03.13-3/1/03-00171

Final

Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment Report for Sites 3, 4, 5, and 6

St. Juliens Creek Annex
Chesapeake, Virginia

Volume II - Text Tables and Figures

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command
Norfolk, Virginia

Contract No. N62470-95-D-6007
CTO-0027

March 2003

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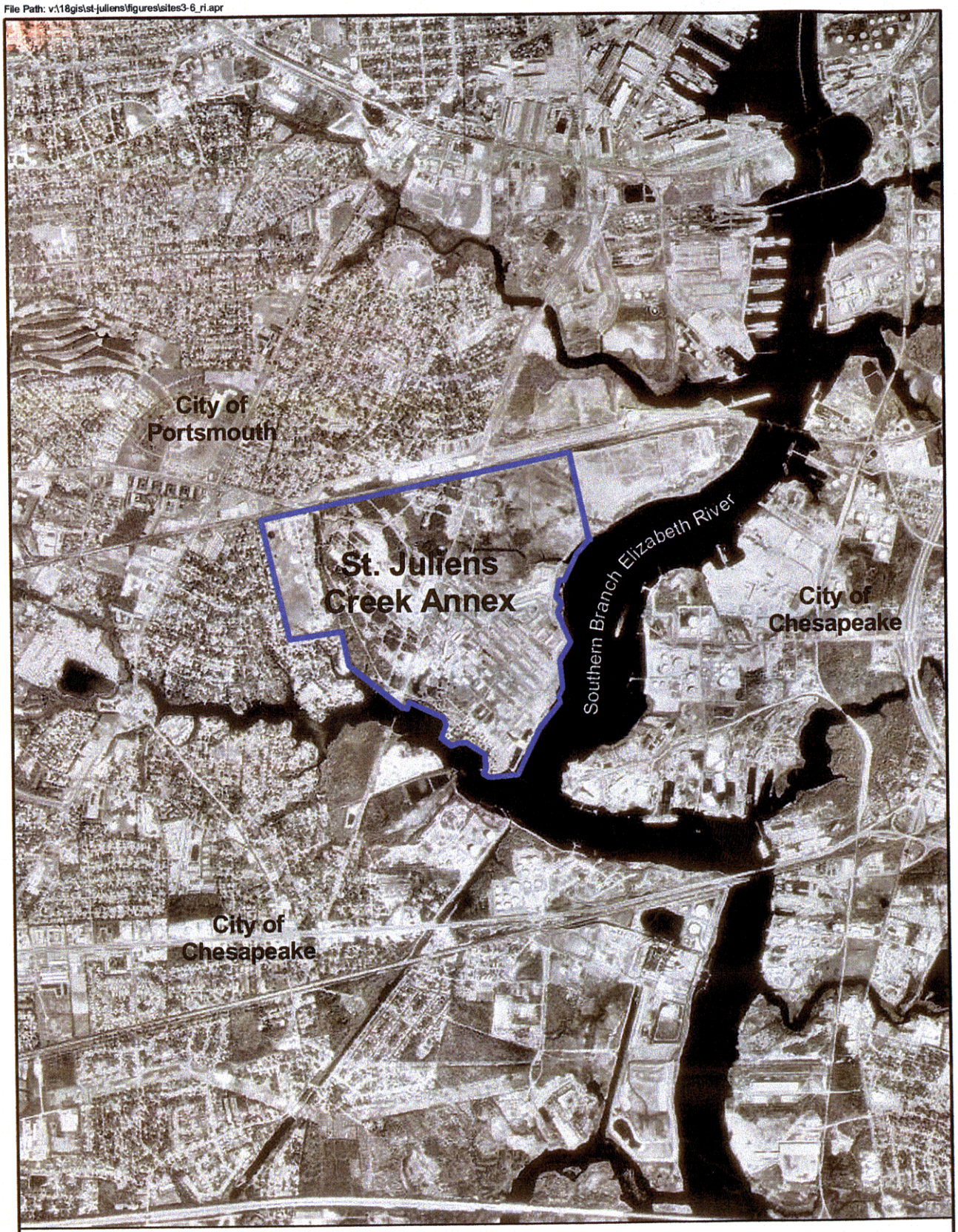

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St. Juliens Creek Annex

N

0 2000 4000 Feet

Figure 1-1
Location of St. Juliens Creek Annex
St. Juliens Creek Annex
Chesapeake, Virginia

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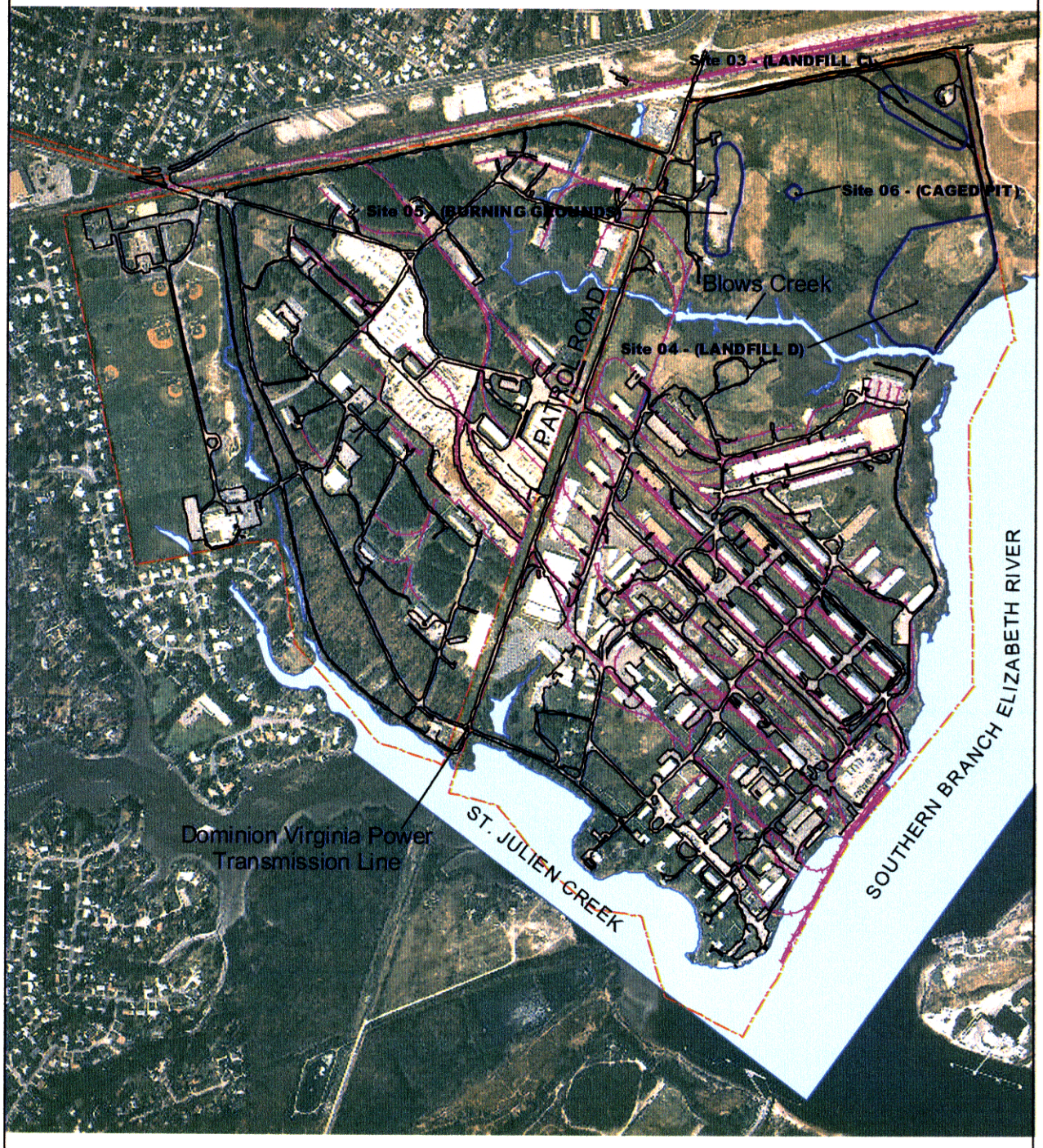

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- Site Locations
- Roads
- Railroads
- Activity Boundary
- Water Bodies

N

500 0 500 1000 Feet

Figure 1-2
Location of Sites 3, 4, 5, and 6
within St. Juliens Creek Annex
St. Juliens Creek Annex
Chesapeake, Virginia

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Table 2-1
Summary of Samples Collected During the Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

				Analytical Parameters				
Site Name	**Sample Type**	**Number of Samples**	**Sample Names**	**TCL VOCs**	**TCL SVOCs**	**TCL Pesticides/PCBs**	**TAL Inorganics**	**Nitramines**
Site 3 (Landfill C)	Surface Soil	2	03SS01, 03SS02	x	x	x	x	x
	Groundwater	3	03GW01, 03GW02, 03GW03	x	x	x	x	x
Site 4 (Landfill D)	Surface Soil	2	04SS01, 04SS02	x	x	x	x	x
	Groundwater	3	04GW01, 04GW02, 04GW03	x	x	x	x	x
Site 5 (Burning Grounds)	Surface Soil	4	05SS01, 05SS02, 05SS03, 05SS04	x	x	x	x	x
	Groundwater	4	05GW01, 05GW02, 05GW03, 05GW04	x	x	x	x	x
Site 6 (Caged Pit Area)	Surface Soil	1	06SS01	x	x	x	x	x

TCL - Target Compound List
VOC - Volatile Organic Compound
SVOC - Semivolatile Organic Compound
PCB - Polychlorinated biphenly

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 3				
	Site 3 Surface Soil		Site 3 Direct-Push Groundwater		
Analyte	03SS01	03SS02	03GW01	03GW02	03GW03
Volatile Organic Compounds (VOCs)[1]					
1,1,1-Trichloroethane	12 U	13 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	12 U	13 U	10 U	10 U	10 U
1,1,2-Trichloroethane	12 U	13 U	10 U	10 U	10 U
1,1-Dichloroethane	12 U	13 U	10 U	10 U	10 U
1,1-Dichloroethene	12 U	13 U	10 U	10 U	10 U
1,2-Dichloroethane	12 U	13 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	12 U	13 U	10 U	10 U	10 U
1,2-Dichloropropane	12 U	13 U	10 U	10 U	10 U
2-Butanone	12 U	13 U	10 U	10 U	10 U
2-Hexanone	12 U	13 U	10 U	10 U	10 U
4-Methyl-2-pentanone	12 U	13 U	10 U	10 U	10 U
Acetone	3 BJ	5 BJ	10 U	10 U	10 U
Benzene	12 U	13 U	10 U	10 U	10 U
Bromodichloromethane	12 U	13 U	10 U	10 U	10 U
Bromoform	12 U	13 U	10 U	10 U	10 U
Bromomethane	12 U	13 U	10 U	10 U	10 U
Carbon disulfide	12 U	13 U	10 U	10 U	10 U
Carbon tetrachloride	12 U	13 U	10 U	10 U	10 U
Chlorobenzene	12 U	13 U	10 U	10 U	10 U
Chloroethane	12 U	13 U	10 U	10 U	10 U
Chloroform	12 U	13 U	10 U	10 U	10 U
Chloromethane	12 U	13 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	12 U	13 U	10 U	10 U	10 U
Dibromochloromethane	12 U	13 U	10 U	10 U	10 U
Ethylbenzene	12 U	13 U	10 U	10 U	10 U
Methylene chloride	6 BJ	8 BJ	14 B	3 BJ	4 BJ
Styrene	12 U	13 U	10 U	10 U	10 U
Tetrachloroethene	12 U	13 U	10 U	10 U	10 U
Toluene	12 U	13 U	10 U	10 U	10 U
Trichloroethene	12 U	13 U	10 U	10 U	10 U
Vinyl chloride	12 U	13 U	10 U	10 U	10 U
Xylene, total	12 U	13 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	12 U	13 U	10 U	10 U	10 U
Semivolatile Organic Compounds (SVOCs)[1]					
1,2,4-Trichlorobenzene	500 U	490 U	10 U	10 U	10 U
1,2-Dichlorobenzene	500 U	490 U	10 U	10 U	10 U
1,3-Dichlorobenzene	500 U	490 U	10 U	10 U	10 U
1,4-Dichlorobenzene	500 U	490 U	10 U	10 U	10 U
2,2'-Oxybis(1-chloropropane)	500 U	490 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	1200 U	1200 U	25 U	25 U	25 U
2,4,6-Trichlorophenol	500 U	490 U	10 U	10 U	10 U
2,4-Dichlorophenol	500 U	490 U	10 U	10 U	10 U
2,4-Dimethylphenol	500 U	490 U	10 U	10 U	10 U
2,4-Dinitrophenol	1200 U	1200 U	25 U	25 U	25 U
2,4-Dinitrotoluene	500 U	490 U	10 U	10 U	10 U
2,6-Dichlorophenol (2,6-Dinitrotoluene)	500 U	490 U	10 U	10 U	10 U
2-Chloronaphthalene	500 U	490 U	10 U	10 U	10 U
2-Chlorophenol	500 U	490 U	10 U	10 U	10 U
2-Methylnaphthalene	500 U	490 U	10 U	10 U	10 U
2-Methylphenol	500 U	490 U	10 U	10 U	10 U
2-Nitroaniline	1200 U	1200 U	25 U	25 U	25 U
2-Nitrophenol	500 U	490 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	500 U	490 U	10 U	10 U	10 U
3-Nitroaniline	1200 U	1200 U	25 U	25 U	25 U
4,6-Dinitro-2-methylphenol	1200 U	1200 U	25 U	25 U	25 U
4-Bromophenyl-phenylether	500 U	490 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	500 U	490 U	10 U	10 U	10 U
4-Chloroaniline	500 U	490 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	500 U	490 U	10 U	10 U	10 U
4-Methylphenol	500 U	490 U	10 U	10 U	10 U
4-Nitroaniline	1200 U	1200 U	25 U	25 U	25 U
4-Nitrophenol	1200 U	1200 U	25 U	25 U	25 U
Acenaphthene	500 U	490 U	5 J	10 U	1 J
Acenaphthylene	500 U	490 U	10 U	10 U	10 U
Anthracene	89 J	490 U	3 J	10 U	10 U
Benzo(a)anthracene	280 J	490 U	1 J	10 U	10 U
Benzo(a)pyrene	380 J	490 U	10 U	10 U	10 U
Benzo(b)fluoranthene	420 J	61 J	10 U	10 U	10 U
Benzo(g,h,i)perylene	260 J	490 U	10 U	10 U	10 U
Benzo(k)fluoranthene	140 J	490 U	10 U	10 U	10 U
Bis(2-Chloroethoxy)Methane	500 U	490 U	10 U	10 U	10 U
Bis(2-Chloroethyl)Ether	500 U	490 U	10 U	10 U	10 U

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 3				
	Site 3 Surface Soil		Site 3 Direct-Push Groundwater		
Analyte	03SS01	03SS02	03GW01	03GW02	03GW03
Semivolatile Organic Compounds (SVOCs)[1] (cont.)					
Bis(2-Ethylhexyl)Phthalate	61 J	490 U	10 U	10 U	10 U
Butylbenzylphthalate	500 U	490 U	10 U	10 U	10 U
Carbazole	60 J	490 U	2 J	10 U	10 U
Chrysene	480 J	60 J	1 J	10 U	10 U
Di-n-butylphthalate	500 U	490 U	10 U	10 U	10 U
Di-n-octylphthalate	500 U	490 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	500 U	490 U	10 U	10 U	10 U
Dibenzofuran	500 U	490 U	4 J	10 U	10 U
Diethylphthalate	500 U	490 U	10 U	10 U	10 U
Dimethyl phthalate	500 U	490 U	10 U	10 U	10 U
Fluoranthene	660	74 J	5 J	10 U	10 U
Fluorene	52 J	490 U	4 J	10 U	10 U
Hexachlorobenzene	500 U	490 U	10 U	10 U	10 U
Hexachlorobutadiene	500 U	490 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	500 U	490 U	10 U	10 U	10 U
Hexachloroethane	500 U	490 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	230 J	490 U	10 U	10 U	10 U
Isophorone	500 U	490 U	10 U	10 U	10 U
n-Nitroso-Di-N-Propylamine	500 U	490 U	10 U	10 U	10 U
n-Nitrosodiphenylamine	500 U	490 U	10 U	10 U	10 U
Naphthalene	57 J	490 U	1 J	10 U	10 U
Nitrobenzene	500 U	490 U	10 U	10 U	10 U
Pentachlorophenol	1200 U	1200 U	25 U	25 U	1 J
Phenanthrene	420 J	490 U	8 J	10 U	10 U
Phenol	500 U	490 U	10 U	10 U	10 U
Pyrene	520	51 J	3 J	10 U	10 U
Pesticides/Polychlorinated Biphenyls (PCBs)[1]					
4,4'-DDD	5.1 U	4.9 U	0.1 U	0.1 U	0.1 U
4,4'-DDE	17 P	4.9 U	0.1 U	0.1 U	0.1 U
4,4'-DDT	7.9	4.9 U	0.1 U	0.1 U	0.1 U
Aldrin	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
Alpha-BHC	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
alpha-Chlordane	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
Aroclor-1016	51 U	49 U	1 U	1 U	1 U
Aroclor-1221	100 U	98 U	2 U	2 U	2 U
Aroclor-1232	51 U	49 U	1 U	1 U	1 U
Aroclor-1242	51 U	49 U	1 U	1 U	1 U
Aroclor-1248	51 U	49 U	1 U	1 U	1 U
Aroclor-1254	51 U	44 JP	1 U	1 U	1 U
Aroclor-1260	51 U	49 U	1 U	1 U	1 U
Beta-BHC	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
delta-BHC	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
Dieldrin	5.1 U	4.9 U	0.1 U	0.1 U	0.1 U
Endosulfan I	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
Endosulfan II	5.1 U	4.9 U	0.1 U	0.1 U	0.1 U
Endosulfan sulfate	5.1 U	4.9 U	0.1 U	0.1 U	0.1 U
Endrin	5.1 U	4.9 U	0.1 U	0.1 U	0.1 U
Endrin aldehyde	5.1 U	4.9 U	0.1 U	0.1 U	0.1 U
Endrin ketone	5.1 U	4.9 U	0.1 U	0.1 U	0.1 U
gamma-BHC	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
gamma-Chlordane	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
Heptachlor	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
Heptachlor epoxide	2.6 U	2.5 U	0.05 U	0.05 U	0.05 U
Methoxychlor	26 U	25 U	0.5 U	0.5 U	0.5 U
Toxaphene	260 U	250 U	5 U	5 U	5 U
Explosives[1]					
1,3,5-Trinitrobenzene	60 U	56 U	0.7	0.5 U	1.1
1,3-Dinitrobenzene	60 U	56 U	0.5 U	0.5 U	0.5 U
2,4,6-Trinitrotoluene	60 U	56 U	0.5 U	0.5 U	0.5 U
2,4-Dinitrotoluene	60 U	56 U	0.5 U	0.5 U	0.5 U
2,6-Dinitrotoluene	60 U	56 U	0.5 U	2.4	0.5 U
2-AM-4,6-DNT	60 U	56 U	0.5 U	0.5 U	0.5 U
2-Nitrotoluene	60 U	56 U	0.5 U	0.5 U	0.5 U
3-Nitrotoluene	60 U	56 U	0.5 U	0.5 U	0.5 U
4-AM-2,6-DNT	60 U	56 U	0.5 U	0.5 U	0.5 U
4-Nitrotoluene	60 U	56 U	0.5 U	1.2	0.5 U
HMX	60 U	56 U	0.5 U	0.5 U	0.5 U
Nitrobenzene	60 U	56 U	0.5 U	0.5 U	0.5 U
RDX	60 U	56 U	0.5 U	0.5 U	0.5 U
Tetryl	60 U	56 U	0.5 U	0.5 U	0.5 U

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 3				
	Site 3 Surface Soil		Site 3 Direct-Push Groundwater		
Analyte	03SS01	03SS02	03GW01	03GW02	03GW03
Inorganics[2]					
Aluminum	3950	3860	2280	53.7 B	68.4 B
Antimony	8 U	10 U	46 U	46 U	46 U
Arsenic	1.6 B	2.2 B	7.4 B	2 U	2.2 B
Barium	18.2 B	25.8 B	787	757	99 B
Beryllium	0.17 U	0.22 U	1 U	1 U	1 U
Cadmium	0.35 U	0.43 U	2 U	2 U	2 U
Calcium	2470	1600	124000	142000	176000
Chromium	4.3	7.6	5 U	5 U	5 U
Cobalt	1.1 B	2.3 B	2 U	2 U	2 U
Copper	10.9	31.9	4.5 B	29.8	14.4 B
Cyanide	0.59 U	0.73 U	5 U	5 U	5 U
Iron	3620	5900	15700	35500	123000
Lead	18.9	41	2 U	2 U	2 U
Magnesium	464 B	794 B	352000	312000	224000
Manganese	40.2	39.5	292	1940	3500
Mercury	0.07 B	0.18	0.41	0.14 U	0.13 U
Nickel	1.6 U	4.3 B	14.5 B	24.4 B	16.3 B
Potassium	461 B	568 B	80100	61400	25900
Selenium	0.7 U	0.87 U	4 U	4 U	4 U
Silver	0.87 U	1.1 U	5 U	5 U	5 U
Sodium	134 B	133 B	2250000	2440000	1430000
Thallium	0.7 U	0.87 U	17.5	11.4	4 U
Vanadium	8.1 B	10.1 B	8.6 B	2.7 B	2.9 B
Zinc	39.5	54.3	63.9	98.7	28

