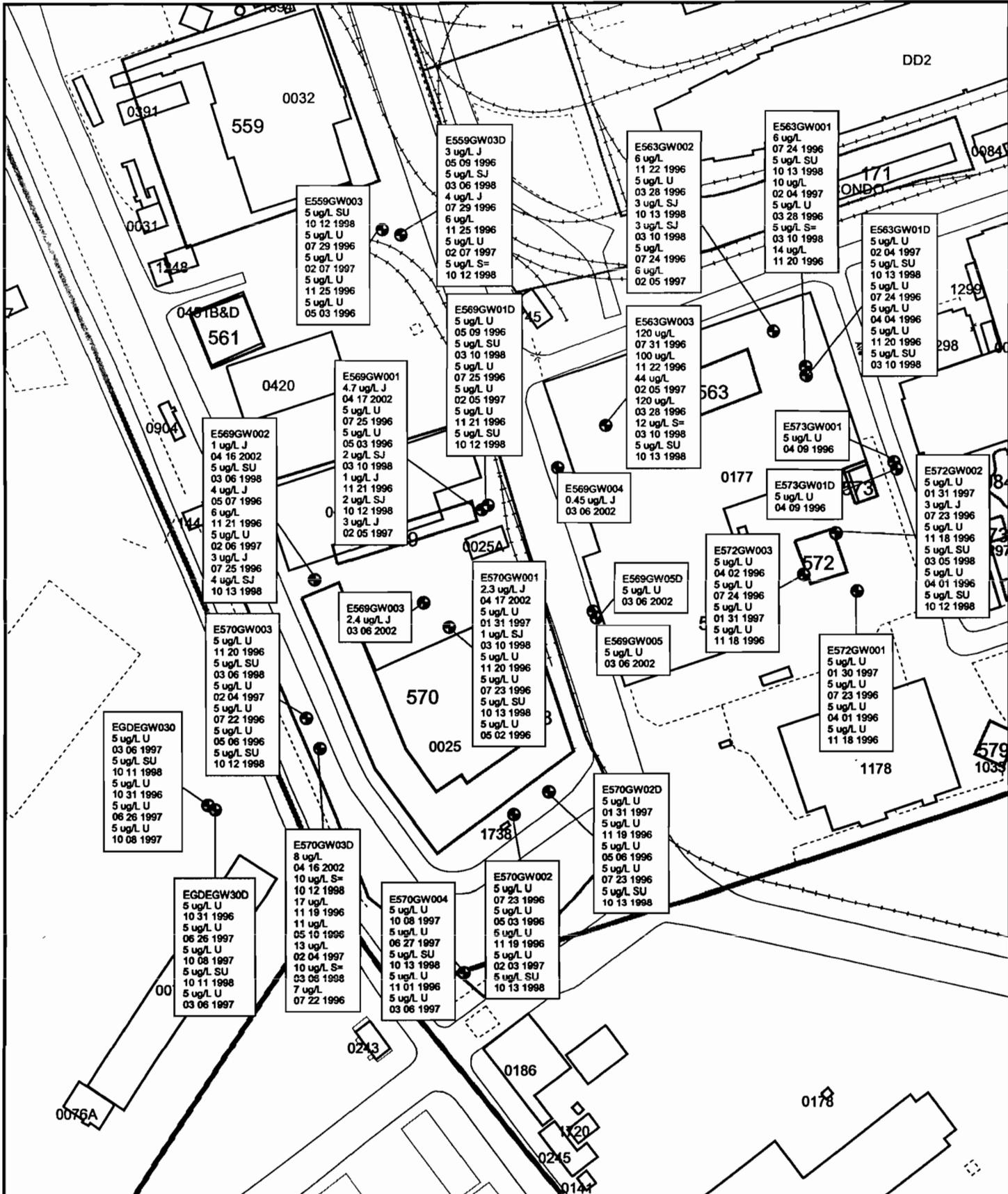
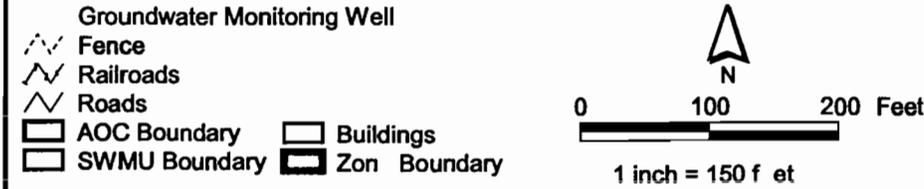