Notes:

[1] Units are in ug/kg for solid and ug/l for aqueous samples
[2] Units are in mg/kg for solid and ug/l for aqueous samples
U = Not Detected
B = Compound also detected in blank
J = Estimated Value
E = Concentration exceeds calibration range
P = Concentration showed greater than 25% difference between columns; the lower of the 2 values is reported
ND - analyte not detected

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 4				
	Site 4 Surface Soil		Site 4 Direct-Push Groundwater		
Analyte	04SS01	04SS02	04GW01	04GW02	04GW03
Volatile Organic Compounds (VOCs)[1]					
1,1,1-Trichloroethane	11 U	11 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	11 U	11 U	10 U	10 U	10 U
1,1,2-Trichloroethane	11 U	11 U	10 U	10 U	10 U
1,1-Dichloroethane	11 U	11 U	10 U	10 U	10 U
1,1-Dichloroethene	11 U	11 U	10 U	10 U	10 U
1,2-Dichloroethane	11 U	11 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	11 U	11 U	10 U	10 U	10 U
1,2-Dichloropropane	11 U	11 U	10 U	10 U	10 U
2-Butanone	11 U	11 U	10 U	10 U	10 U
2-Hexanone	11 U	11 U	10 U	10 U	10 U
4-Methyl-2-pentanone	11 U	11 U	10 U	10 U	10 U
Acetone	4 BJ	2 BJ	25	10 U	10 U
Benzene	11 U	11 U	10 U	10 U	10 U
Bromodichloromethane	11 U	11 U	10 U	10 U	10 U
Bromoform	11 U	11 U	10 U	10 U	10 U
Bromomethane	11 U	11 U	10 U	10 U	10 U
Carbon disulfide	11 U	11 U	10 U	10 U	10 U
Carbon tetrachloride	11 U	11 U	10 U	10 U	10 U
Chlorobenzene	11 U	11 U	10 U	10 U	10 U
Chloroethane	11 U	11 U	10 U	10 U	10 U
Chloroform	11 U	11 U	10 U	10 U	10 U
Chloromethane	11 U	11 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	11 U	11 U	10 U	10 U	10 U
Dibromochloromethane	11 U	11 U	10 U	10 U	10 U
Ethylbenzene	11 U	11 U	10 U	10 U	10 U
Methylene chloride	6 BJ	4 J	10 B	4 BJ	4 BJ
Styrene	11 U	11 U	10 U	10 U	10 U
Tetrachloroethene	11 U	11 U	10 U	10 U	10 U
Toluene	11 U	11 U	10 U	10 U	10 U
Trichloroethene	11 U	11 U	10 U	10 U	10 U
Vinyl chloride	11 U	11 U	10 U	10 U	10 U
Xylene, total	11 U	11 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	11 U	11 U	10 U	10 U	10 U
Semivolatile Organic Compounds (SVOCs)[1]					
1,2,4-Trichlorobenzene	8100 U	8000 U	10 U	10 U	10 U
1,2-Dichlorobenzene	8100 U	8000 U	10 U	10 U	10 U
1,3-Dichlorobenzene	8100 U	8000 U	10 U	10 U	10 U
1,4-Dichlorobenzene	8100 U	8000 U	10 U	10 U	10 U
2,2'-Oxybis(1-chloropropane)	8100 U	8000 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	20000 U	20000 U	25 U	25 U	25 U
2,4,6-Trichlorophenol	8100 U	8000 U	10 U	10 U	10 U
2,4-Dichlorophenol	8100 U	8000 U	10 U	10 U	10 U
2,4-Dimethylphenol	8100 U	8000 U	10 U	10 U	10 U
2,4-Dinitrophenol	20000 U	20000 U	25 U	25 U	25 U
2,4-Dinitrotoluene	8100 U	8000 U	10 U	10 U	10 U
2,6-Dichlorophenol (2,6-Dinitrotoluene)	8100 U	8000 U	10 U	10 U	10 U
2-Chloronaphthalene	8100 U	8000 U	10 U	10 U	10 U
2-Chlorophenol	8100 U	8000 U	10 U	10 U	10 U
2-Methylnaphthalene	8100 U	8000 U	10 U	10 U	10 U
2-Methylphenol	8100 U	8000 U	10 U	10 U	10 U
2-Nitroaniline	20000 U	20000 U	25 U	25 U	25 U
2-Nitrophenol	8100 U	8000 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	8100 U	8000 U	10 U	10 U	10 U
3-Nitroaniline	20000 U	20000 U	25 U	25 U	25 U
4,6-Dinitro-2-methylphenol	20000 U	20000 U	25 U	25 U	25 U
4-Bromophenyl-phenylether	8100 U	8000 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	8100 U	8000 U	10 U	10 U	10 U
4-Chloroaniline	8100 U	8000 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	8100 U	8000 U	10 U	10 U	10 U
4-Methylphenol	8100 U	8000 U	10 U	10 U	10 U
4-Nitroaniline	20000 U	20000 U	25 U	25 U	25 U
4-Nitrophenol	20000 U	20000 U	25 U	25 U	25 U
Acenaphthene	8100 U	8000 U	10 U	10 U	10 U
Acenaphthylene	8100 U	8000 U	10 U	10 U	10 U
Anthracene	8100 U	8000 U	10 U	10 U	10 U
Benzo(a)anthracene	1300 J	8000 U	10 U	10 U	10 U
Benzo(a)pyrene	1900 J	8000 U	10 U	10 U	10 U
Benzo(b)fluoranthene	3100 J	990 J	10 U	10 U	10 U
Benzo(g,h,i)perylene	8100 U	8000 U	10 U	10 U	10 U
Benzo(k)fluoranthene	8100 U	8000 U	10 U	10 U	10 U
Bis(2-Chloroethoxy)Methane	8100 U	8000 U	10 U	10 U	10 U
Bis(2-Chloroethyl)Ether	8100 U	8000 U	10 U	10 U	10 U

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 4				
	Site 4 Surface Soil		Site 4 Direct-Push Groundwater		
Analyte	04SS01	04SS02	04GW01	04GW02	04GW03
Semivolatile Organic Compounds (SVOCs)[1](cont.)					
Bis(2-Ethylhexyl)Phthalate	8100 U	8000 U	10 U	10 U	10 U
Butylbenzylphthalate	8100 U	8000 U	10 U	10 U	10 U
Carbazole	8100 U	8000 U	10 U	10 U	10 U
Chrysene	1400 J	8000 U	10 U	10 U	10 U
Di-n-butylphthalate	8100 U	8000 U	10 U	10 U	10 U
Di-n-octylphthalate	8100 U	8000 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	8100 U	8000 U	10 U	10 U	10 U
Dibenzofuran	8100 U	8000 U	10 U	10 U	10 U
Diethylphthalate	8100 U	8000 U	10 U	10 U	10 U
Dimethyl phthalate	8100 U	8000 U	10 U	10 U	10 U
Fluoranthene	2200 J	1700 J	10 U	10 U	10 U
Fluorene	8100 U	8000 U	10 U	10 U	10 U
Hexachlorobenzene	8100 U	8000 U	10 U	10 U	10 U
Hexachlorobutadiene	8100 U	8000 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	8100 U	8000 U	10 U	10 U	10 U
Hexachloroethane	8100 U	8000 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	8100 U	8000 U	10 U	10 U	10 U
Isophorone	8100 U	8000 U	10 U	10 U	10 U
n-Nitroso-Di-N-Propylamine	8100 U	8000 U	10 U	10 U	10 U
n-Nitrosodiphenylamine	8100 U	8000 U	10 U	10 U	10 U
Naphthalene	8100 U	8000 U	10 U	10 U	10 U
Nitrobenzene	8100 U	8000 U	10 U	10 U	10 U
Pentachlorophenol	20000 U	20000 U	25 U	25 U	25 U
Phenanthrene	1000 J	1300 J	10 U	10 U	10 U
Phenol	8100 U	8000 U	10 U	10 U	10 U
Pyrene	1600 J	1200 J	10 U	10 U	10 U
Pesticides/Polychlorinated Biphenyls (PCBs)[1]					
4,4'-DDD	20 P	4 U	0.1 U	0.1 U	0.2 U
4,4'-DDE	7.8 P	18	0.1 U	0.1 U	0.2 U
4,4'-DDT	19 P	64 P	0.1 U	0.1 U	0.2 U
Aldrin	2.1 U	2.1 U	0.05 U	0.05 U	0.1 U
Alpha-BHC	2.1 U	2.1 U	0.05 U	0.05 U	0.1 U
alpha-Chlordane	34	12	0.05 U	0.05 U	0.1 U
Aroclor-1016	41 U	40 U	1 U	1 U	2 U
Aroclor-1221	81 U	80 U	2 U	2 U	4 U
Aroclor-1232	41 U	40 U	1 U	1 U	2 U
Aroclor-1242	41 U	40 U	1 U	1 U	2 U
Aroclor-1248	41 U	40 U	1 U	1 U	2 U
Aroclor-1254	190 P	260 P	1 U	1 U	2 U
Aroclor-1260	41 U	40 U	1 U	1 U	2 U
Beta-BHC	2.1 U	2.1 U	0.05 U	0.05 U	0.1 U
delta-BHC	2.1 U	2.1 U	0.05 U	0.05 U	0.1 U
Dieldrin	24 P	34	0.1 U	0.1 U	0.2 U
Endosulfan I	2.1 U	2.1 U	0.05 U	0.05 U	0.1 U
Endosulfan II	4.1 U	5.5 P	0.1 U	0.1 U	0.2 U
Endosulfan sulfate	4.1 U	4 U	0.1 U	0.1 U	0.2 U
Endrin	4.1 U	4 U	0.1 U	0.1 U	0.2 U
Endrin aldehyde	4.1 U	4 U	0.1 U	0.1 U	0.2 U
Endrin ketone	4.1 U	4 U	0.1 U	0.1 U	0.2 U
gamma-BHC	2.1 U	2.1 U	0.05 U	0.05 U	0.1 U
gamma-Chlordane	45	14 P	0.05 U	0.05 U	0.1 U
Heptachlor	2.1 U	2.1 U	0.05 U	0.05 U	0.1 U
Heptachlor epoxide	2.1 U	2.1 U	0.05 U	0.05 U	0.1 U
Methoxychlor	21 U	21 U	0.5 U	0.5 U	1 U
Toxaphene	210 U	210 U	5 U	5 U	10 U
Explosives[1]					
1,3,5-Trinitrobenzene	44 U	44 U	0.5 U	0.5 U	0.5 U
1,3-Dinitrobenzene	44 U	44 U	0.5 U	0.5 U	0.5 U
2,4,6-Trinitrotoluene	44 U	44 U	--	--	0.5 U
2,4-Dinitrotoluene	44 U	44 U	0.5 U	0.5 U	0.5 U
2,6-Dinitrotoluene	44 U	44 U	0.5 U	0.5 U	0.5 U
2-AM-4,6-DNT	44 U	44 U	0.5 U	0.5 U	0.5 U
2-Nitrotoluene	44 U	44 U	0.5 U	0.5 U	0.5 U
3-Nitrotoluene	44 U	44 U	0.5 U	0.5 U	0.5 U
4-AM-2,6-DNT	44 U	44 U	0.5 U	0.5 U	0.5 U
4-Nitrotoluene	44 U	44 U	0.5 U	0.5 U	0.5 U
HMX	44 U	44 U	0.5 U	0.5 U	0.5 U
Nitrobenzene	44 U	44 U	0.5 U	0.5 U	0.5 U
RDX	44 U	44 U	0.5 U	0.5 U	0.5 U
Tetryl	44 U	44 U	0.5 U	0.5 U	0.5 U

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 4				
	Site 4 Surface Soil		Site 4 Direct-Push Groundwater		
Analyte	04SS01	04SS02	04GW01	04GW02	04GW03
Inorganics[2]					
Aluminum	7390	5440	98.7 B	133 B	19 U
Antimony	7.3 U	10.4 U	46 U	46 U	46 U
Arsenic	13.4	13.5	2 U	56.5	43.7
Barium	57.6	107	45.2 B	49.9 B	364
Beryllium	0.03 B	1.4	1 U	1 U	1 U
Cadmium	0.32 U	0.45 U	2 U	2 U	2 U
Calcium	7830	4210	165000	184000	78800
Chromium	20.4	256	15.2	5 U	5 U
Cobalt	3.3 B	14.7	2 U	2 U	4.4 B
Copper	158	263	4 U	6.3 B	4 U
Cyanide	0.55 U	0.56 U	5 U	11.2	5 U
Iron	9620	37000	575	71.9 B	93800
Lead	306	366	2 U	2 U	2 U
Magnesium	1250	1070 B	265000	41700	58100
Manganese	113	153	431	947	711
Mercury	1.5	1.6	0.13 U	0.13 U	0.13 U
Nickel	95.3	1400	9 U	9 U	29.9 B
Potassium	674 B	859 B	93900	30400	54000
Selenium	0.64 U	0.9 U	4 U	4 U	4 U
Silver	0.8 U	1.1 U	5 U	5 U	5 U
Sodium	207 B	366 B	1980000	97200	436000
Thallium	0.64 U	0.9 U	12.7	4.1 B	4 U
Vanadium	27.9	5330	5.1 B	4.3 B	2.5 B
Zinc	284	615	8.4 B	13.1 B	82.5

Notes:

[1] Units are in ug/kg for solid and ug/l for aqueous samples
[2] Units are in mg/kg for solid and ug/l for aqueous samples
U = Not Detected
B = Compound also detected in blank
J = Estimated Value
E = Concentration exceeds calibration range
P = Concentration showed greater than 25% difference between columns; the lower of the 2 values is reported
ND - analyte not detected

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 5							
	Site 5 Surface Soil				Site 5 Direct-Push Groundwater			
Analyte	05SS01	05SS02	05SS03	05SS04	05GW01	05GW02	05GW03	05GW04
Volatile Organic Compounds (VOCs)[1]								
1,1,1-Trichloroethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
1,1,2,2-Tetrachloroethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
1,1,2-Trichloroethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
1,2-Dichloroethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
1,2-Dichloroethene (total)	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
1,2-Dichloropropane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
2-Butanone	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
2-Hexanone	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Acetone	7 BJ	11 U	12 U	2 BJ	10 U	10 U	10 U	10 U
Benzene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Bromodichloromethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Bromoform	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Bromomethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Carbon disulfide	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Carbon tetrachloride	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Chlorobenzene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Chloroethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Chloroform	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Chloromethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
cis-1,3-Dichloropropene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Dibromochloromethane	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Ethylbenzene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Methylene chloride	9 BJ	4 BJ	5 BJ	3 BJ	4 BJ	8 BJ	6 BJ	2 BJ
Styrene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Tetrachloroethene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Toluene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Trichloroethene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Vinyl chloride	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Xylene, total	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
trans-1,3-Dichloropropene	14 U	11 U	12 U	12 U	10 U	10 U	10 U	10 U
Semivolatile Organic Compounds (SVOCs)[1]								
1,2,4-Trichlorobenzene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
1,2-Dichlorobenzene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2,2'-Oxybis(1-chloropropane)	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	980 U	880 U	1000 U	980 U	25 U	25 U	25 U	25 U
2,4,6-Trichlorophenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	980 U	880 U	1000 U	980 U	25 U	25 U	25 U	25 U
2,4-Dinitrotoluene	860	360 U	2100	400 U	10 U	10 U	10 U	10 U
2,6-Dichlorophenol (2,6-Dinitrotoluene)	52 J	360 U	200 J	400 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Chloronaphthalene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2-Chlorophenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2-Methylphenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
2-Nitroaniline	980 U	880 U	1000 U	980 U	25 U	25 U	25 U	25 U
2-Nitrophenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
3-Nitroaniline	980 U	880 U	1000 U	980 U	25 U	25 U	25 U	25 U
4,6-Dinitro-2-methylphenol	980 U	880 U	1000 U	980 U	25 U	25 U	25 U	25 U
4-Bromophenyl-phenylether	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
4-Chloro-3-methylphenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
4-Chloroaniline	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
4-Chlorophenyl-phenylether	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
4-Methylphenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
4-Nitroaniline	980 U	880 U	1000 U	980 U	25 U	25 U	25 U	25 U
4-Nitrophenol	980 U	880 U	1000 U	980 U	25 U	25 U	25 U	25 U
Acenaphthene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Acenaphthylene	400 U	360 U	430 U	310 J	10 U	10 U	10 U	10 U
Anthracene	400 U	360 U	430 U	160 J	10 U	10 U	10 U	10 U
Benzo(a)anthracene	64 J	360 U	430 U	700	10 U	10 U	10 U	10 U
Benzo(a)pyrene	81 J	360 U	56 J	800	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	110 J	360 U	70 J	1000	10 U	10 U	10 U	10 U
Benzo(g,h,i)perylene	400 U	360 U	52 J	700	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	51 J	360 U	67 J	540	10 U	10 U	10 U	10 U
Bis(2-Chloroethoxy)Methane	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Bis(2-Chloroethyl)Ether	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 5							
	Site 5 Surface Soil				Site 5 Direct-Push Groundwater			
Analyte	05SS01	05SS02	05SS03	05SS04	05GW01	05GW02	05GW03	05GW04
Semivolatile Organic Compounds (SVOCs)[1](cont.)								
Bis(2-Ethylhexyl)Phthalate	48 J	130 J	97 J	76 J	10 U	10 U	10 U	10 U
Butylbenzylphthalate	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Carbazole	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Chrysene	160 J	360 U	88 J	750	10 U	10 U	10 U	10 U
Di-n-butylphthalate	400 U	360 U	3400	400 U	10 U	10 U	1 J	10 U
Di-n-octylphthalate	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Dibenz(a,h)anthracene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Dibenzofuran	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Diethylphthalate	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Dimethyl phthalate	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Fluoranthene	160 J	360 U	95 J	830	10 U	10 U	10 U	10 U
Fluorene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Hexachloroethane	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)pyrene	49 J	360 U	430 U	580	10 U	10 U	10 U	10 U
Isophorone	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
n-Nitroso-Di-N-Propylamine	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
n-Nitrosodiphenylamine	120 J	360 U	330 J	400 U	10 U	10 U	10 U	10 U
Naphthalene	400 U	360 U	50 J	400 U	10 U	10 U	10 U	10 U
Nitrobenzene	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Pentachlorophenol	980 U	880 U	1000 U	980 U	25 U	1 J	25 U	25 U
Phenanthrene	77 J	360 U	92 J	280 J	10 U	10 U	10 U	1 JX
Phenol	400 U	360 U	430 U	400 U	10 U	10 U	10 U	10 U
Pyrene	170 J	360 U	58 J	1200	10 U	10 U	10 U	10 U
Pesticides/Polychlorinated Biphenyls (PCBs)[1]								
4,4'-DDD	4 U	3.9	4.3 U	4 U	0.2 U	0.1 U	0.1 U	0.2 U
4,4'-DDE	4.3	18	4.3 U	5.4 P	0.2 U	0.1 U	0.1 U	0.2 U
4,4'-DDT	5.2 P	6.3	4.3 U	4 U	0.2 U	0.1 U	0.1 U	0.2 U
Aldrin	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
Alpha-BHC	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
alpha-Chlordane	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
Aroclor-1016	40 U	36 U	43 U	40 U	2 U	1 U	1 U	2 U
Aroclor-1221	79 U	73 U	85 U	82 U	4 U	2 U	2 U	4 U
Aroclor-1232	40 U	36 U	43 U	40 U	2 U	1 U	1 U	2 U
Aroclor-1242	40 U	36 U	43 U	40 U	2 U	1 U	1 U	2 U
Aroclor-1248	40 U	36 U	43 U	40 U	2 U	1 U	1 U	2 U
Aroclor-1254	40 U	10 J	43 U	23 J	2 U	1 U	1 U	2 U
Aroclor-1260	40 U	36 U	43 U	40 U	2 U	1 U	1 U	2 U
Beta-BHC	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
delta-BHC	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
Dieldrin	4 U	3.6 U	4.3 U	4 U	0.2 U	0.1 U	0.1 U	0.2 U
Endosulfan I	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
Endosulfan II	4 U	3.6 U	4.3 U	5 P	0.2 U	0.1 U	0.1 U	0.2 U
Endosulfan sulfate	4 U	3.6 U	4.3 U	4 U	0.2 U	0.1 U	0.1 U	0.2 U
Endrin	4 U	3.6 U	4.3 U	17 P	0.2 U	0.1 U	0.1 U	0.2 U
Endrin aldehyde	4 U	5.2	4.3 U	4 U	0.2 U	0.1 U	0.1 U	0.2 U
Endrin ketone	4 U	3.6 U	4.3 U	4 U	0.2 U	0.1 U	0.1 U	0.2 U
gamma-BHC	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
gamma-Chlordane	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
Heptachlor	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
Heptachlor epoxide	2 U	1.9 U	2.2 U	2.1 U	0.1 U	0.05 U	0.05 U	0.1 U
Methoxychlor	20 U	19 U	22 U	21 U	1 U	0.5 U	0.5 U	1 U
Toxaphene	200 U	190 U	220 U	210 U	10 U	5 U	5 U	10 U
Explosives[1]								
1,3,5-Trinitrobenzene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
1,3-Dinitrobenzene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
2,4,6-Trinitrotoluene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
2,4-Dinitrotoluene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
2,6-Dinitrotoluene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
2-AM-4,6-DNT	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Nitrotoluene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
3-Nitrotoluene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
4-AM-2,6-DNT	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
4-Nitrotoluene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
HMX	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
Nitrobenzene	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
RDX	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetryl	46 U	42 U	50 U	48 U	0.5 U	0.5 U	0.5 U	0.5 U

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 5							
	Site 5 Surface Soil				Site 5 Direct-Push Groundwater			
Analyte	05SS01	05SS02	05SS03	05SS04	05GW01	05GW02	05GW03	05GW04
Inorganics[2]								
Aluminum	4520	4690	5210	4390	60 B	21.1 B	78.9 B	96.2 B
Antimony	10.3 U	7.2 U	9.1 U	18.6	46 U	46 U	46 U	46 U
Arsenic	5.2	4	16.7	8.3	6.1 B	2 U	3.1 B	15.6
Barium	67.3	42.7	4640	583	48 B	21.3 B	264	159 B
Beryllium	0.32 B	0.37 B	0.27 B	0.5 B	1 U	1 U	1 U	1 U
Cadmium	0.45 U	0.86	6	6.6	2 U	2 U	2 U	2 U
Calcium	7340	6030	43500	16200	57000	50700	93600	131000
Chromium	5.8	5.2	15.9	63.8	5 U	5 U	5 U	5 U
Cobalt	2.1 B	3.5 B	5.8 B	5.7 B	2 U	20.8 B	14.7 B	2.2 B
Copper	17.4	33.3	310	1210	15.9 B	22.2 B	19.3 B	18.2 B
Cyanide	0.68 U	0.54 U	0.57 U	0.6 U	5 U	5 U	5 U	5.4 B
Iron	7700	10000	6670	31400	2960	42600	25200	3600
Lead	29.9	60.4	742	7910	2 U	2 U	2 U	2 U
Magnesium	1540	1850	2200	2000	123000	68400	118000	242000
Manganese	245	222	144	658	609	1890	1460	300
Mercury	0.06 U	0.05 B	0.19	0.26	0.13 U	0.13 U	0.13 U	0.13 U
Nickel	129	4.8 B	46.1	34.3	16.4 B	19.2 B	9 U	14.5 B
Potassium	912 B	1200	626 B	1120	44200	16500	29300	71200
Selenium	0.89 U	0.63 U	0.79 U	0.81 U	4 U	4 U	4 U	4 U
Silver	1.1 U	0.79 U	0.99 U	1.5 B	5 U	11.1	7.9 B	5 U
Sodium	234 B	63.8 B	387 B	448 B	958000	619000	767000	2010000
Thallium	0.89 U	0.63 U	0.79 U	0.81 U	9.3 B	4 U	4 U	12.7
Vanadium	11.1 B	11.9	5.7 B	13.3	2.2 B	2.9 B	2 U	2.3 B
Zinc	55.5	105	1550	2470	21.2	75.4	22.9	25.4

Notes:
[1] Units are in ug/kg for solid and ug/l for aqueous samples
[2] Units are in mg/kg for solid and ug/l for aqueous samples
U = Not Detected
B = Compound also detected in blank
J = Estimated Value
E = Concentration exceeds calibration range
P = Concentration showed greater than 25% difference between columns; the lower of the 2 values is reported
ND - analyte not detected

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 6
	Site 6 Surface Soil
Analyte	06SS01
Volatile Organic Compounds (VOCs)[1]	
1,1,1-Trichloroethane	11 U
1,1,2,2-Tetrachloroethane	11 U
1,1,2-Trichloroethane	11 U
1,1-Dichloroethane	11 U
1,1-Dichloroethene	11 U
1,2-Dichloroethane	11 U
1,2-Dichloroethene (total)	11 U
1,2-Dichloropropane	11 U
2-Butanone	11 U
2-Hexanone	11 U
4-Methyl-2-pentanone	11 U
Acetone	3 BJ
Benzene	11 U
Bromodichloromethane	11 U
Bromoform	11 U
Bromomethane	11 U
Carbon disulfide	11 U
Carbon tetrachloride	11 U
Chlorobenzene	11 U
Chloroethane	11 U
Chloroform	11 U
Chloromethane	11 U
cis-1,3-Dichloropropene	11 U
Dibromochloromethane	11 U
Ethylbenzene	11 U
Methylene chloride	12 B
Styrene	11 U
Tetrachloroethene	11 U
Toluene	11 U
Trichloroethene	11 U
Vinyl chloride	11 U
Xylene, total	11 U
trans-1,3-Dichloropropene	11 U
Semivolatile Organic Compounds (SVOCs)[1]	
1,2,4-Trichlorobenzene	390 U
1,2-Dichlorobenzene	390 U
1,3-Dichlorobenzene	390 U
1,4-Dichlorobenzene	390 U
2,2'-Oxybis(1-chloropropane)	390 U
2,4,5-Trichlorophenol	940 U
2,4,6-Trichlorophenol	390 U
2,4-Dichlorophenol	390 U
2,4-Dimethylphenol	390 U
2,4-Dinitrophenol	940 U
2,4-Dinitrotoluene	390 U
2,6-Dichlorophenol (2,6-Dinitrotoluene)	390 U
2-Chloronaphthalene	390 U
2-Chlorophenol	390 U
2-Methylnaphthalene	390 U
2-Methylphenol	390 U
2-Nitroaniline	940 U
2-Nitrophenol	390 U
3,3'-Dichlorobenzidine	390 U
3-Nitroaniline	940 U
4,6-Dinitro-2-methylphenol	940 U
4-Bromophenyl-phenylether	390 U
4-Chloro-3-methylphenol	390 U
4-Chloroaniline	390 U
4-Chlorophenyl-phenylether	390 U
4-Methylphenol	390 U
4-Nitroaniline	940 U
4-Nitrophenol	940 U
Acenaphthene	390 U
Acenaphthylene	390 U
Anthracene	91 J
Benzo(a)anthracene	920
Benzo(a)pyrene	910
Benzo(b)fluoranthene	1200
Benzo(g,h,i)perylene	860
Benzo(k)fluoranthene	500
Bis(2-Chloroethoxy)Methane	390 U
Bis(2-Chlroethyl)Ether	390 U

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 6
	Site 6 Surface Soil
Analyte	06SS01
Semivolatile Organic Compounds (SVOCs)[1](cont.)	
Bis(2-Ethylhexyl)Phthalate	390 U
Butylbenzylphthalate	390 U
Carbazole	77 J
Chrysene	1000
Di-n-butylphthalate	390 U
Di-n-octylphthalate	390 U
Dibenz(a,h)anthracene	160 J
Dibenzofuran	390 U
Diethylphthalate	390 U
Dimethyl phthalate	390 U
Fluoranthene	1300
Fluorene	390 U
Hexachlorobenzene	390 U
Hexachlorobutadiene	390 U
Hexachlorocyclopentadiene	390 U
Hexachloroethane	390 U
Indeno(1,2,3-cd)pyrene	390 U
Isophorone	390 U
n-Nitroso-Di-N-Propylamine	390 U
n-Nitrosodiphenylamine	390 U
Naphthalene	390 U
Nitrobenzene	390 U
Pentachlorophenol	940 U
Phenanthrene	420
Phenol	390 U
Pyrene	1400
Pesticides/Polychlorinated Biphenyls (PCBs)[1]	
4,4'-DDD	5.8 P
4,4'-DDE	120 E
4,4'-DDT	73 E
Aldrin	2 U
Alpha-BHC	2 U
alpha-Chlordane	2 U
Aroclor-1016	39 U
Aroclor-1221	79 U
Aroclor-1232	39 U
Aroclor-1242	39 U
Aroclor-1248	39 U
Aroclor-1254	39 U
Aroclor-1260	39 U
Beta-BHC	2 U
delta-BHC	2 U
Dieldrin	3.9 U
Endosulfan I	2 U
Endosulfan II	3.9 U
Endosulfan sulfate	3.9 U
Endrin	3.9 U
Endrin aldehyde	3.9 U
Endrin ketone	3.9 U
gamma-BHC	2 U
gamma-Chlordane	2 U
Heptachlor	2 U
Heptachlor epoxide	2 U
Methoxychlor	20 U
Toxaphene	200 U
Explosives[1]	
1,3,5-Trinitrobenzene	40 U
1,3-Dinitrobenzene	40 U
2,4,6-Trinitrotoluene	40 U
2,4-Dinitrotoluene	40 U
2,6-Dinitrotoluene	40 U
2-AM-4,6-DNT	40 U
2-Nitrotoluene	40 U
3-Nitrotoluene	40 U
4-AM-2,6-DNT	40 U
4-Nitrotoluene	40 U
HMX	40 U
Nitrobenzene	40 U
RDX	40 U
Tetryl	40 U

Table 2-2
Analytical Results for Samples Collected During the
Relative Risk Ranking System Data Collection at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

	Site 6
	Site 6 Surface Soil
Analyte	06SS01
Inorganics[2]	
Aluminum	2020
Antimony	8 U
Arsenic	4.6
Barium	30.4 B
Beryllium	0.17 U
Cadmium	0.43 B
Calcium	19500
Chromium	5.1
Cobalt	2.1 B
Copper	10.3
Cyanide	0.59 U
Iron	4350
Lead	69.2
Magnesium	716 B
Manganese	104
Mercury	0.05 U
Nickel	3.5 B
Potassium	581 B
Selenium	0.7 U
Silver	0.87 U
Sodium	113 B
Thallium	0.7 U
Vanadium	6.4 B
Zinc	163

Notes:
[1] Units are in ug/kg for solid and ug/l for aqueous samples
[2] Units are in mg/kg for solid and ug/l for aqueous samples
U = Not Detected
B = Compound also detected in blank
J = Estimated Value
E = Concentration exceeds calibration range
P = Concentration showed greater than 25% difference between columns; the lower of the 2 values is reported
ND - analyte not detected

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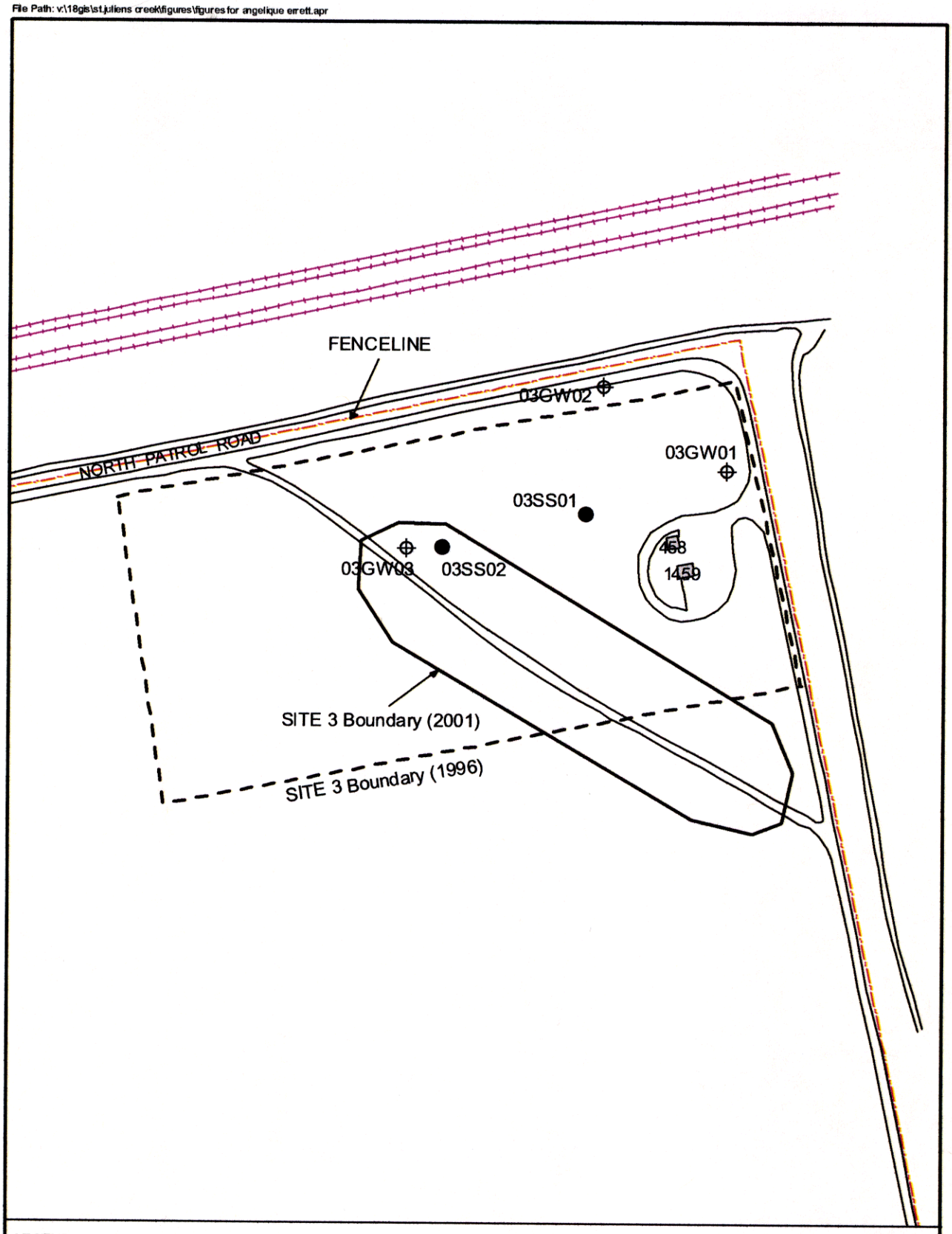

LEGEND

- Surface Soil Sampling Location
- Direct-Push Groundwater Sampling Location
- Buildings
- Activity Boundary
- Site 3 Boundary (2001)
- Site 3 Boundary (1996)

N

0 100 200 Feet

Figure 2-1
Site 3 Relative Risk Ranking System
Data Collection Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

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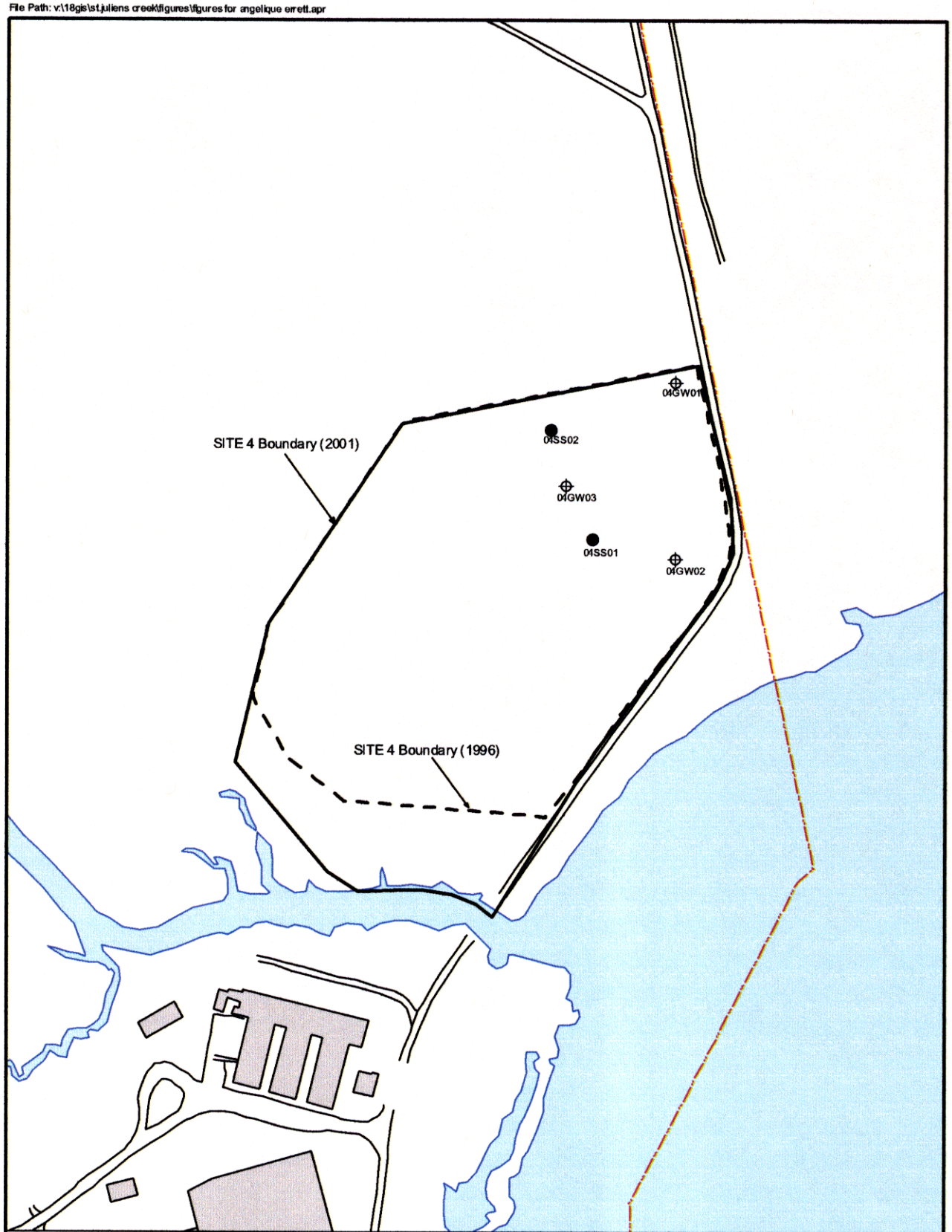

LEGEND

- Surface Soil Sampling Location
- Direct-Push Groundwater Sampling Location
- Buildings
- Activity Boundary
- Site 3 Boundary (2001)
- Site 3 Boundary (1996)

N

0 100 200 Feet

Figure 2-2
Site 4 Relative Risk Ranking System
Data Collection Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

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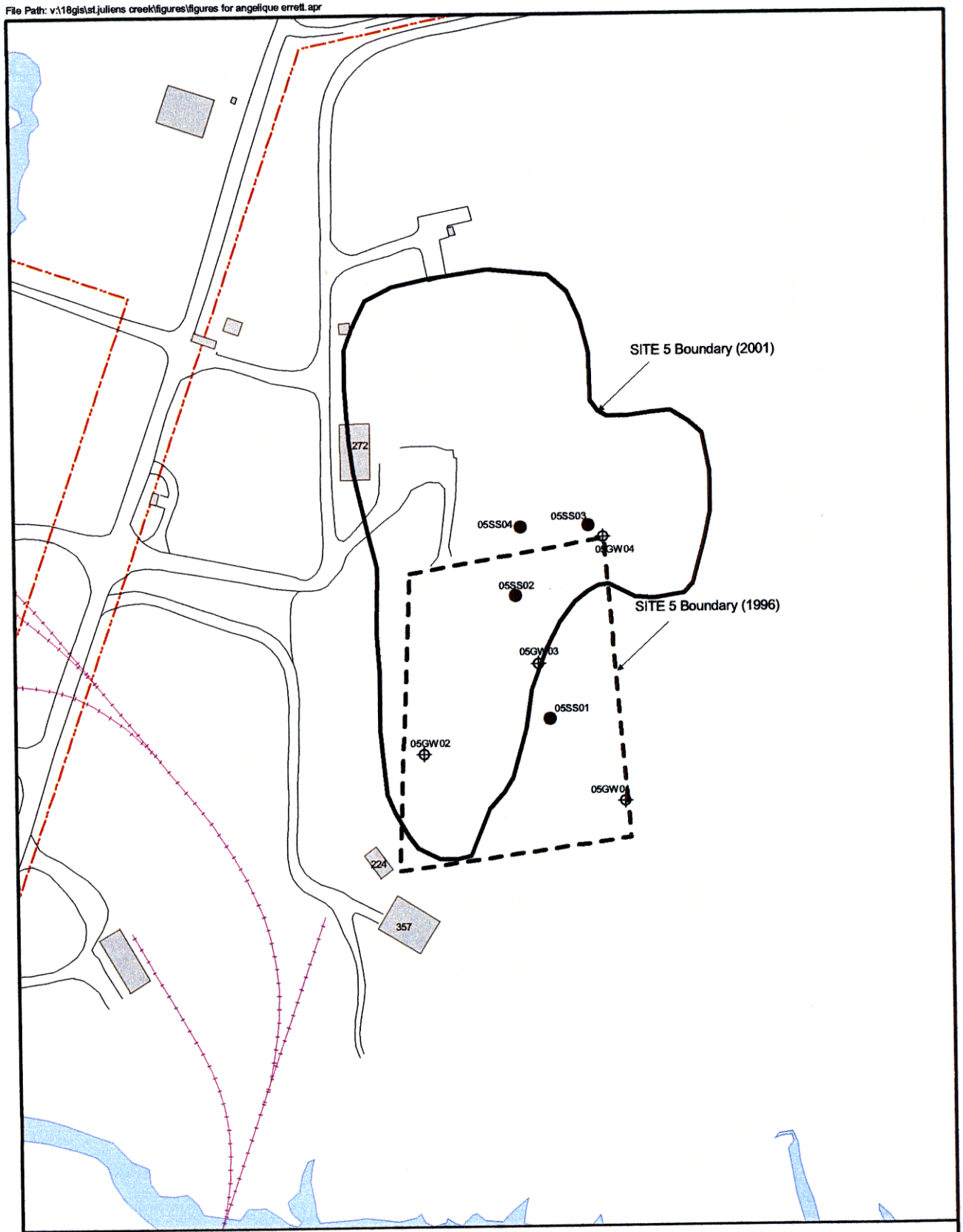