Figure 3-1
 Historical Groundwater TCE Detections
 AOCs 563, 569, 570, and 578, Zone E
 Charleston Naval Complex



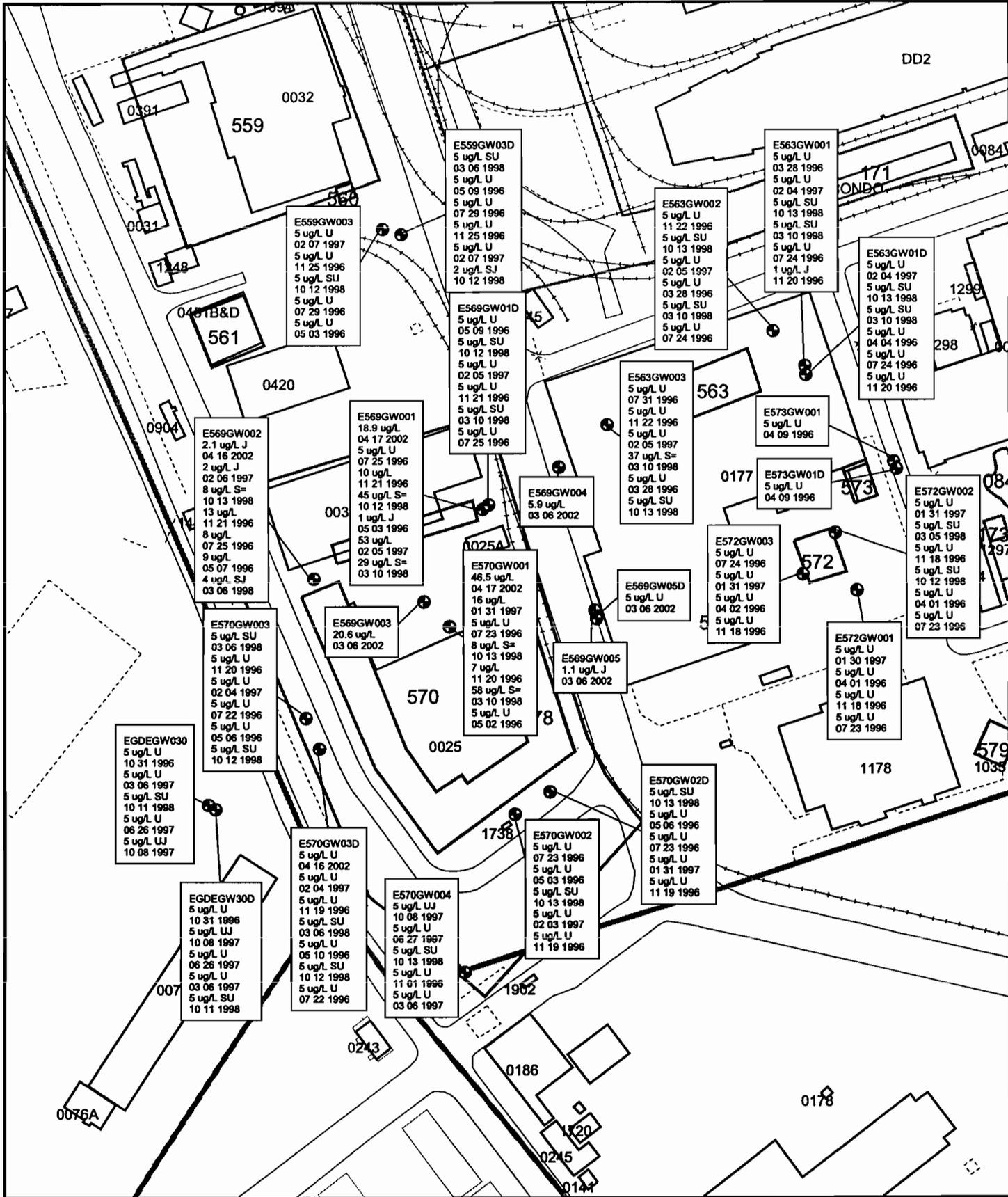
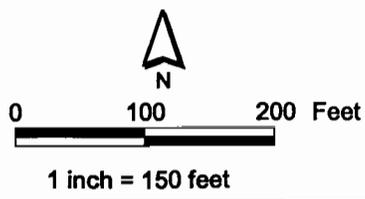
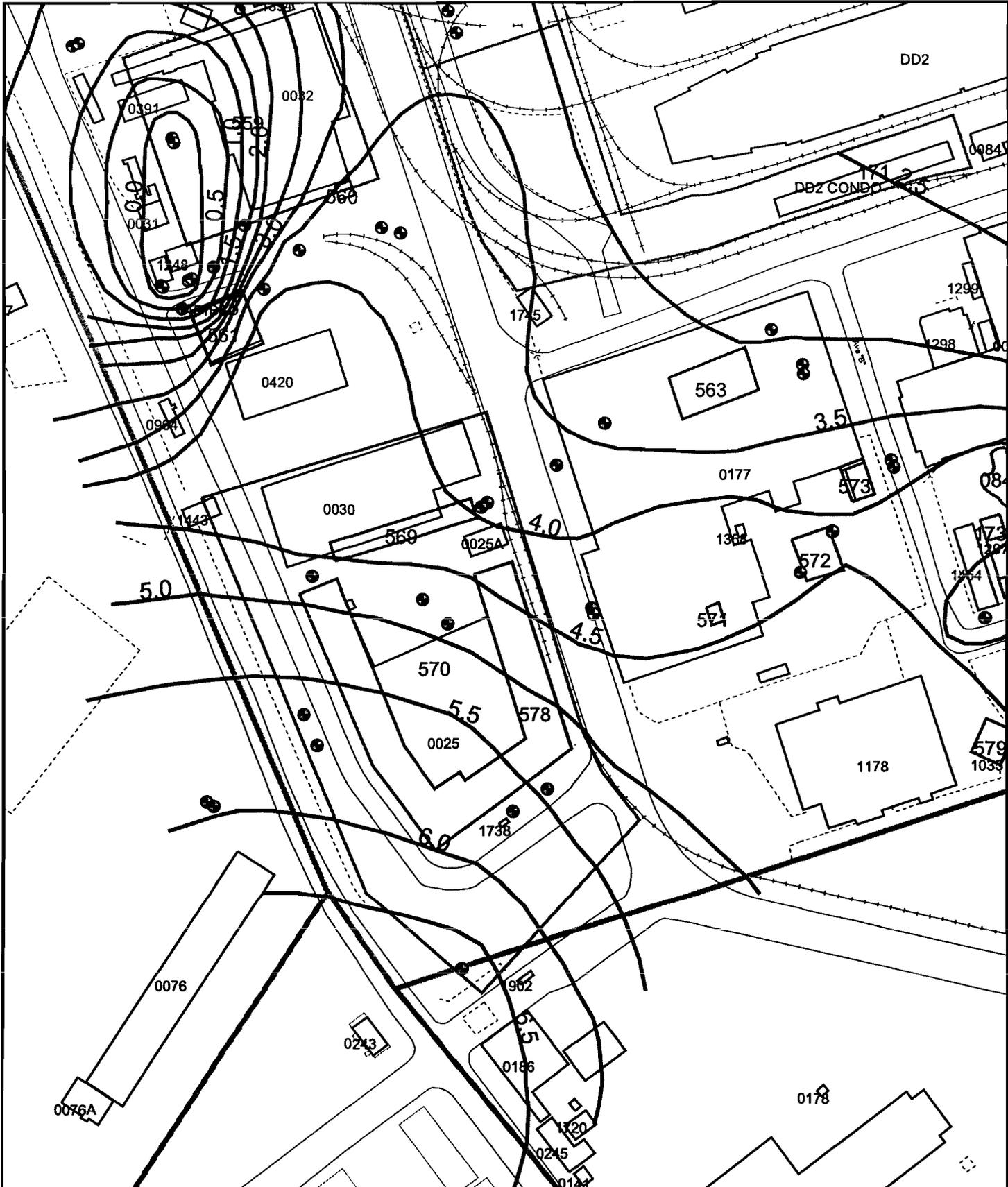