LEGEND

- Surface Soil Sampling Location
- Direct-Push Groundwater Sampling Location
- Buildings
- Roads
- Activity Boundary

N

0 100 200 Feet

Figure 2-3
Site 5 Relative Risk Ranking System
Data Collection Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

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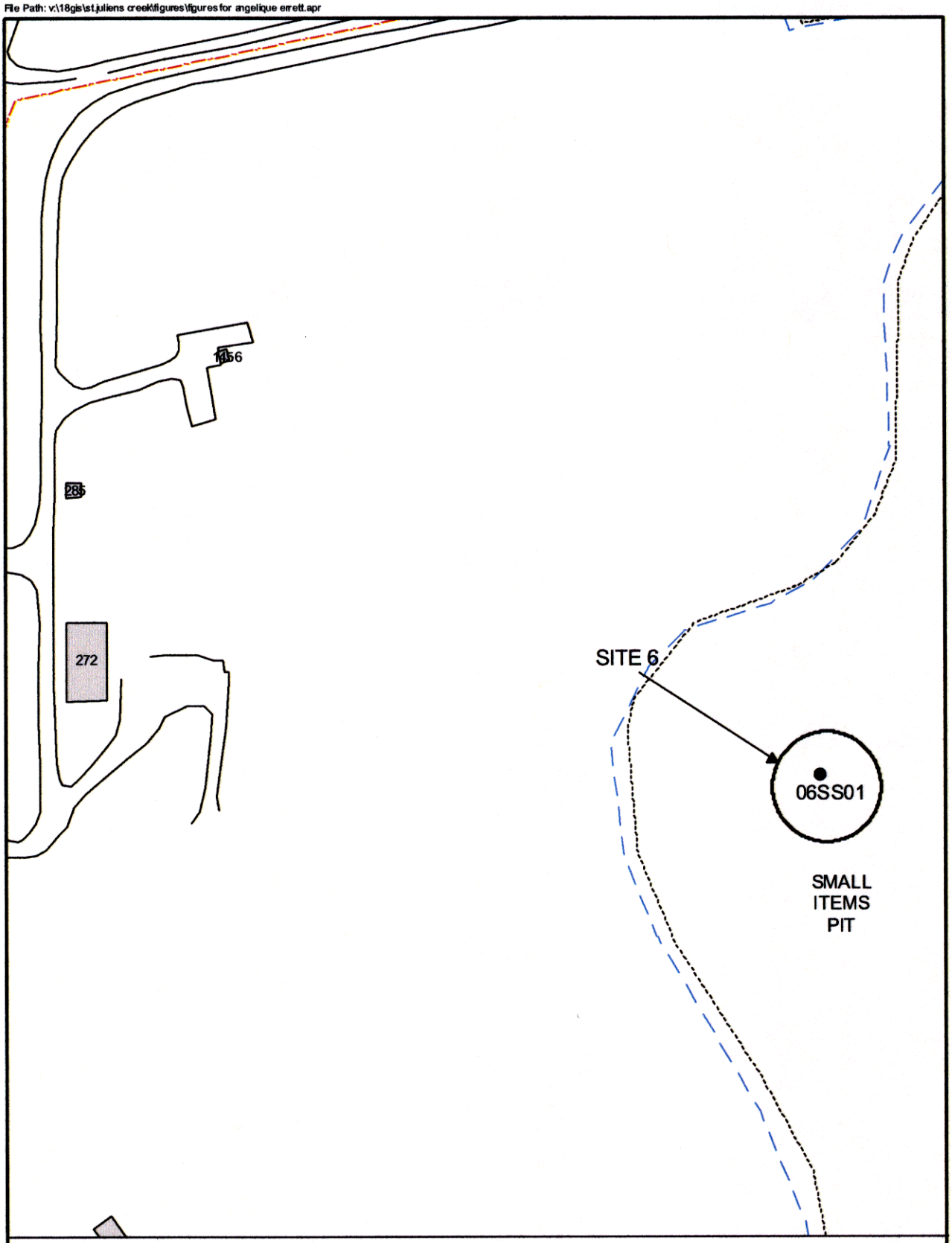


LEGEND

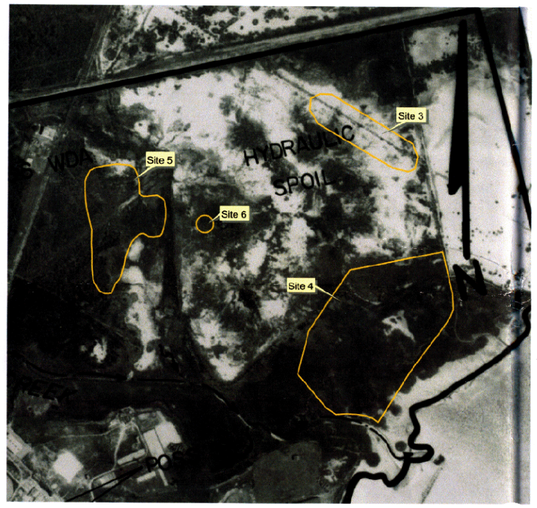
- Surface Soil Sampling Location
- Direct-Push Groundwater Sampling Location
- Buildings
- Roads
- Activity Boundary

N

0 80 160 Feet

Figure 2-4
Site 6 Relative Risk Ranking System
Data Collection Locations
St. Juliens Creek Annex
Chesapeake, Virginia

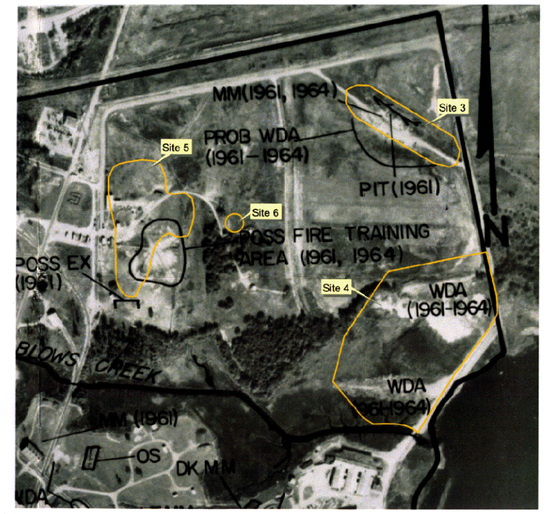
CH2MHILL



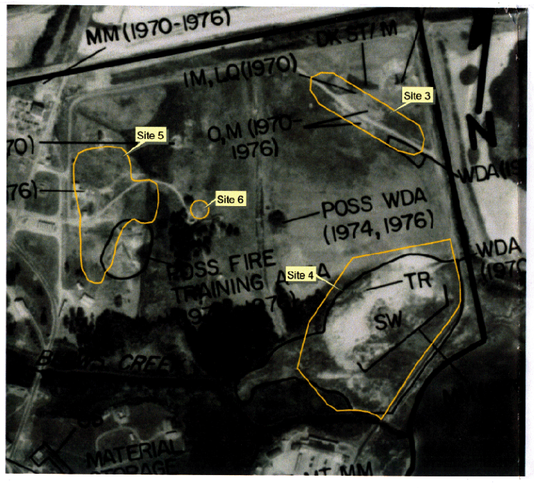
May 20, 1937

April 9, 1949

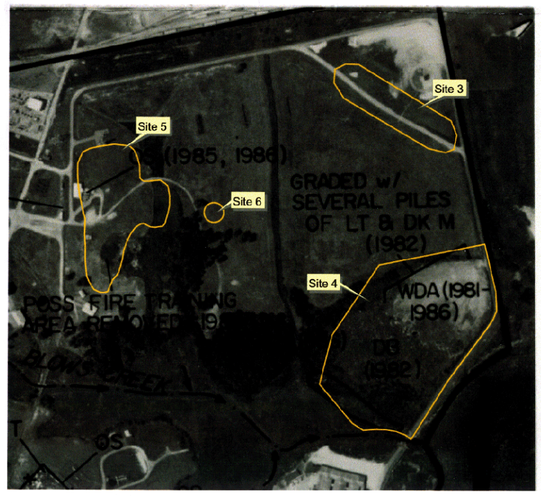
May 4, 1958



October 26, 1964



October 10, 1974



June 9, 1986

March 4, 1990

Circa 1995

Source:
Aerial photograph site analysis
Norfolk Naval Shipyard: Annex Areas
Norfolk, Virginia
February 1995

N

400 0 400 800 Feet

Figure 2-5
Epic Photos
St. Juliens Creek Annex
Chesapeake, Virginia

Table 3-1
Summary of RI Field Investigation Activities at Sites 3, 4, 5, and 6
St. Juliens Creek Annex
Chesapeake, Virginia

Field Investigation Acivity	Site 3		Site 4		Site 5		Site 6	
Geophysical Surveys								
Electronmagnetic	X		X		X		X	
Magnetometer			X					
Ground Penetrating Radar			X					
Monitoring Well Installation								
Phase 1 Monitoring Wells Installed	4 shallow and 2 deep wells		4 shallow and 2 deep wells		3 shallow and 2 deep wells		0	
Phase II Monitoring Wells Installed	2 shallow wells		0		2 shallow and 1 deep well		0	
Total Monitoring Wells	6 shallow and 2 deep wells		4 shallow and 2 deep wells		5 shallow and 3 deep wells		0	
Surface Soil Sampling	**Samples**	**Duplicates**	**Samples**	**Duplicates**	**Samples**	**Duplicates**	**Samples**	**Duplicates**
Phase 1 Samples	7	1	10	1	10	1	0	0
Phase 2 Samples	11	2	8	1	25	2	1	0
Total RI Samples	18	3	18	2	35	3	1	0
Subsurface Soil Sampling								
Phase 1 Samples	7	1	3	0	15	2	0	0
Phase 2 Samples	13	2	5	1	6	1	0	0
Phase 3 Samples	5	0	0	0	4	0	1	1
Total RI Samples	25	3	8	1	25	3	1	1
Monitoring Well Groundwater Sampling								
Phase 1 Sampling - July 1997	4 shallow and 2 deep wells		4 shallow and 2 deep wells		3 shallow and 2 deep wells		0	
Phase 1 Sampling - November 1997	4 shallow and 2 deep wells		4 shallow and 2 deep wells		3 shallow and 2 deep wells		0	
Phase 2 Sampling - May 1999	6 shallow and 2 deep wells		4 shallow and 2 deep wells		5 shallow and 3 deep wells		0	
Surface Water Sampling	**Samples**	**Duplicates**	**Samples**	**Duplicates**	**Samples**	**Duplicates**	**Samples**	**Duplicates**
Phase 1 Samples	0	0	1	1	0	0	0	0
Phase 2 Samples	7	2	7	2	7	2	0	0
Phase 3 Samples	0	0	0	0	0	0	0	0
Total RI Samples	7	2	8	3	7	2	0	0
Sediment Sampling								
Phase 1 Samples	3	1	4	0	3	0	0	0
Phase 2 Samples	4	1	5	1	4	2	0	0
Phase 3 Samples	0	0	0	0	0	0	0	0
Total RI Samples	7	2	9	1	7	2	0	0
Groundwater Elevation Monitoring Events								
Phase 2 Monitoring Events	17-May-99		17-May-99		17-May-99		--	
Phase 3 Monitoring Events	16-Aug-01		16-Aug-01		16-Aug-01		--	
Tidal Survey	1 deep well (May 1-4, 1999) and 2 shallow (May 5-8, 1999)		1 deep well (May 1-4, 1999) and 1 shallow (May 5-8, 1999)		1 deep well (May 1-4, 1999) and 4 shallow (May 5-8, 1999)		--	
Slug Tests	4 shallow, 2 deep wells		4 shallow, 2 deep wells		4 shallow, 3 deep wells			
Waste Delineation Trenching	49 test pits		0 test pits		42 test pits		2 test pits	

Table 3-2
Sample Analyses for RI Activities at Site 3
St. Juliens Creek Annex
Chesapeake, Virginia

Site 3 Samples		TCL VOCs	TCL SVOCs	TCL Pesticides/PCBs	TAL Metals and Cyanide	Dioxin	Total Phosphorus	Total Petroleum Hydrocarbons	Total Organic Carbon
Surface Soil Samples									
	Phase I	7	7	7	7	--	7	--	--
	Phase II	11	11	11	11	--	11	11	--
	Phase III	--	--	--	--	--	--	--	--
	Total	18	18	18	18	--	18	11	--
Subsurface Soil Samples									
	Phase I	7	7	7	7	--	7	--	--
	Phase II	13	13	13	13	--	13	13	--
	Phase III	--	--	--	--	3	--	2	--
	Total	20	20	20	20	3	20	15	--
Shallow Groundwater Samples									
	Phase I	8	8	8	8	--	8	--	--
	Phase II	6	6	6	6	--	6	--	--
	Phase III	--	--	--	--	--	--	--	--
	Total	14	14	14	14	--	14	--	--
Deep Groundwater Samples									
	Phase I	4	4	4	4	--	4	--	--
	Phase II	2	2	2	2	--	2	--	--
	Phase III	--	--	--	--	--	--	--	--
	Total	6	6	6	6	--	6	--	--
Sediment Samples									
	Phase I	4	4	4	4	--	4	--	4
	Phase II	3	3	3	3	--	3	--	3
	Phase III	--	--	--	--	--	--	--	--
	Total	7	7	7	7	--	7	--	7
Surface Water Samples									
	Phase I	--	--	--	--	--	--	--	--
	Phase II	7	7	7	7	--	7	--	--
	Phase III	--	--	--	--	--	--	--	--
	Total	7	7	7	7	--	7	--	--

TCL - Target Compound List
VOC - Volatile Organic Compound
SVOC - Semivolatile Organic Compound
PCB - Polychlorinated biphenyl
-- No Sample Analyzed

Table 3-3
Sample Analyses for RI Activities at Site 4
St. Juliens Creek Annex
Chesapeake, Virginia

Site 4 Samples		TCL VOCs	TCL SVOCs	TCL Pesticides/PCBs	TAL Metals and Cyanide	Total Phosphorus	Total Petroleum Hydrocarbons	Total Organic Carbon
Surface Soil Samples								
	Phase I	10	10	10	10	10	--	--
	Phase II	12	12	12	12	2	--	--
	Phase III	--	--	--	--	--	--	--
	Total	22	22	22	22	12	--	--
Subsurface Soil Samples								
	Phase I	3	3	3	3	3	--	--
	Phase II	5	5	5	5	2	--	--
	Phase III	--	--	--	--	--	--	--
	Total	8	8	8	8	5	--	--
Shallow Groundwater Samples								
	Phase I	8	8	8	8	8	--	--
	Phase II	4	4	4	4	4	--	--
	Phase III	--	--	--	--	--	--	--
	Total	12	12	12	12	12	--	--
Deep Groundwater Samples								
	Phase I	4	3	3	3	3	--	--
	Phase II	2	2	2	2	2	--	--
	Phase III	--	--	--	--	--	--	--
	Total	6	5	5	5	5	--	--
Sediment Samples								
	Phase I	4	4	4	4	4	--	4
	Phase II	5	5	5	5	2	--	4
	Phase III	--	--	--	--	--	--	--
	Total	9	9	9	9	6	--	8
Surface Water Samples								
	Phase I	1	1	1	1	1	--	--
	Phase II	7	7	7	7	7	--	--
	Phase III	--	--	--	--	--	--	--
	Total	8	8	8	8	8	--	--

TCL - Target Compound List
VOC - Volatile Organic Compound
SVOC - Semivolatile Organic Compound
PCB - Polychlorinated Biphenyl
-- No Sample Analyzed

Table 3-4
Sample Analyses for RI Activities at Sites 5 and 6
St. Juliens Creek Annex
Chesapeake, Virginia

Site 5 & 6 Samples		TCL VOCs	TCL SVOCs	TCL Pesticides/PCBs	TAL Metals and Cyanide	Dioxin	Explosives	Total Phosphorus	Total Petroleum Hydrocarbons	Total Organic Carbon
Surface Soil Samples										
	Phase I	9	9	9	9	--	1	9	--	--
	Phase II	26	26	26	26	--	26	26	--	--
	Phase III	--	--	--	--	--	--	--	--	--
	Total	35	35	35	35	--	27	35	--	--
Subsurface Soil Samples										
	Phase I	15	15	15	15	5	2	15	--	--
	Phase II	6	6	6	6	--	6	6	--	--
	Phase III	--	--	--	--	5	--	--	--	--
	Total	21	21	21	21	10	8	21	--	--
Shallow Groundwater Samples										
	Phase I	6	6	6	6	--	1	6	--	--
	Phase II	5	5	5	5	--	5	5	--	--
	Phase III	--	--	--	--	--	--	--	--	--
	Total	11	11	11	11	--	6	11	--	--
Deep Groundwater Samples										
	Phase I	4	4	4	4	--	--	4	--	--
	Phase II	3	3	3	3	--	3	3	--	--
	Phase III	--	--	--	--	--	--	--	--	--
	Total	7	7	7	7	--	3	7	--	--
Sediment Samples										
	Phase I	3	3	3	3	--	2	3	--	3
	Phase II	4	4	4	4	--	4	4	--	1
	Phase III	--	--	--	--	--	--	--	--	--
	Total	7	7	7	7	--	6	7	--	4
Surface Water Samples										
	Phase I	--	--	--	--	--	--	--	--	--
	Phase II	7	7	7	7	--	7	6	--	--
	Phase III	--	--	--	--	--	--	--	--	--
	Total	7	7	7	7	--	7	6	--	--

TCL - Target Compound List
VOC - Volatile Organic Compound
SVOC - Semivolatile Organic Compound
PCB - Polychlorinated Biphenyl
-- No Sample Analyzed

Table 3-5
Tidal Survey Dates and Monitoring Wells
St. Juliens Creek Annex
Chesapeake, Virgnia

Dates of Water-Level Monitoring	Site 2 Monitoring Wells Observed	Site 3 Monitoring Wells Observed	Site 4 Monitoring Wells Observed	Site 5 Monitoring Wells Observed	Background Monitoring Wells Observed
November 4, 1997	SJS02-MW02S SJS02-MW02D	-----	-----	SJS05-MW01S SJS05-MW01D	-----
November 5, 1997	SJS02-MW03S	-----	-----	-----	-----
May 1 through 4, 1999	SJS02-MW05S SJS02-MW05D	SJS03-MW01D	SJS04-MW03D	SJS05-MW02D	SJSBK-MW02D
May 5 through 8, 1999	-----	SJS03-MW05S SJS03-MW06S	SJS04-MW02S	SJS05-MW01S SJS05-MW02S SJS05-MW04S SJS05-MW05S	-----

Table 3-6
Deviations from the RI Work Plan
St. Juliens Creek Annex
Chesapeake, Virginia

Deviation from Work Plan	Reason	Impact on Quantity or Quality of Data
Geophysical grid did not extend over the entire Site 4 area.	Very heavy brush covered significant areas of the landfill.	Limited geophysical data along the southern and western portion of the site. Other data (visual inspection and historical aerial photographs) provide data for the unsurveyed areas.
Cesium proton magnetometer was used for the magnetometer survey instead of an EM-61.	Cesium magnetometer detects anomalies over a greater width along the grid line.	Higher quality data obtained.
Did not collect sediment conductivity readings during sampling.	Per agreement with VADEQ.	Not considered to be a data gap. Sediment conductivity is not considered standard data.
Collected three (not 10) subsurface soil samples at Landfill D During Phase I.	Potential for unexploded ordnance and very high density of concrete and other rubble, which would cause DPT refusal.	Less data from within the landfill boundary. In consideration of the potential for buried unexploded ordnance, further intrusive exploration within the landfill boundary is not warranted.
No surface water collected at Landfill 3 during Phase I. Only one surface water sample collected from Landfill D. All locations sampled during phase II.	No surface water available.	None.
Upgradient monitoring well location and associated soil samples at Site 3 were collected closer to the landfill boundary than proposed in the work plan.	Brought sampling locations within the St. Juliens Creek Annex property. Also moved the locations away from a railroad track. Locations are not within the landfill boundaries.	None. Locations are not within the landfill boundary.
Isolation casing installed in all deep monitoring wells.	Confining clay unit found at all locations.	None.
Geophysical grid not extended into Wetlands area of Site 5. Ten-foot grid at caged pit.	Presence of dense vegetation requiring significant cutting of reeds in wetlands. Obtain more anomaly definition at caged pit.	Geophysical data not collected in westernmost portion of the site. Increased definition of anomaly at caged pit.
Collected nine (not 10) surface soil sample.Changed location on several samples.	Proposed Phase I sample locations were covered with 18" of gravel. Locations were moved to give more coverage in areas where original soil surface is still present. Collected some samples of gravel.	One fewer samples were collected due to large area of gravel fill. Increased area of coverage. Additional data collected during Phase II.
No surface water collected with SJS05-SD01, and SJS05-SD02.	No Surface water available.	No upstream surface water or downstream surface water data from Site 5.
All Site 5 sediment samples collected during Phase I were analyzed for nitramine.	Sediment samples were collected at different times (in anticipation of a rainfall event that might provide surface water).	Additional nitramine data.
Isolation casing installed in all deep monitoring wells.	Confining clay unit found at all locations.	None.

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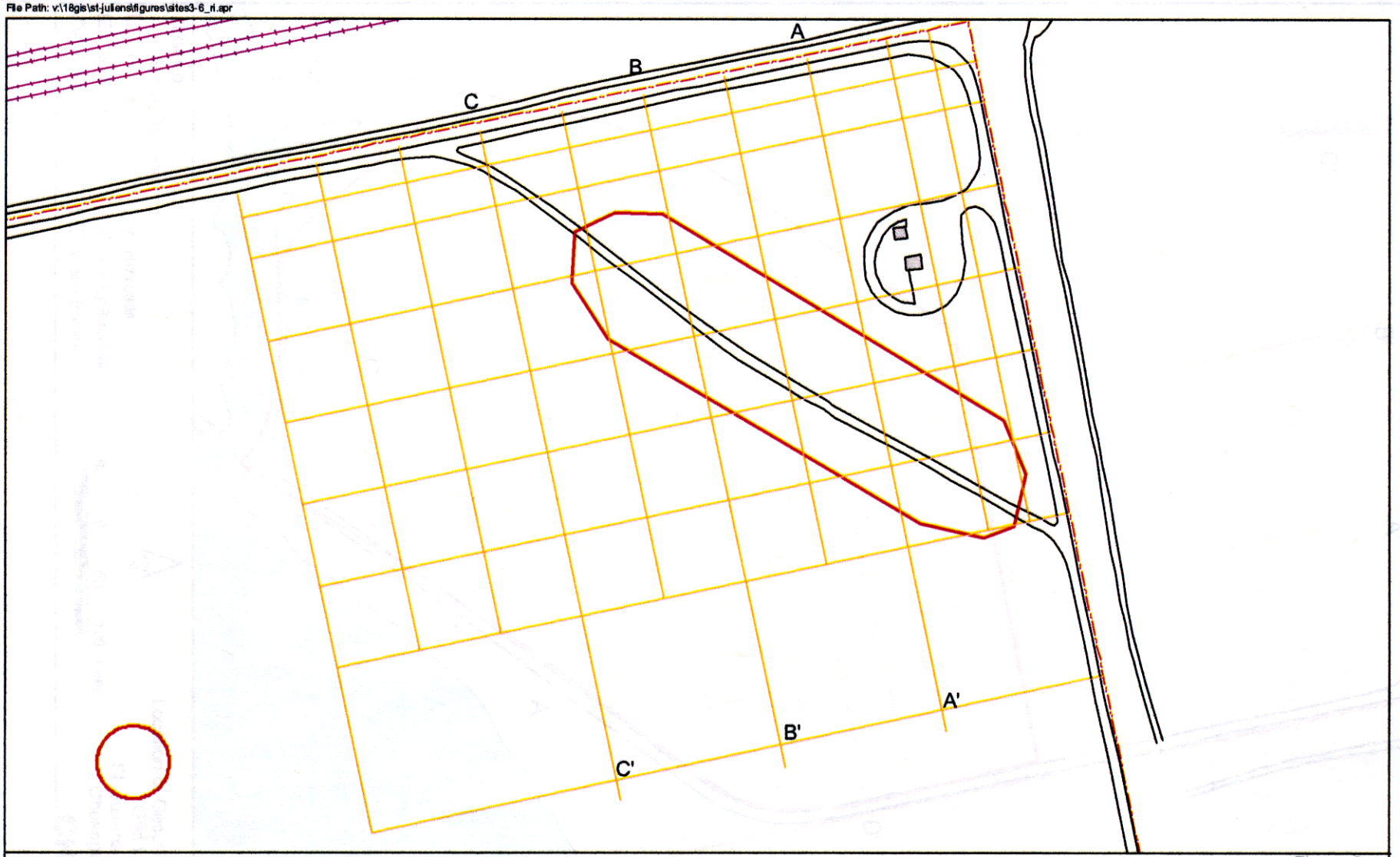


LEGEND

- Survey Grid Lines
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary

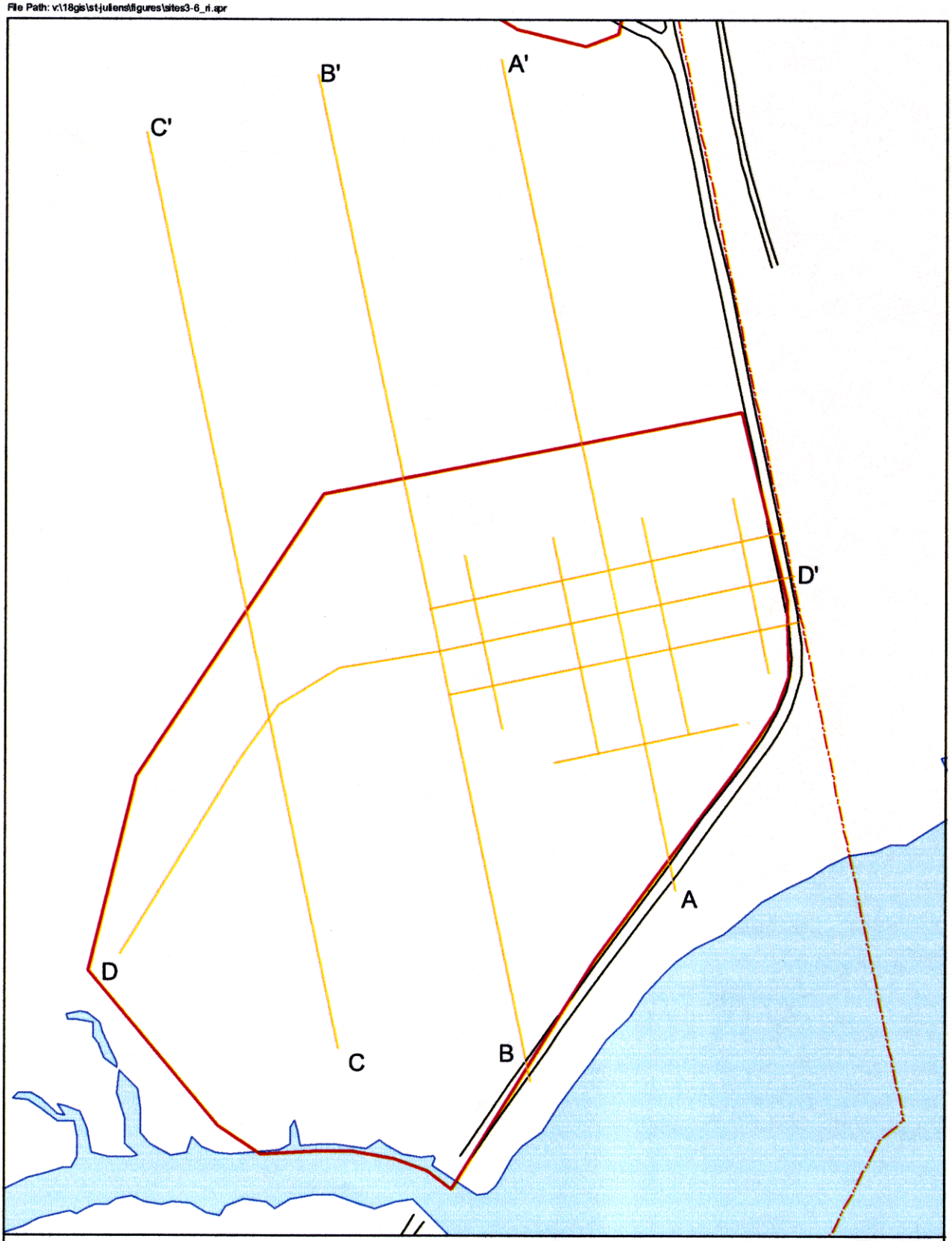
N

100 0 100 200 Feet

Figure 3-1
Location of Geophysical Survey
Grid Lines at Site 3
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



LEGEND

- Survey Grid Lines
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

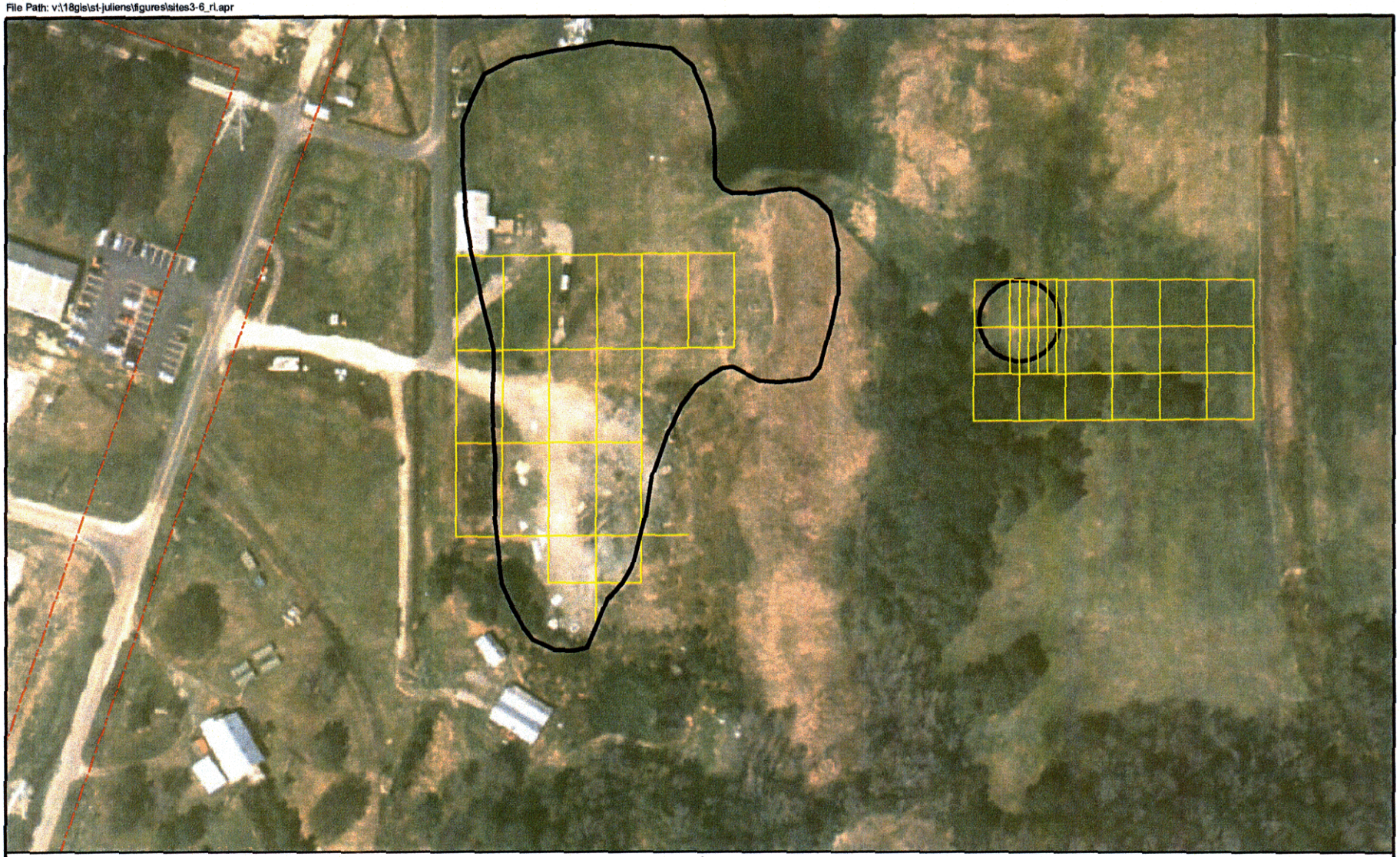
N

60 0 60 120 Feet

Figure 3-2
Location of Geophysical Survey
Grid Lines at Site 4
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_rl.apr



LEGEND

- Survey Grid Lines
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

N

90 0 90 180 Feet

Figure 3-3
Location of Geophysical Survey
Grid Lines at Sites 5 and 6
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr

LEGEND

- Surface Soil Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary

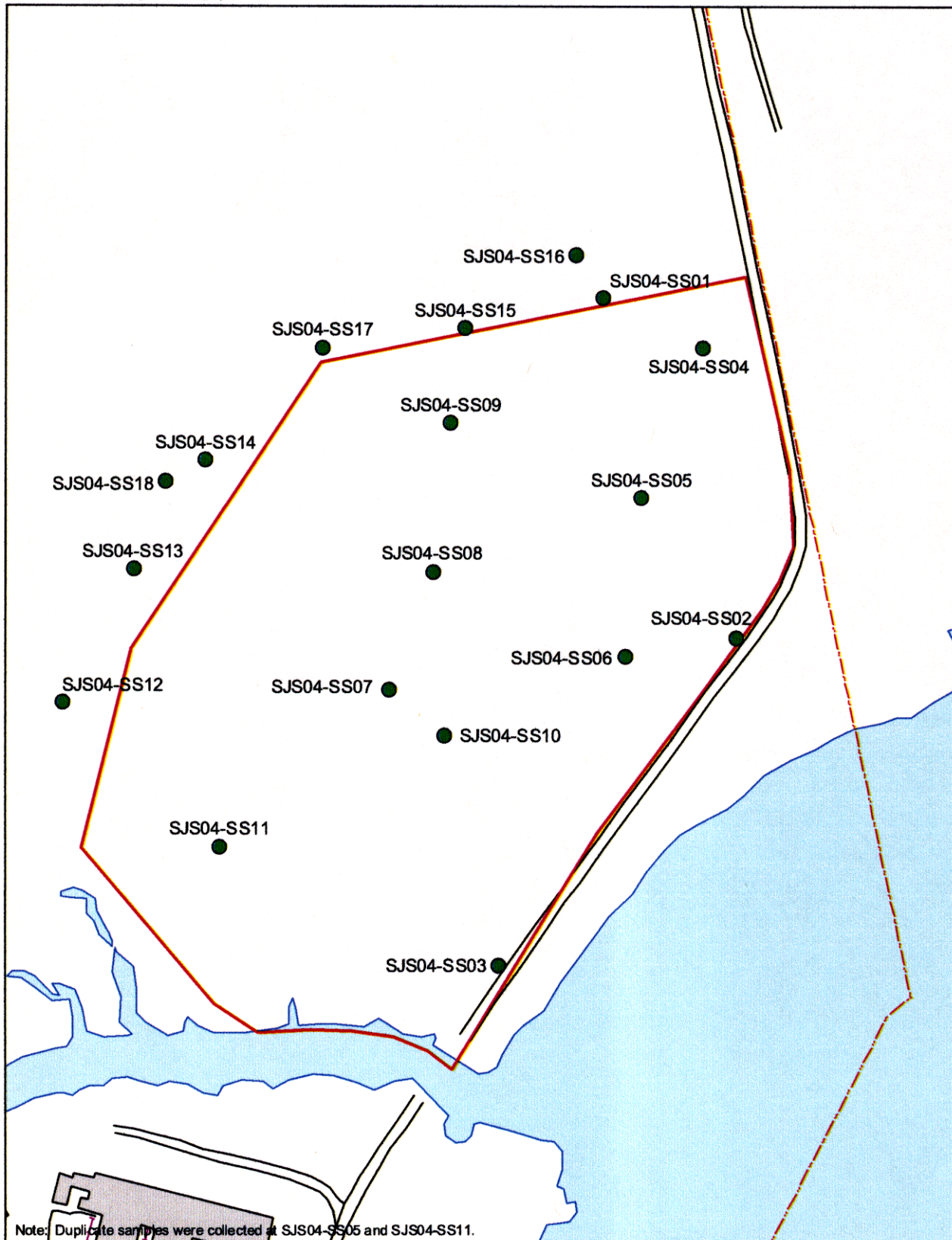
N

80 0 80 160 Feet

Figure 3-4
Site 3 Surface Soil Sample Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



LEGEND

- Surface Soil Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

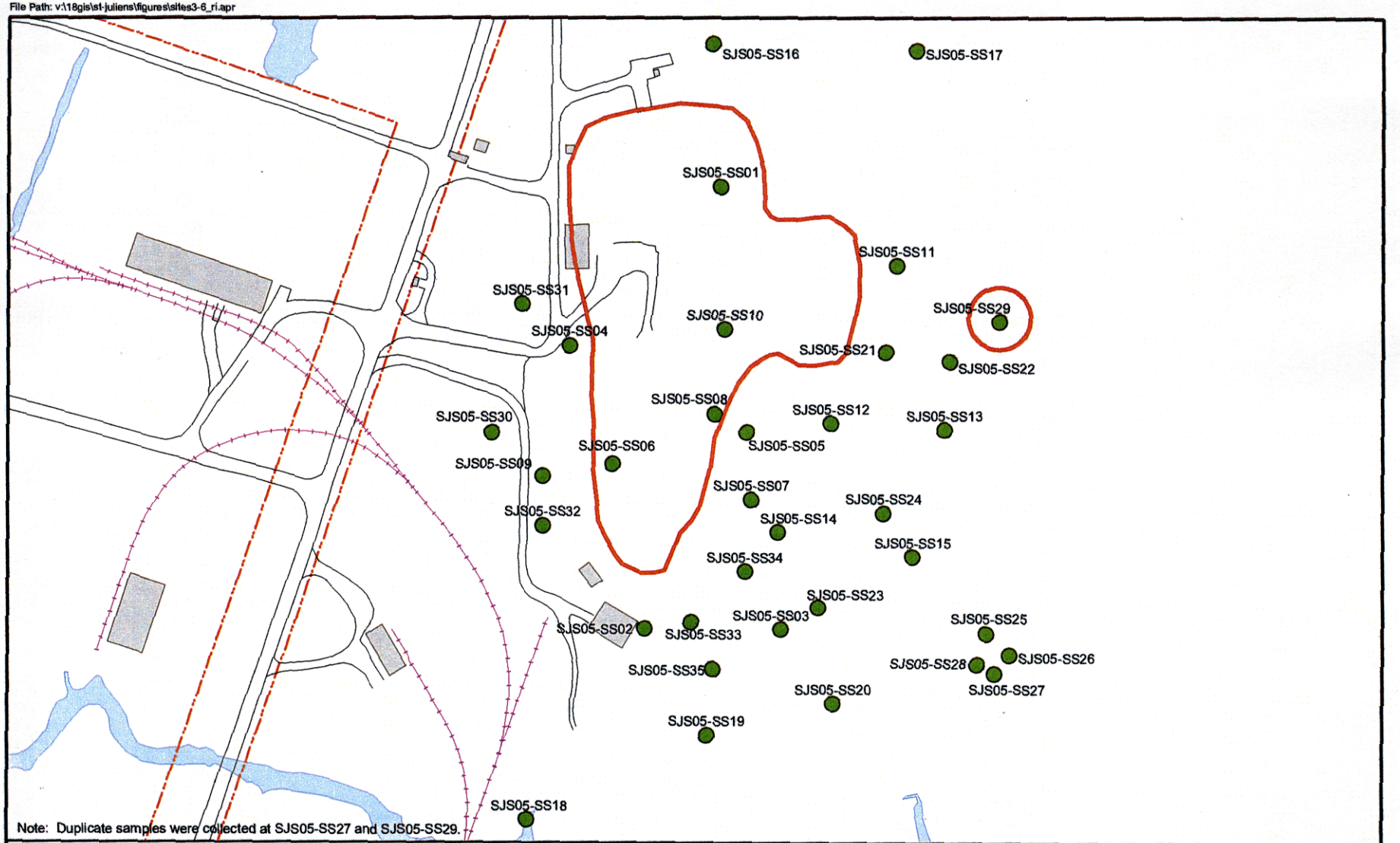
N

60 0 60 120 Feet

Figure 3-5
Site 4 Surface Soil Sample Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