Figure 3-2
 Historical Groundwater PCE D tctions
 AOCs 563, 569, 570, and 578, Zone E
 Charleston Naval Complex

- Groundwater Monitoring Well
- F nce
- Railroads
- Roads
- AOC Boundary
- Buildings
- SWMU Boundary
- Zone Boundary

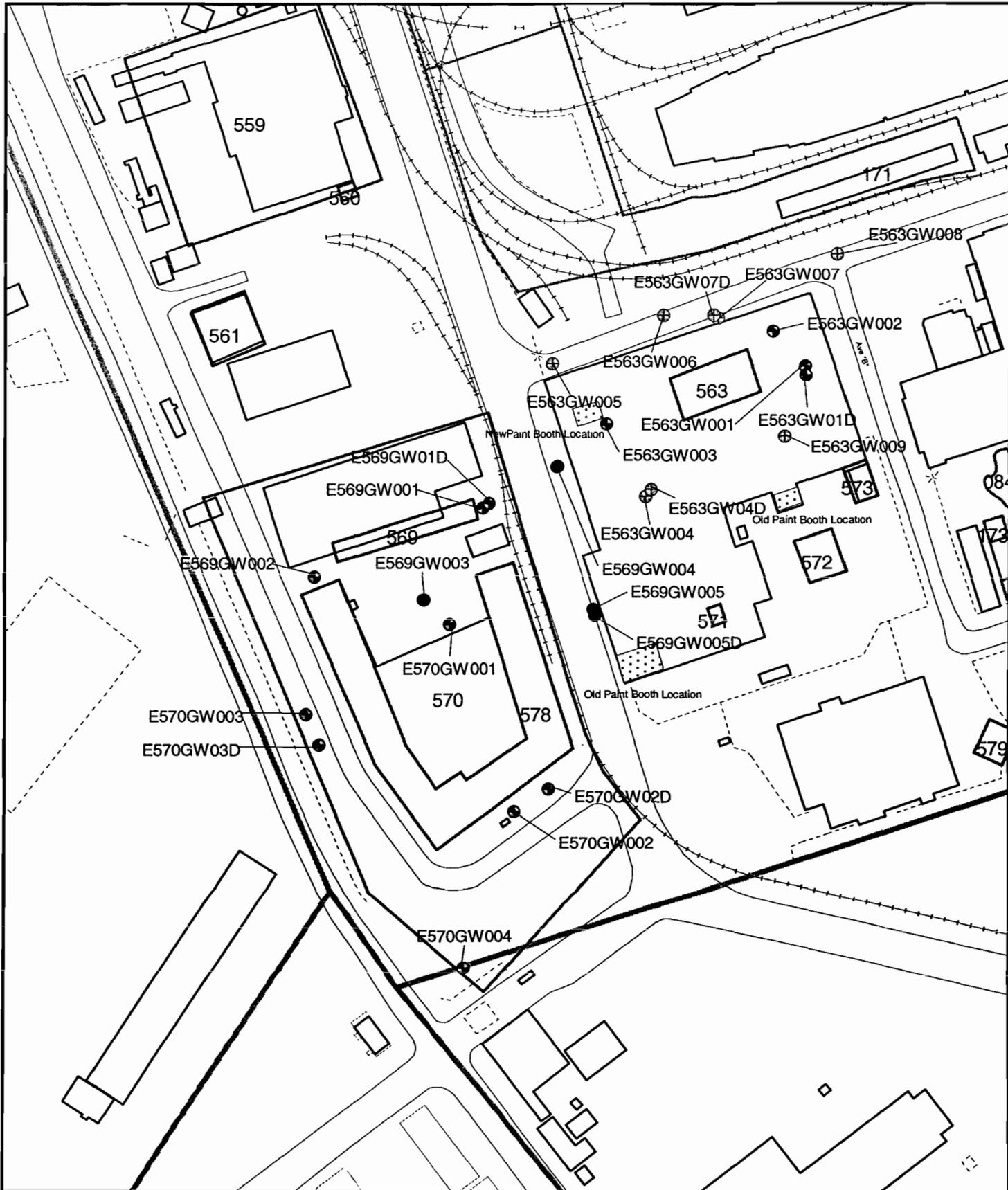




	Shallow Groundwater Elevation (ft above msl)		0 100 200 Feet
	Groundwater Monitoring W II		
	Fenc		1 inch = 150 feet
	Railroads		
	Roads		
	AOC Boundary		
	SWMU Boundary		
	Buildings		
	Zone Boundary		

Figure 3-3
 Shallow Groundwater Contour Map, May 2002
 AOCs 563, 569, 570, 578, Zone E
 Charleston Naval Complex





- Groundwater Monitoring Well
- Groundwater Monitoring Well (installed March 2002)
- Proposed Groundwater Monitoring Well
- Fence
- Railroads
- Roads
- Zone Boundary
- SWMU Boundary
- AOC Boundary
- Buildings

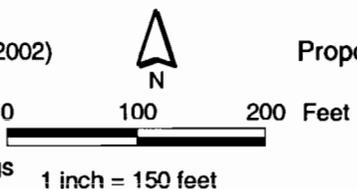


Figure 3-4
 Proposed New Groundwater Sampling Locations
 AOCs 563, 569, 570, and 578, Zone E
 Charleston Naval Complex

1 4.0 References

- 2 CH2M-Jones. *CH2M-Jones Site-Specific Health and Safety Plan*. 2000.
- 3 EnSafe Inc. *Zone E RFI Report, Revision 0, NAVBASE Charleston*. November 1997.
- 4 EnSafe Inc./Allen & Hoshall. *Final RCRA Facility Assessment, Naval Base Charleston*. June
5 1995.
- 6 EnSafe Inc./Allen & Hoshall. *Final Zone E RFI Work Plan, Naval Base Charleston. Revision 1*.
7 June 1995.
- 8 EnSafe Inc. *Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) Report*.
9 July 1995.