LEGEND

- Surface Soil Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

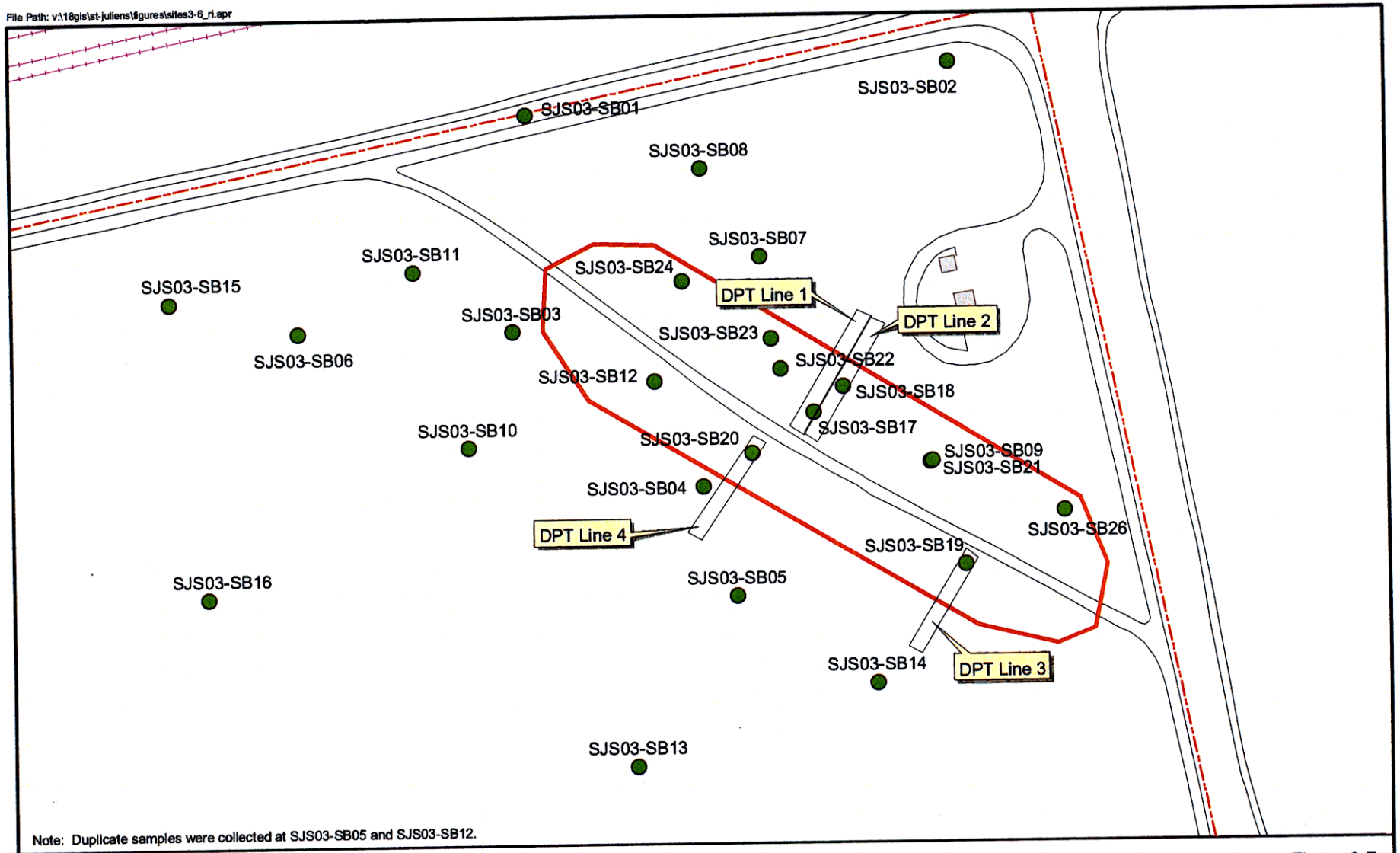
N

0 100 200 Feet

Figure 3-6
Site 5 and 6 Surface Soil Sample Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



Note: Duplicate samples were collected at SJS03-SB05 and SJS03-SB12.

LEGEND

- Subsurface Soil Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Approximate Location of DPT Lines

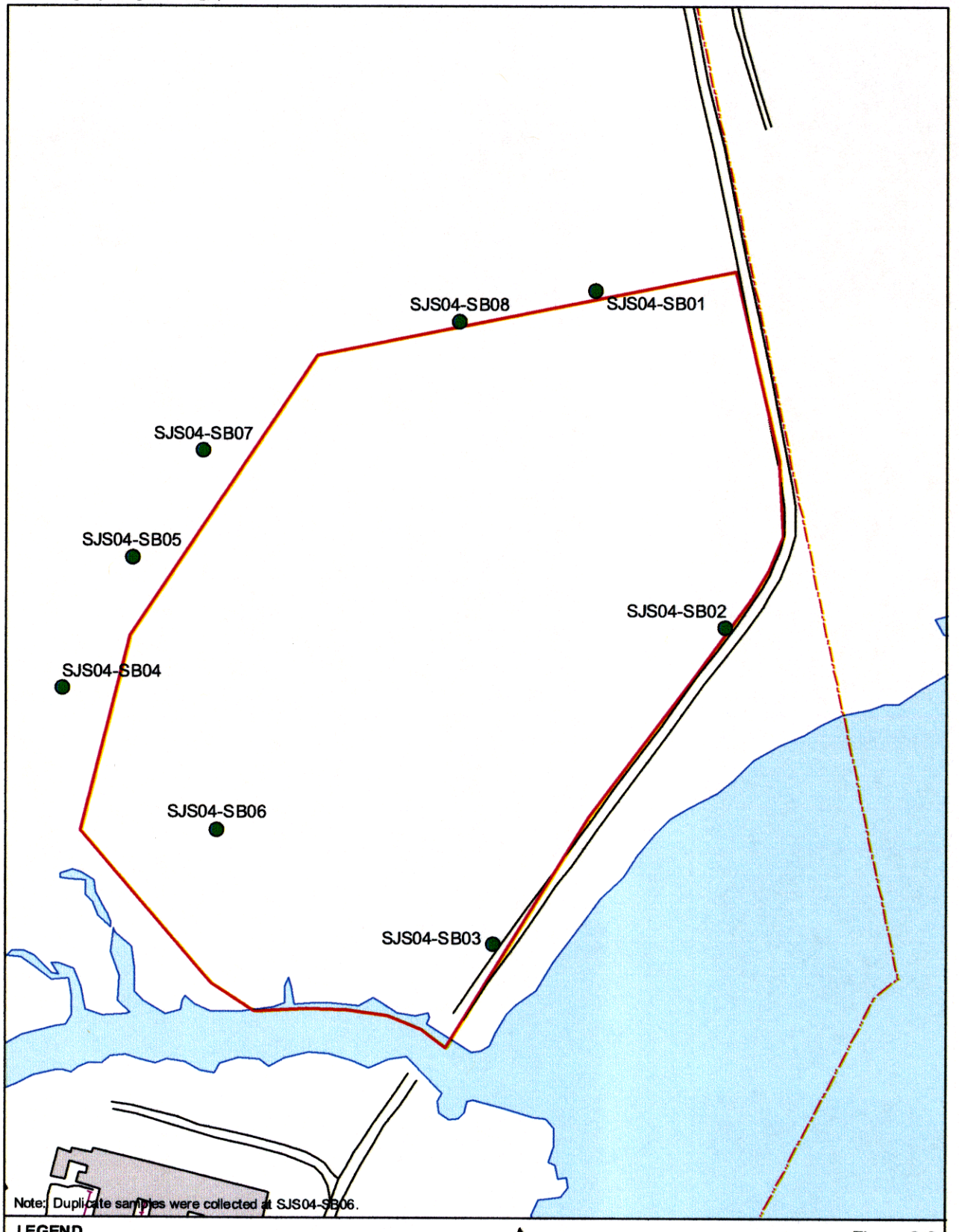
N

80 0 80 160 Feet

Figure 3-7
Site 3 Subsurface Soil Sample Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



LEGEND

- Subsurface Soil Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

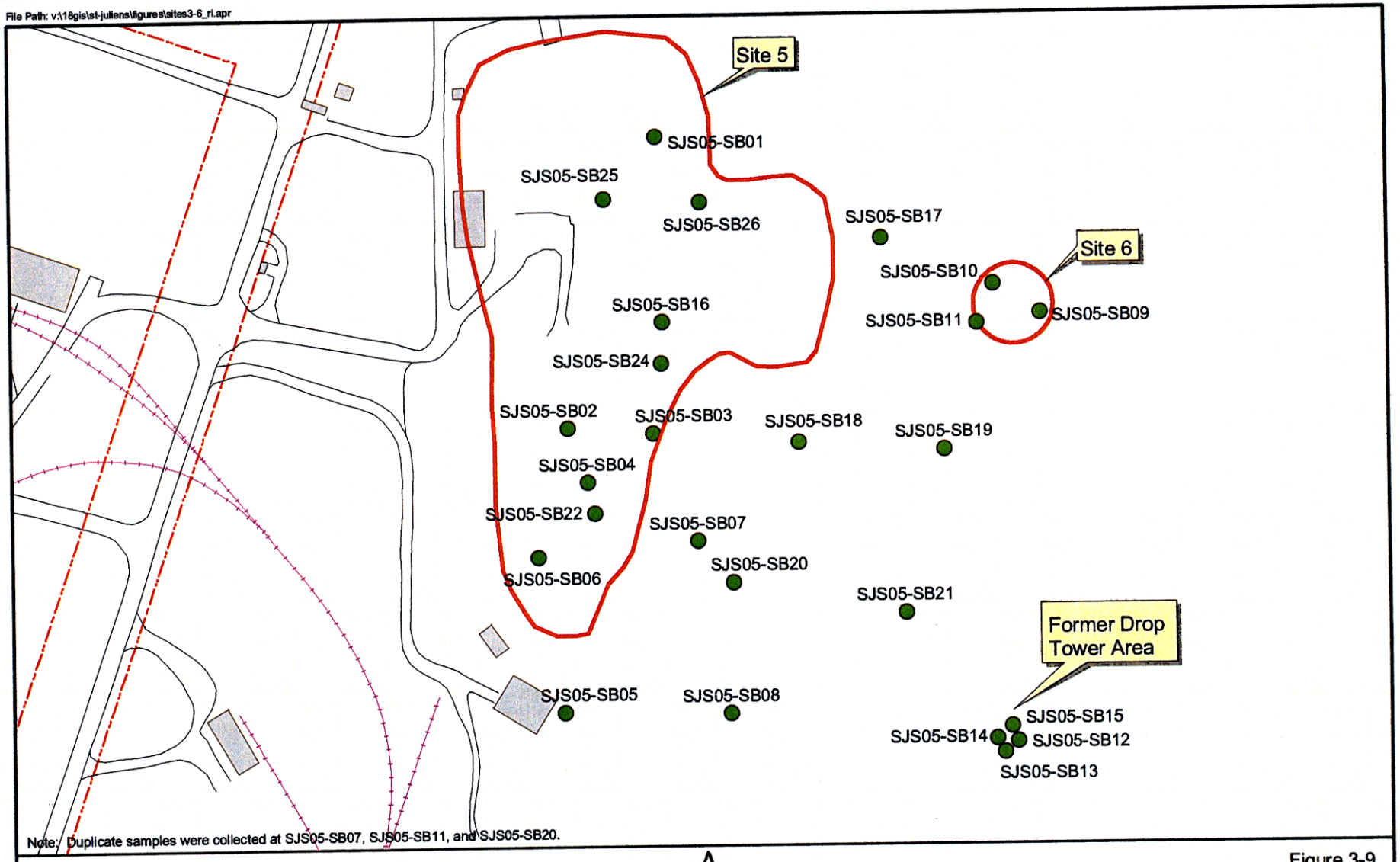
N

60 0 60 120 Feet

Figure 3-8
Site 4 Subsurface Soil Sample Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



Note: Duplicate samples were collected at SJS05-SB07, SJS05-SB11, and SJS05-SB20.

LEGEND

- Subsurface Soil Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

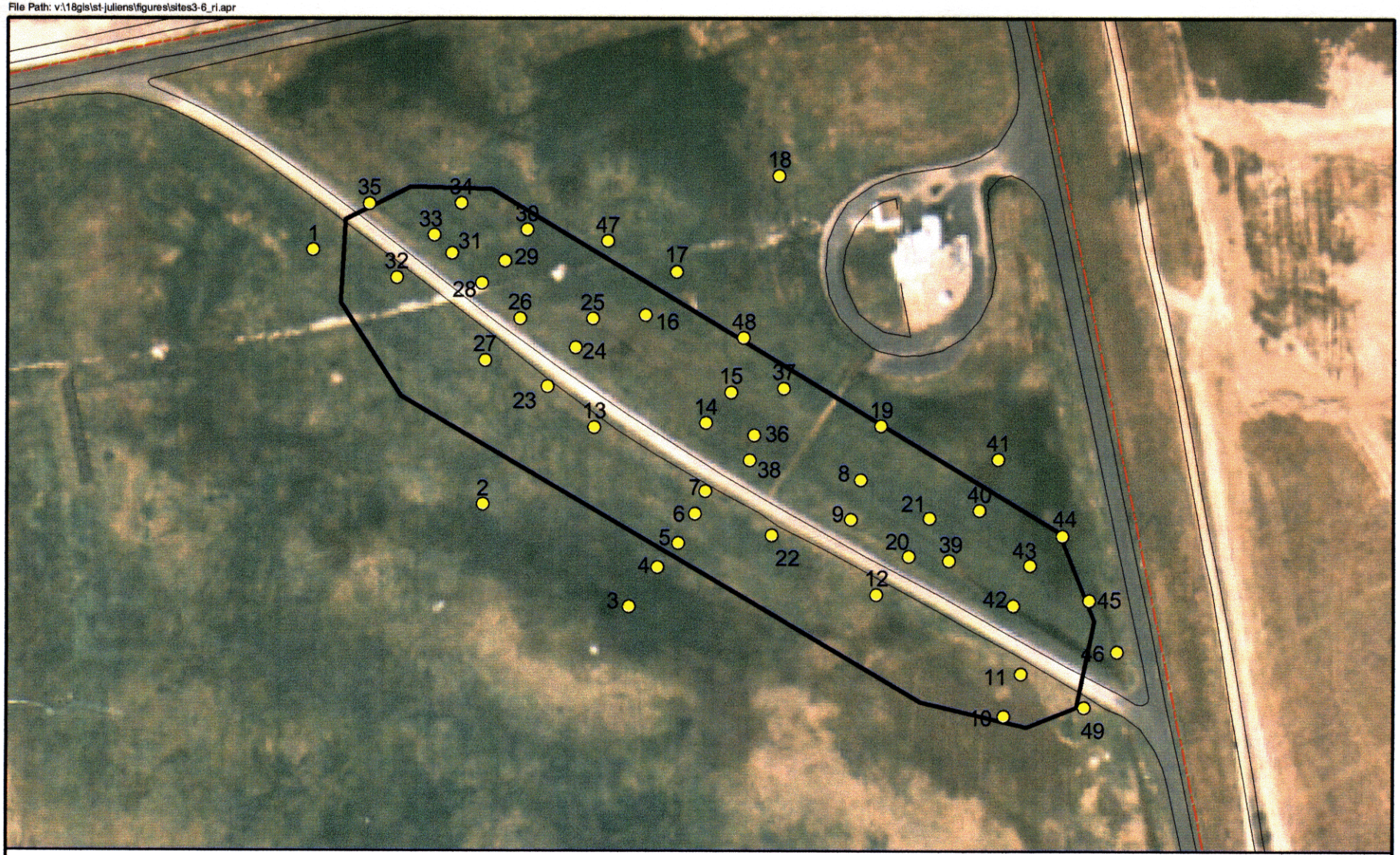
N

90 0 90 180 Feet

Figure 3-9
Site 5 and 6 Subsurface Soil Sample Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



LEGEND

- Testpits
- IR Sites
- Activity Boundary

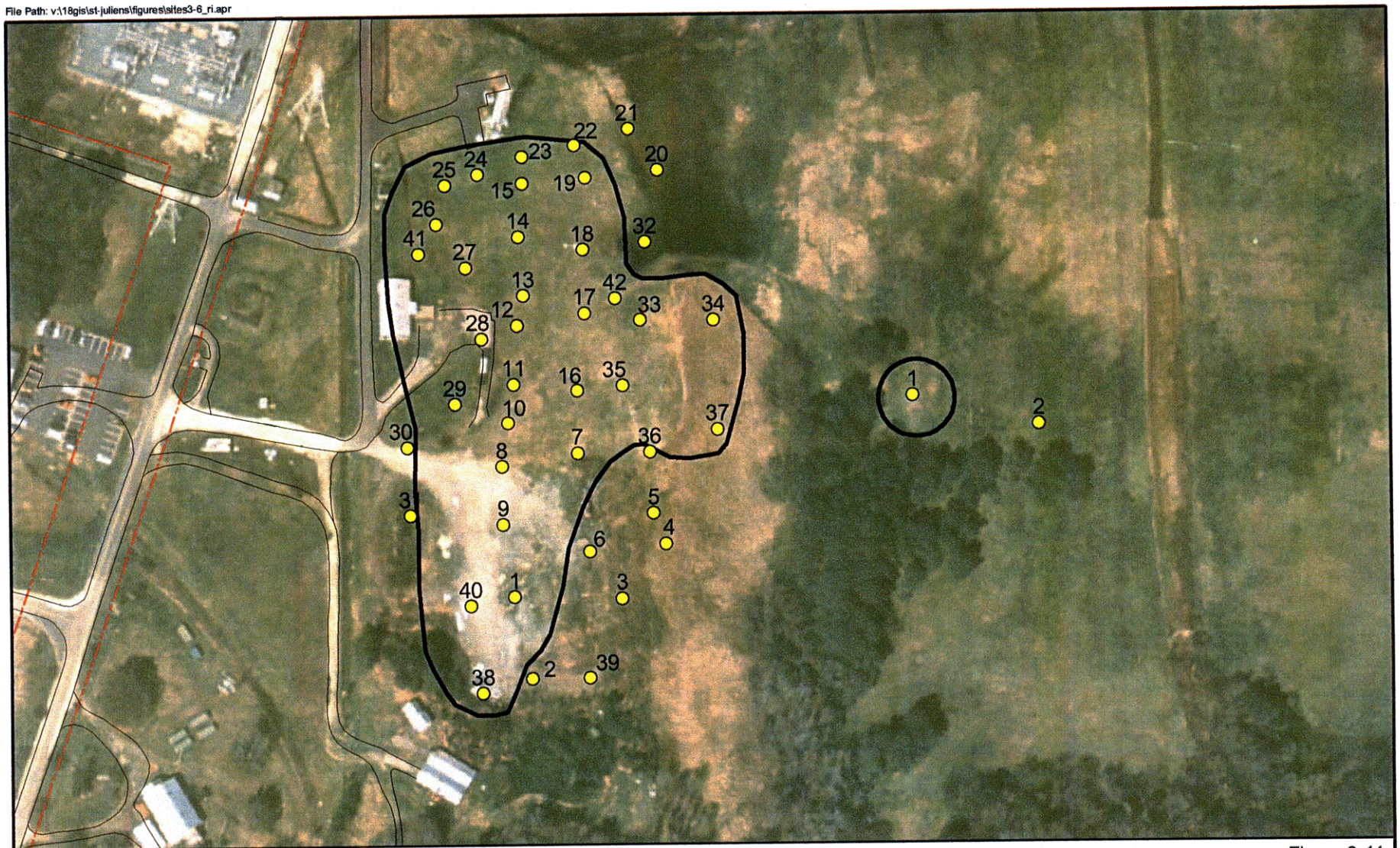
N

0 70 140 Feet

Figure 3-10
Site 3
Test Pit Locations
St. Julien's Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



LEGEND

- Testpits
- IR Sites
- Activity Boundary

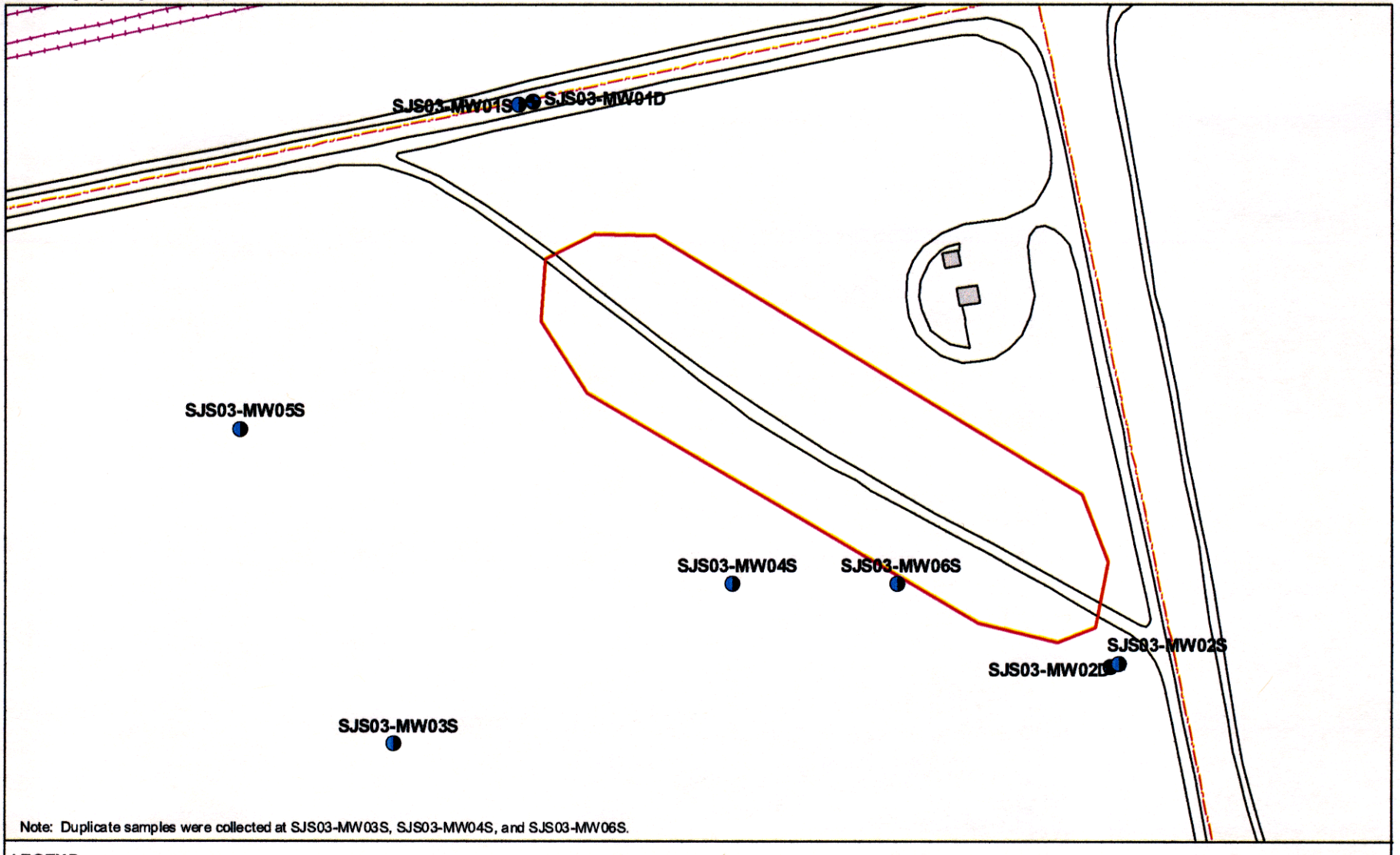
N

0 100 200 Feet

Figure 3-11
Site 5 and 6
Test Pit Locations
St. Julien's Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



Note: Duplicate samples were collected at SJS03-MW03S, SJS03-MW04S, and SJS03-MW06S.

LEGEND

- Monitoring Wells - Deep
- Monitoring Wells - Shallow
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary

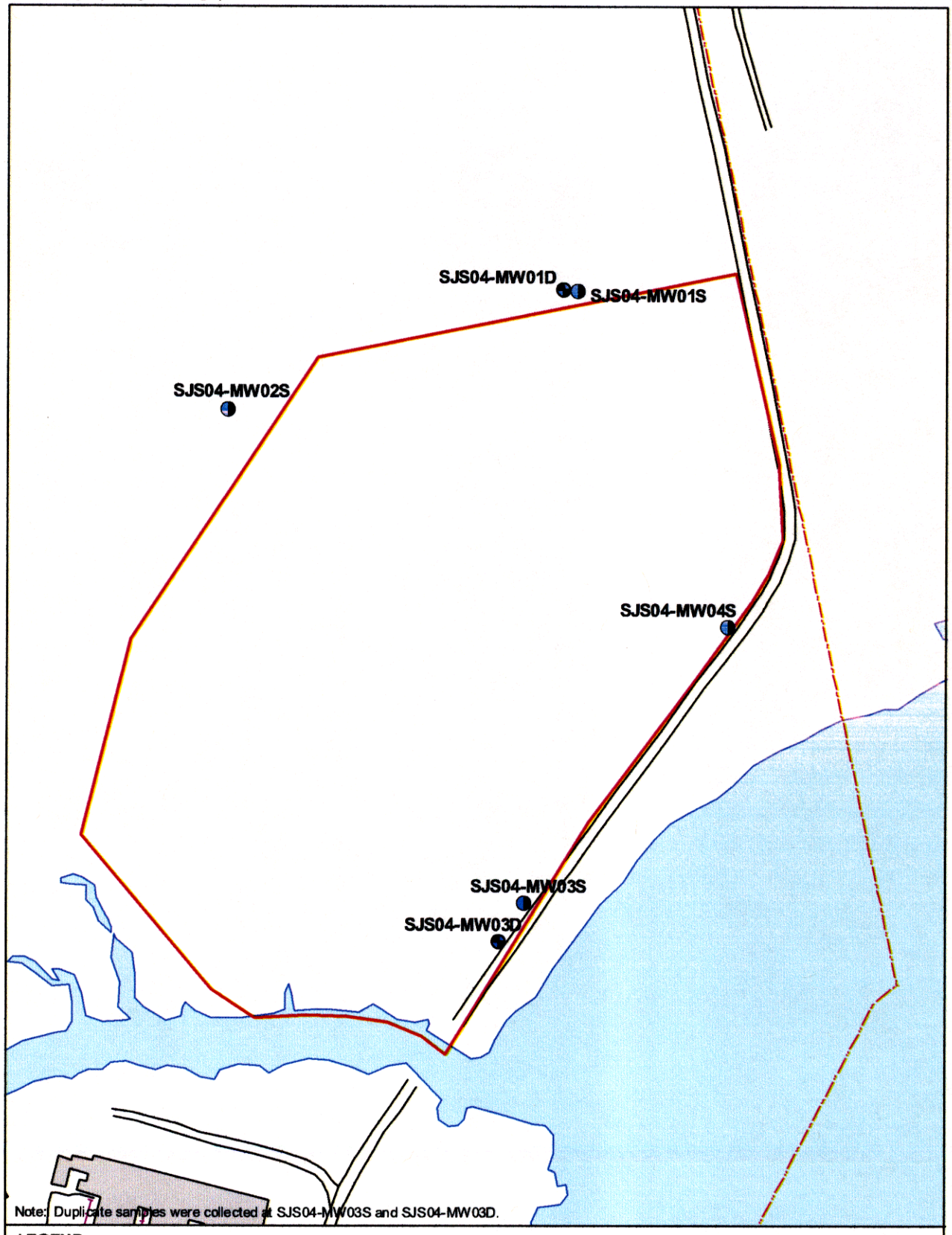
N

80 0 80 160 Feet

Figure 3-12
Site 3 Monitoring Well Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



LEGEND

- Monitoring Wells - Deep
- Monitoring Wells - Shallow
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

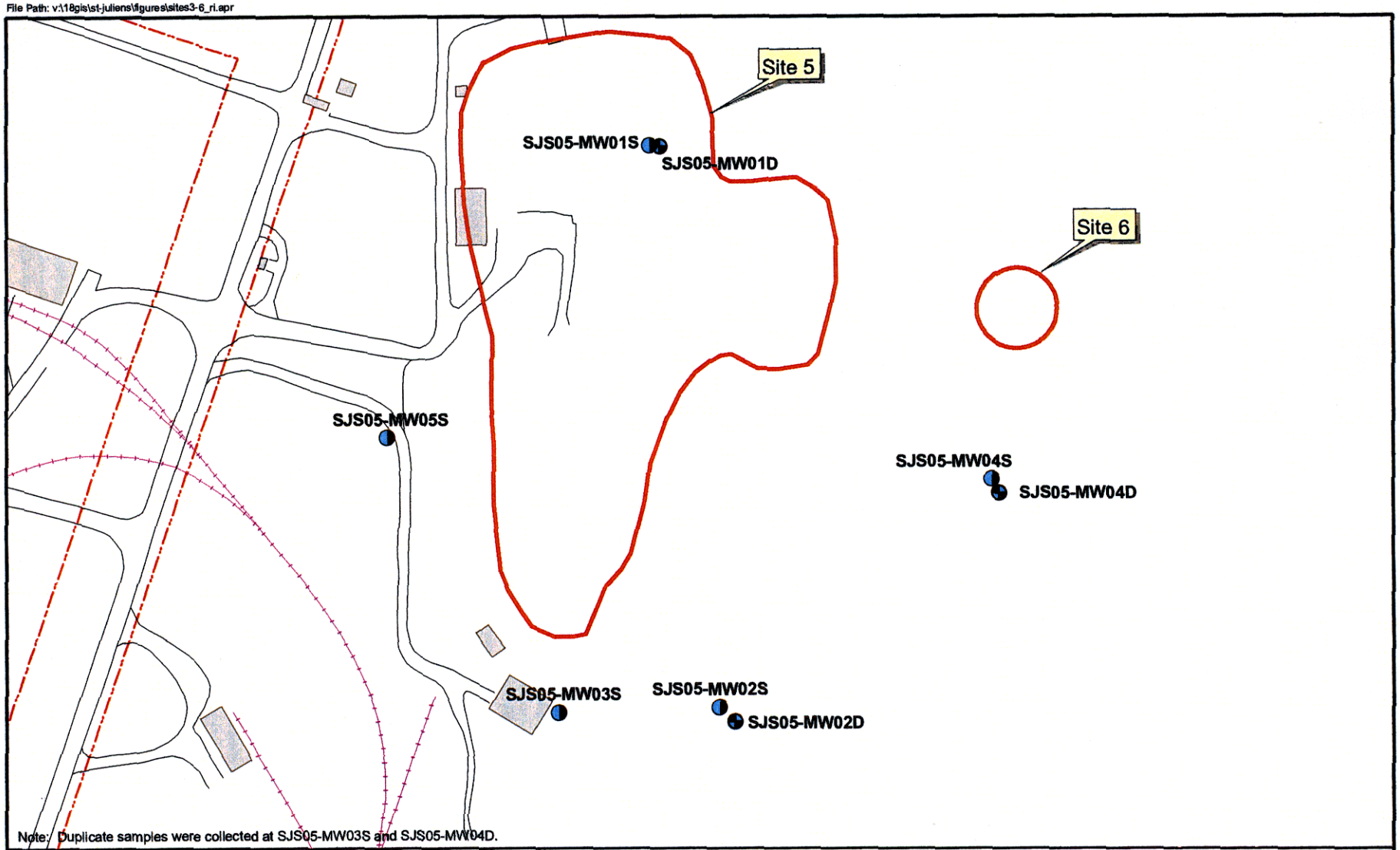
N

60 0 60 120 Feet

Figure 3-13
Site 4 Monitoring Well Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



Note: Duplicate samples were collected at SJS05-MW03S and SJS05-MW04D.

LEGEND

- Monitoring Wells - Deep
- Monitoring Wells - Shallow
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

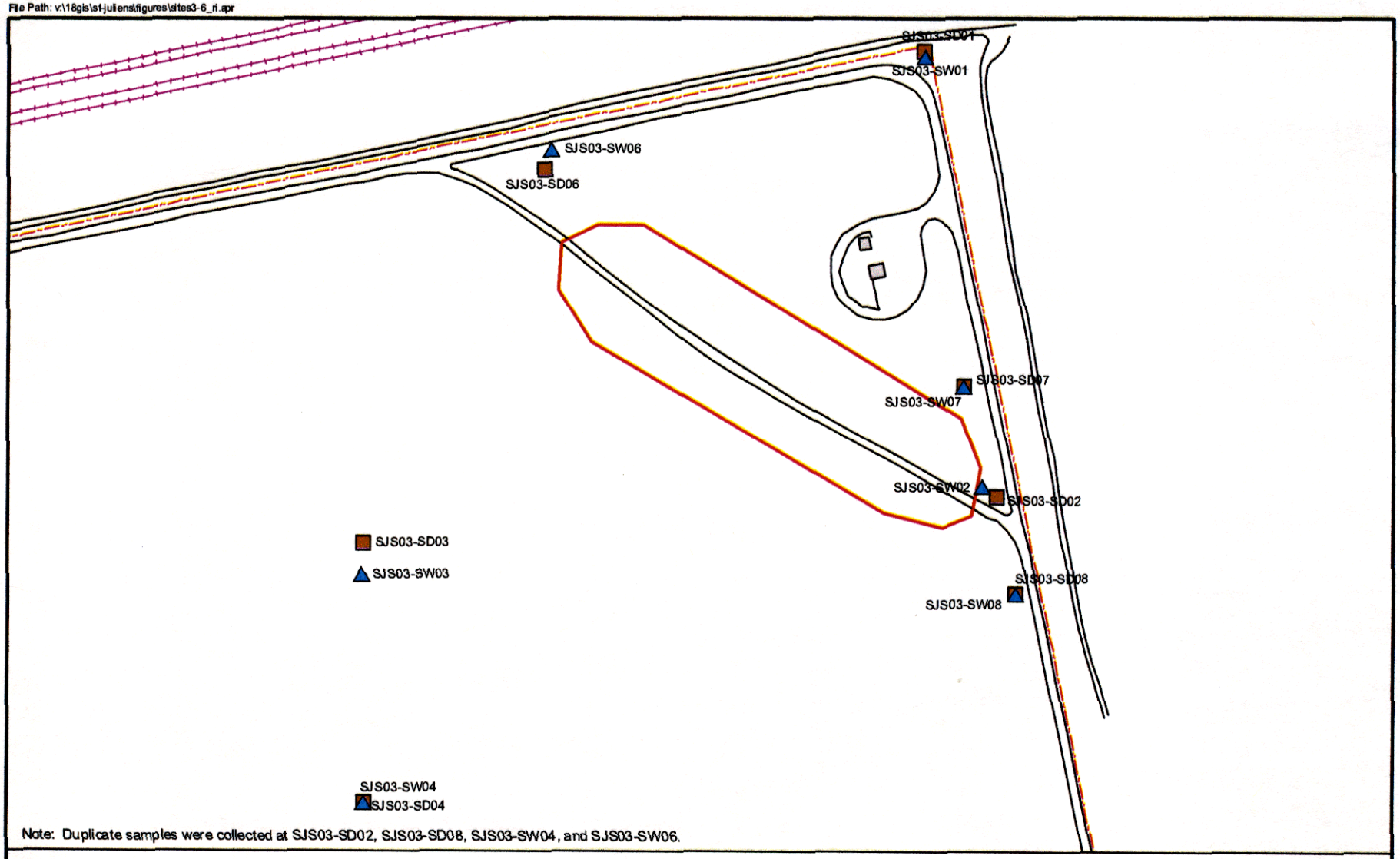
N

90 0 90 180 Feet

Figure 3-14
Site 5 Monitoring Well Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



Note: Duplicate samples were collected at SJS03-SD02, SJS03-SD08, SJS03-SW04, and SJS03-SW06.

LEGEND

- Surface Water Sample Locations
- Sediment Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary

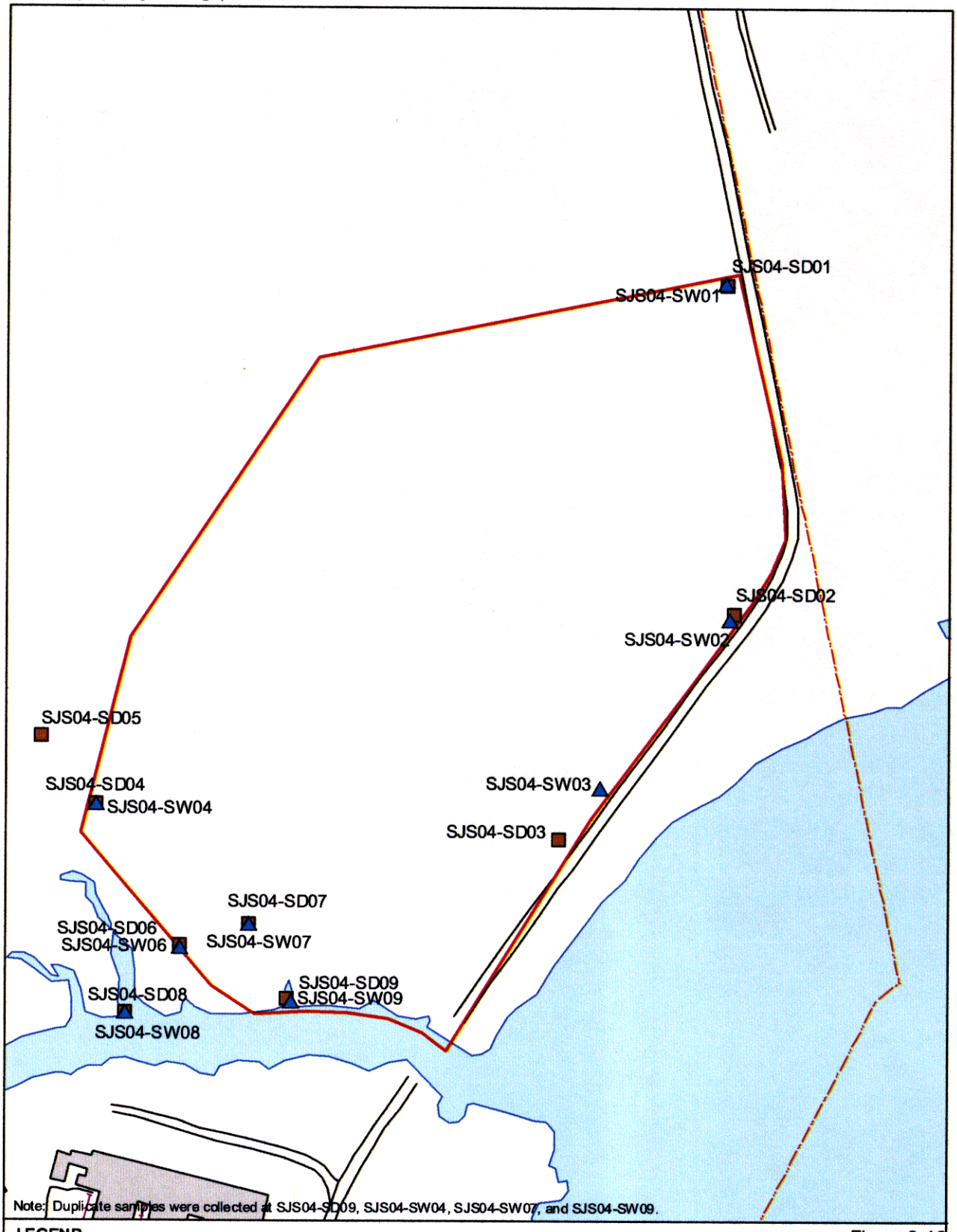
N

0 100 200 Feet

Figure 3-15
Site 3 Sediment and Surface Water Sampling Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



LEGEND

- Surface Water Sample Locations
- Sediment Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

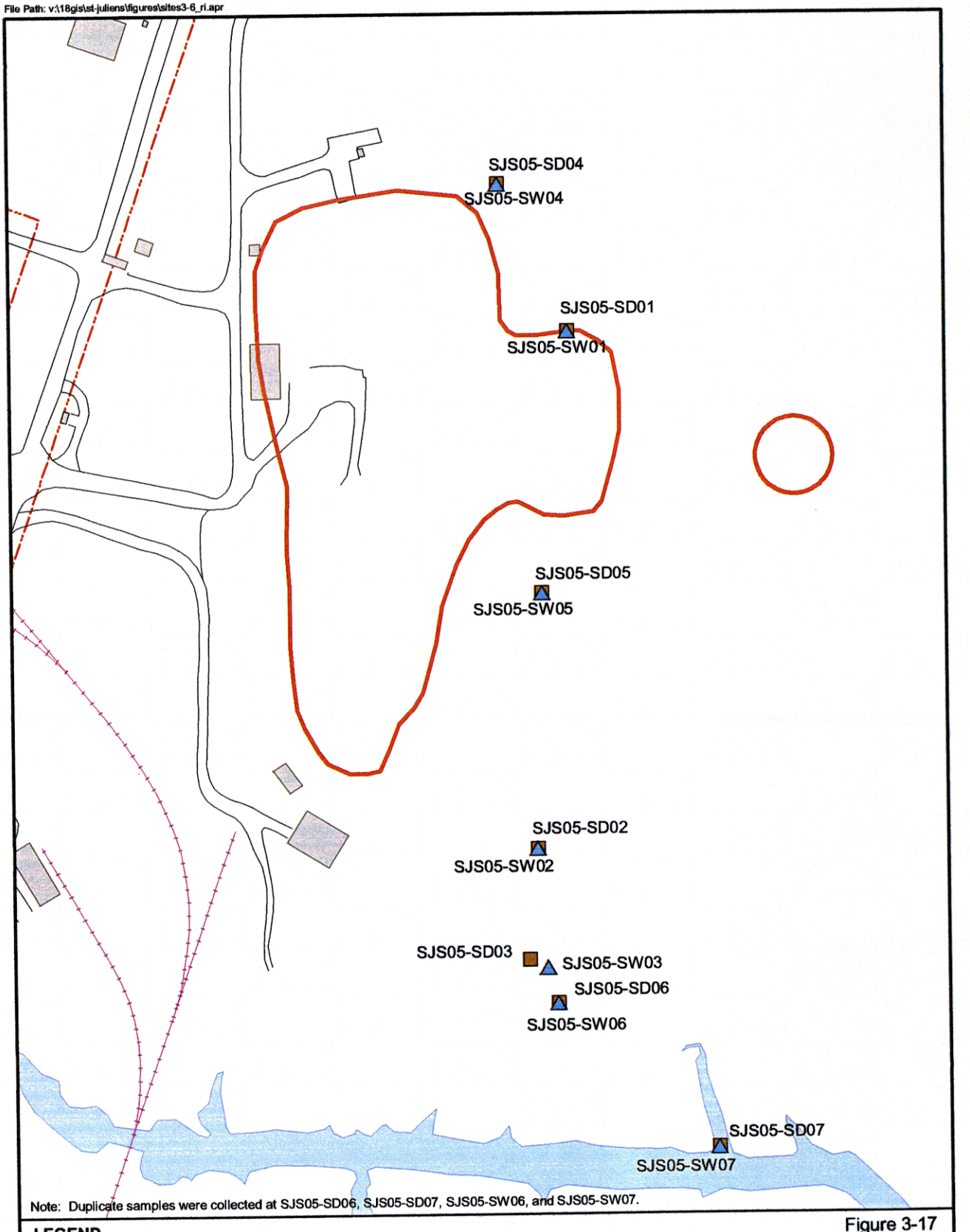
N

60 0 60 120 Feet

Figure 3-16
Site 4 Sediment and Surface Water Sampling Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

File Path: v:\18gis\st-juliens\figures\sites3-6_ri.apr



Note: Duplicate samples were collected at SJS05-SD06, SJS05-SD07, SJS05-SW06, and SJS05-SW07.