- 10 U.S. Environmental Protection Agency (EPA). *Environmental Services Division Standard*
11 *Operating Procedures and Quality Assurance Manual (ESDSOPQAM)*. 1996.
- 12 LandRec. *Investigation of Underground Contamination, Charleston Naval Shipyard – Building*
13 1279. 1992.

Attachment

October 31, 2002

158814.ZE.PR.07

Mr. Paul Bergstrand, P. G.
Hydrogeologist
South Carolina Department of Health and Environmental Control
Bureau of Land & Waste Management
Division of Hydrogeology
8901 Farrow Road
Columbia, SC 29203

Subject: Request for Installation of Groundwater Monitor Wells near AOC 563, Zone E
Charleston Naval Complex, North Charleston, South Carolina

Dear Paul:

On behalf of the U.S. Navy Southern Division Naval Facilities Engineering Command, CH2M-Jones requests the installation of six shallow groundwater monitoring wells and two deep groundwater monitoring wells around AOC 563 in the vicinity of Building 177 in Zone E, CNC. Figure 1 rev. 1 shows the site map with the locations of the proposed six wells.

The purpose of these new wells is to verify the presence of trichloroethylene (TCE) in the shallow groundwater around AOC 563 which has historically shown low-level detections of TCE above its MCL.

The depth to groundwater at the site is approximately 4-5 ft below land surface (bls).

Well installations will be performed in accordance with the South Carolina Well Standards and Regulations (R.61-71).

Table 1 rev.1 presents the detailed information required for monitoring well installation approval.

CH2M-Jones has scheduled to complete this work during the first week of November 2002, coinciding with the completion of well installations at AOC 617. If you have any questions, comments, or require additional information please do not hesitate to contact us.

Mr. Paul Bergstrand, P.G.
Page 2
October 31, 2002

Sincerely,

CH2M HILL

Tom Beisel, P.G.
Project Geologist
(770) 604-9182 ext 367

enclosures

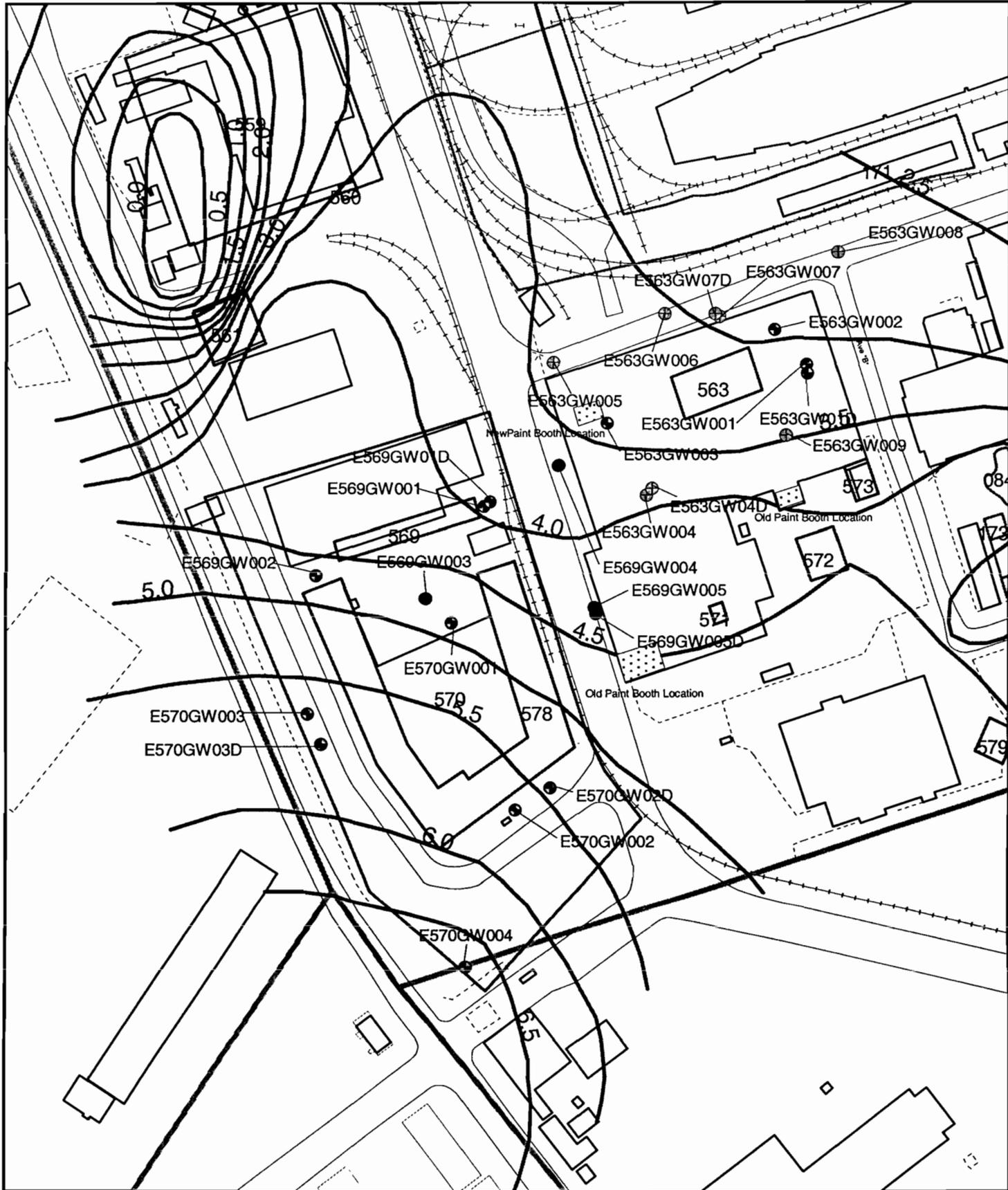
cc:

Tony Hunt, P.E./SOUTHDIV
Rob Harrell/SOUTHDIV
Dean Williamson, P.E./CH2M HILL/GNV

TABLE 1 REV.1

Monitoring Well Installation Information Summary
 AOC 563 Area, Zone E, Charleston Naval Complex

Well Identification	Well Diameter (Inner & Outer)	Method of Drilling	Screen Depth (ft bls)	Screen Length (ft)	Screen Mesh/ Slot Size	Expected Total Depth of Well (ft bls)	Material of Well Construction	Analysis Parameters*	Development (e.g., low flow, bailer, etc.)	Grout (Type, Mixture Ratio, etc.)	Finish Type	Purpose for Well	Other/ Comments
E563GW004	2-inch (inner)	Hollow Stem Auger	3-13	10	0.01	13	Schedule 40 PVC	VOCs, Fe, ORP, DO, Mn, pH, Temp, Cond.	Low Flow Pump with surge block	Portland Type II with 5% Bentonite	flush-mount	Groundwater monitoring	
E563GW005	2-inch (inner)	Hollow Stem Auger	3-13	10	0.01	13	Schedule 40 PVC	VOCs, Fe, ORP, DO, Mn, pH, Temp, Cond.	Low Flow Pump with surge block	Portland Type II with 5% Bentonite	flush-mount	Groundwater monitoring	
E563GW006	2-inch (inner)	Hollow Stem Auger	3-13	10	0.01	13	Schedule 40 PVC	VOCs, Fe, ORP, DO, Mn, pH, Temp, Cond.	Low Flow Pump with surge block	Portland Type II with 5% Bentonite	flush-mount	Groundwater monitoring	
E563GW007	2-inch (inner)	Hollow Stem Auger	3-13	10	0.01	13	Schedule 40 PVC	VOCs, Fe, ORP, DO, Mn, pH, Temp, Cond.	Low Flow Pump with surge block	Portland Type II with 5% Bentonite	flush-mount	Groundwater monitoring	
E563GW008	2-inch (inner)	Hollow Stem Auger	3-13	10	0.01	13	Schedule 40 PVC	VOCs, Fe, ORP, DO, Mn, pH, Temp, Cond.	Low Flow Pump with surge block	Portland Type II with 5% Bentonite	flush-mount	Groundwater monitoring	
E563GW009	2-inch (inner)	Hollow Stem Auger	3-13	10	0.01	13	Schedule 40 PVC	VOCs, Fe, ORP, DO, Mn, pH, Temp, Cond.	Low Flow Pump with surge block	Portland Type II with 5% Bentonite	flush-mount	Groundwater monitoring	
E563GW04D	2-inch (inner)	Hollow Stem Auger	22-32	10	0.01	32	Schedule 40 PVC	VOCs, Fe, ORP, DO, Mn, pH, Temp, Cond.	Low Flow Pump with surge block	Portland Type II with 5% Bentonite	flush-mount	Groundwater monitoring	
E563GW07D	2-inch (inner)	Hollow Stem Auger	22-32	10	0.01	32	Schedule 40 PVC	VOCs, Fe, ORP, DO, Mn, pH, Temp, Cond.	Low Flow Pump with surge block	Portland Type II with 5% Bentonite	flush-mount	Groundwater monitoring	



Groundwater Monitoring Well
 Groundwater Monitoring Well (installed March 2002)
 Proposed Groundwater Monitoring Well
 4.0 Shallow Groundwater Elevation (ft. above msl)
 Fence
 Railroads
 Roads
 Zone Boundary
 SWMU Boundary
 AOC Boundary
 Buildings



0 100 200 Feet

1 inch = 150 feet

Figur 1 r v. 1
 Proposed New Groundwater Sampling Locations
 AOCs 563, 569, 570, and 578, Zone E
 Charleston Naval Complex