LEGEND

- Surface Water Sample Locations
- Sediment Sample Locations
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies

N

60 0 60 Feet

Figure 3-17
Site 5 Sediment and Surface Water Sampling Locations
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

Table 4-1
Monitoring Well Construction Summary
St. Juliens Creek Annex
Chesapeake, Virginia

Monitoring Well	Installation Date	Ground Elevation (ft msl)	Top of PVC Elevation (ft msl)	Total Well Depth (ft bgs)	Depth of Surface Casing (ft bgs)	Length of Screen (ft)	Depth of Top of Screen (ft bgs)	Depth of Bottom of Screen (ft bgs)	Soil Boring Log Available?	Need to Construct Soil Boring Log ?	Depth to Base of Columbia Aquifer (ft bgs)	Depth to Base of Yorktown Confining Unit (ft bgs)	Thickness of Yorktown Confining Unit (ft)	Hydrogeologic Unit of Screened Interval
Site 3 Landfill C														
SJS03-MW01S	7/14/97	12.01	12.55	14	NA	10	3.4	13.4	Y	Y	>14	NA	NA	Columbia Aquifer
SJS03-MW02S	7/11/97	12.84	15.86	14.5	NA	10	3.9	13.9	Y	Y	>14	NA	NA	Columbia Aquifer
SJS03-MW03S	7/11/97	11.31	14.12	14	NA	10	3.9	13.9	Y	Y	>14	NA	NA	Columbia Aquifer
SJS03-MW04S	7/10/97	12.64	15.73	14.5	NA	10	3.1	13.1	Y	Y	>14	NA	NA	Columbia Aquifer
SJS03-MW05S	4/28/99	10.55	12.69	15	NA	10	4	14	Y	Y	>15	NA	NA	Columbia Aquifer
SJS03-MW06S	4/28/99	13.33	15.37	18.5	NA	10	8.5	18.5	Y	Y	>19	NA	NA	Columbia Aquifer
SJS03-MW01D	7/14/97	12.04	12.69	60	22	10	48	58	Y	Y	20	45.1	25.1	Upper Yorktown Aquifer
SJS03-MW02D	7/14/97	12.41	15.37	62	29	10	49	59	Y	Y	21.3	48.5	27.2	Upper Yorktown Aquifer/Middle Yorktown Confining Unit
Site 4 Landfill D														
SJS04-MW01S	7/10/97	10.47	13.66	15	NA	10	3.9	13.9	Y	Y	>15	NA	NA	Columbia Aquifer
SJS04-MW02S	7/18/97	9.36	12.12	14	NA	10	3.5	13.5	Y	Y	>14	NA	NA	Columbia Aquifer
SJS04-MW03S	7/1/97	4.19	7.31	14	NA	10	3.4	13.4	Y	Y	>14	NA	NA	Columbia Aquifer
SJS04-MW04S	7/9/97	6.34	9.24	15	NA	10	3.5	13.5	Y	Y	>15	NA	NA	Columbia Aquifer

171BB4Z

Table 4-1
Monitoring Well Construction Summary
St. Juliens Creek Annex
Chesapeake, Virginia

Monitoring Well	Installation Date	Ground Elevation (ft msl)	Top of PVC Elevation (ft msl)	Total Well Depth (ft bgs)	Depth of Surface Casing (ft bgs)	Length of Screen (ft)	Depth of Top of Screen (ft bgs)	Depth of Bottom of Screen (ft bgs)	Soil Boring Log Available?	Need to Construct Soil Boring Log ?	Depth to Base of Columbia Aquifer (ft bgs)	Depth to Yorktown Confi
SJS04-MW01D	7/2/97	10.7	13.96	91	28	10	41.9	51.9	Y	Y	25	49
SJS04-MW03D	7/15/97	3.6	6.2	60	20	10	46	56	Y	Y	32.3	41
Site 5 Burning Grounds												
SJS05-MW01S	7/8/97	6.45	9.76	14	NA	10	3.5	13.5	Y	Y	>14	N
SJS05-MW02S	7/8/97	4.55	7.89	14	NA	10	3.5	13.5	Y	Y	>14	N
SJS05-MW03S	7/7/97	4.69	9.32	14	NA	10	3.2	13.2	Y	Y	>14	N
SJS05-MW04S	4/27/99	8.45	11.09	14	NA	10	3	13	Y	Y	>14	N
SJS05-MW05S	NA	7.37	9.99	15	NA	10	4	14	Y	Y	>15	N
SJS05-MW01D	7/11/97	6.11	9.23	58	30	10	45	55	Y	Y	14.5	4
SJS05-MW02D	7/13/97	4.56	7.76	60	22	10	47	57	Y	Y	20	45
SJS05-MW04D	NA	8.38	10.84	67	65	10	55	65	Y	Y	15	5

Table 4-1
Monitoring Well Construction Summary
St. Juliens Creek Annex
Chesapeake, Virginia

Monitoring Well	Installation Date	Ground Elevation (ft msl)	Top of PVC Elevation (ft msl)	Total Well Depth (ft bgs)	Depth of Surface Casing (ft bgs)	Length of Screen (ft)	Depth of Top of Screen (ft bgs)	Depth of Bottom of Screen (ft bgs)	Soil Boring Log Available?	Need to Construct Soil Boring Log ?	Depth to Base of Columbia Aquifer (ft bgs)	Depth to Base of Yorktown Confining Unit (ft bgs)	Thickness of Yorktown Confining Unit (ft)	Hydrogeologic Unit of Screened Interval
Background														
SJSBK-MW01S	4/20/99	7.2	9.52	14	NA	10	3	13	Y	Y	>14	NA	NA	Colum bia Aquifer
SJSBK-MW02S	look in field notes	7.06	9.5	14	NA	10	3	13	Y	Y	>14	NA	NA	Colum bia Aquifer
SJSBK-MW03S	4/27/99	9	11.56	14	NA	10	3	13	Y	Y	>14	NA	NA	Colum bia Aquifer
SJSBK-MW04S	NA	7.85	10.64	15	NA	10	4	14	Y	Y	>15	NA	NA	Colum bia Aquifer
SJSBK-MW01D	4/24/99	7.2	9.72	54	17	10	44.25	54.25	Y	Y	13.5	42.5	29	Yorktown Aquifer
SJSBK-MW02D	NA	7.31	9.22	56	18	10	45	55	Y	Y	14	42.25	28.25	Yorktown Aquifer
SJSBK-MW03D	NA	8.76	11.07	46	18.5	10	35	45	Y	Y	13.5	35	21.5	Yorktown Aquifer

NA = Not Available or Not Applicable
NR = Not Reported

Table 4-1
Monitoring Well Construction Summary
St. Juliens Creek Annex
Chesapeake, Virginia

Monitoring Well	Description of Screened Lithology	Elevation of Top of Screen (ft msl)	Elevation of Bottom of Screen (ft msl)	Elevation of Base of Borehole	Elevation of Base of Columbia Aquifer (ft msl)	Elevation of Base of Yorktown Confining Unit (ft msl)
Site 3 Landfill C						
SJS03-MW01S	Columbia - si f sd, yellowish brown to greyish brown with depth; interbedded cl si with organics, wood at about 7' color -greenish grey - thick layer 1.7' thick from 5.2 to 7' bgs,	8.61	-1.39	-1.99	NA	NA
SJS03-MW02S	Columbia - f si sd with 1.8' thick f to m sd layer, layers of si cl, organics-black, some shells, (greater si and cl??)	8.94	-1.06	-1.66	NA	NA
SJS03-MW03S	Columbia - cl si, si f sd, si cl (greater abundance of si and cl than in other locations) organic matter - black, layer of f to m sd with si at 10-12', greenish grey with olive brown bands	7.41	-2.59	-2.69	NA	NA
SJS03-MW04S	Columbia - cl si, interbedded f sd, shells, si f sd organics - black, si cl w/ f sd, soft, greenish grey, organic peat layer w/shells 6-8', organic roots and weeds at 12'	9.54	-0.46	-1.86	NA	NA
SJS03-MW05S	Columbia - dk grey di and cl soft, interbedded sand, at depth f sd grey turning to yellowish brown shell frags (native?)	6.55	-3.45	-4.45	NA	NA
SJS03-MW06S	Columbia - si and cl grey stiff, f sd with shells grey, (possibly all native with exception of to 2')	4.83	-5.17	-5.17	NA	NA
SJS03-MW01D	Columbia - see MW01S, vf sd, greenish grey (native); YCU - clay soft, greenish grey little sand/si, trace organics, few shells at 43', YF - f sd trace clay, trace shells, dk greenish grey, some organics, wood layer at 52',	-35.96	-45.96	-47.96	-7.96	-33.06
SJS03-MW02D	Columbia - see MW02S, vf sd, some si and cl, greyish brown, some med to crs sd, YCU - greenish grey clay, med stiff to soft, shell frags , tr vf sd, YF - vf to f sd shells, interbedded clay, mica organics, wood greyish brown, more sandy with depth	-36.59	-46.59	-49.59	-8.89	-36.09
Site 4 Landfill D						
SJS04-MW01S	Columbia Aquifer - si sd, brown, dk grey and black at 5' to 10', void noted at 3-5', soft sl and si dk grey then grading to cl sd with decreasing fines at depth, f to vf sd little si and cl	6.57	-3.43	-4.53	NA	NA
SJS04-MW02S	columbia - si cl , organics, dk greyish br to grey with white layers, interbedded thin f to m sd , base of hole - coarse sd with shells	5.86	-4.14	-4.64	NA	NA
SJS04-MW03S	Columbia - fill material to 7', no recovery (see MW01D), petroleum odor at about 3' OVM -2 ppm	0.79	-9.21	-9.81	NA	NA
SJS04-MW04S	Columbia- si f-m sd, trace c sd, wood, petroleum smell at 3-6', OVM - 5.2 ppm, yellowish brown, at depth si cl interbedded with f sd dk greenish grey	2.84	-7.16	-8.66	NA	NA
				0		

Table 4-1
Monitoring Well Construction Summary
St. Juliens Creek Annex
Chesapeake, Virginia

Monitoring Well	Description of Screened Lithology	Elevation of Top of Screen (ft msl)	Elevation of Bottom of Screen (ft msl)	Elevation of Base of Borehole	Elevation of Base of Columbia Aquifer (ft msl)	Elevation of Base of Yorktown Confining Unit (ft msl)
SJS04-MW01D	Columbia - see MWO1S, f sd coarsening downward to c sd, YCU - soft clay, pale olive to greenish grey, tr c sd, trace orgs, some c -med sd interbeds at 33-40', wood frag above YF, YF - sd w/trace gravel, dk bluish grey, sd cl some wood and organics, si cl from 55'-74', starts to become sandier at about 68' shell frags,	-31.2	-41.2	-80.3	-14.3	-38.8
SJS04-MW03D	Columbia - see MW01S, see log	-42.4	-52.4	-56.4	-28.7	-38.1
Site 5 Burning Grounds						
SJS05-MW01S	Columbia - sil cl and si f sd some organics, dk grey, f sd yellowish brown at 14'	2.95	-7.05	-7.55	NA	NA
SJS05-MW02S	Columbia - si sd, interbedded si cl, dk greenish grey, soft, si cl later 1.4', at 11.5' si f sd turns from dark grey to brownich grey	1.05	-8.95	-9.45	NA	NA
SJS05-MW03S	Columbia - top 3' fill, si f sd yellowish brown with grey bands, some small si cl interbeds,	1.49	-8.51	-9.31	NA	NA
SJS05-MW04S	Columbia - sd some clay, clay content decreases with depth, light yellowish brown turning to greenish grey with depth	5.45	-4.55	-5.55	NA	NA
SJS05-MW05S	Columbia - si and cl interbedded in vf sd yellowish brown, changing to grey at depth (11-12')	3.37	-6.63	-7.63	NA	NA
SJS05-MW01D	Columbia - see MW01S notes, vf to f sd, yellowish brown to grey, YCU - soft greenish grey clay, tr f sd, little organics, some shell frags, clay becoming stiffer at depth, YF - sd and cl, shell frags, dk greenish grey, tr m to c sd and gravel, trace organics, turning coarser so only tr of cl at depth	-38.89	-48.89	-51.89	-8.39	-36.89
SJS05-MW02D	Columbia -see MW02S, greyish brown sd, YCU - greenish grey clay, stiff, tr sd, tr orgs, 1.5' interbed of f sd with some clay lenses, underlain by cl with tr shells/orgs, YF -cl sd, shell frags, sd, si, grades into m to c sd with depth and limestone gravel at 56' with interbedded clayey gravel, still grey	-42.44	-52.44	-55.44	-15.44	-41.14
SJS05-MW04D	Columbia - see MW04S, sd, YCU - cl shells, greenish grey, soft, interbedded thin vf sd layers infrequent, orgs, shells, wood, and org increaseing with depth, YF - vf sd with some silt and some gravel, turns coarser with depth, dk greenish grey	-46.62	-56.62	-58.62	-6.62	-42.62

Table 4-1
Monitoring Well Construction Summary
St. Juliens Creek Annex
Chesapeake, Virginia

Monitoring Well	Description of Screened Lithology	Elevation of Top of Screen (ft msl)	Elevation of Bottom of Screen (ft msl)	Elevation of Base of Borehole	Elevation of Base of Columbia Aquifer (ft msl)	Elevation of Base of Yorktown Confining Unit (ft msl)
Background						
SJSBK-MW01S	Columbia - si and cl in upper 2', sd with tr cl, yellowish brown turning to grey at depth, interbedded clay lense, shells,	4.2	-5.8	-6.8	NA	NA
SJSBK-MW02S	Columbia - si and cl in upper 2', f to m sd with interbedded clay lense, shells	4.06	-5.94	-6.94	NA	NA
SJSBK-MW03S	Columbia- si in upper 1', f sd yellowish brown turns grey with depth, with thin clay lense, orgs.	6	-4	-5	NA	NA
SJSBK-MW04S	Columbia Aquifer - si and cl in first 2', f sd with cl and interbedded clay later, underlain by f sd some cl, shells, soft	3.85	-6.15	-7.15	NA	NA
				0		
SJSBK-MW01D	Columbia - see MW01S, f sd, YCU - cl greenish grey, few shell frags, some f sd, very soft. Little org, YF - m to c sd coarsening with depth, shells, tr org, little cl and si,	-37.05	-47.05	-46.8	-6.3	-35.3
SJSBK-MW02D	Columbia - see MW02S, sd, YCU - clay shell frags, little f sd, soft, orgs, YF - f to c sd and shells, pale yellow, coarsening with depth	-37.69	-47.69	-48.69	-6.69	-34.94
SJSBK-MW03D	Columbia - silt in top 1.5', f sd, org, turns grey, YCU - cl little sd, shells, dk blue-grey, then greenish grey, interbedded sd layer 20-20.25' and 21-24.27', then turning to cl with little sd, soft, YF-clay mixed with gravel and f-m sd, sil and f sd, shell grags	-26.24	-36.24	-37.24	-4.74	-26.24

NA = Not Available or Not
NR = Not Reported

Table 4-2
Groundwater Elevations Measured During the Sites 3, 4, 5, and 6 RIs
St. Juliens Creek Annex
Chesapeake, Virginia

Monitoring Well	Top of PVC Elevation (ft msl)	7/31/97		11/02/1997[1]		5/17/99		10/28/99		8/16/01	
		Depth to Water (ft)	Water Elevation (ft msl)	Depth to Water (ft)	Water Elevation (ft msl)	Depth to Water (ft)	Water Elevation (ft msl)	Depth to Water (ft)	Water Elevation (ft msl)	Depth to Water (ft)	Water Elevation (ft msl)
Site 2 Landfill B											
SJS02-MW01S	7.72	6.65	1.07	5.5	2.22	5.61	2.11	—	—	6.8	0.92
SJS02-MW02S	6.98	8.01	-1.03	7.16	-0.18	6.66	0.32	—	—	6.38	0.6
SJS02-MW03S	7.27	6.65	0.62	4.9	2.37	5.56	1.71	—	—	7.16	0.11
SJS02-MW04S	5.53	—	—	—	—	5.55	-0.02	—	—	7.14	-1.61
SJS02-MW05S	8.52	—	—	—	—	5.93	2.59	—	—	7.6	0.92
SJS02-MW01D	7.94	6.13	1.81			5.43	2.51	5.55	2.39	6.37	1.57
SJS02-MW02D	7.04	5.34	1.7			4.57	2.47	4.57	2.47	5.57	1.47
SJS02-MW05D	8.66	—	—	—	—	6.2	2.46	6.47	2.19	6.83	1.83
Site 3 Landfill C											
SJS03-MW01S	12.55	2.98	9.57	1.5	11.05	1.65	10.9	—	—	3.41	9.14
SJS03-MW02S	15.86	4.7	11.16	3.73	12.13	3.89	11.97	—	—	4.71	11.15
SJS03-MW03S	14.12	6.96	7.16	6	8.12	5.91	8.21	—	—	7.6	6.52
SJS03-MW04S	15.73	5.09	10.64	3.8	11.93	4.28	11.45	—	—	—	—
SJS03-MW05S	12.87	—	—	—	—	4.38	8.49	—	—	5.89	6.98
SJS03-MW06S	15.88	—	—	—	—	5.69	10.19	—	—	6.2	9.68
SJS03-MW01D	12.69	10.09	2.6	—	—	9.96	2.73	10.26	2.43	10.81	1.88
SJS03-MW02D	15.37	13.21	2.16	—	—	12.43	2.94	12.71	2.66	13.15	2.22
Site 4 Landfill D											
SJS04-MW01S	13.66	—	—	4.72	8.94	4.44	9.22	—	—	5.09	8.57
SJS04-MW02S	12.12	—	—	3.1	9.02	5.32	6.8	—	—	7.03	5.09
SJS04-MW03S	7.31	—	—	4.22	3.09	4.09	3.22	—	—	5.64	1.67
SJS04-MW04S	9.24	—	—	4.76	4.48	4.76	4.48	—	—	—	—
SJS04-MW01D	13.96	—	—	11.7	2.26	11.29	2.67	11.74	2.22	11.99	1.97
SJS04-MW03D	6.2	—	—	5.34	0.86	3.38	2.82	3.66	2.54	—	—
Site 5 Burning Grounds											
SJS05-MW01S	9.76	—	—	3.2	6.56	3.72	6.04	—	—	5.98	3.78
SJS05-MW02S	7.89	—	—	4	3.89	4.34	3.55	—	—	6.81	1.08
SJS05-MW03S	9.32	—	—	4.25	5.07	5.37	3.95	—	—	8.52	0.8
SJS05-MW04S	11.09	—	—	—	—	5.51	5.58	—	—	7.55	3.54
SJS05-MW05S	9.99	—	—	—	—	4.27	5.72	—	—	7.39	2.6
SJS05-MW01D	9.23	—	—	—	—	6.48	2.75	6.65	2.58	7.34	1.89
SJS05-MW02D	7.76	—	—	—	—	5.15	2.61	5.16	2.6	6.03	1.73
SJS05-MW04D	10.84	—	—	—	—	8.16	2.68	8.24	2.6	9	1.84
Background											
SJSBK-MW01S	9.52	—	—	—	—	3.61	5.91	—	—	6.31	3.21
SJSBK-MW02S	9.5	—	—	—	—	5.4	4.1	—	—	7.22	2.28
SJSBK-MW03S	11.56	—	—	—	—	6.18	5.38	—	—	8.17	3.39
SJSBK-MW04S	10.64	—	—	—	—	4.19	6.45	—	—	7.43	3.21
SJSBK-MW01D	9.72	—	—	—	—	6.82	2.9	6.99	2.73	7.78	1.94
SJSBK-MW02D	9.22	—	—	—	—	5.69	3.53	5.38	3.84	6.84	2.38
SJSBK-MW03D	11.07	—	—	—	—	7.46	3.61	7.18	3.89	8.69	2.38

— indicates depth to water not measured.

[1]Water levels in Site 4 wells were measured on 11/03/97

Table 4-3
Slug Test Results
St. Juliens Creek Annex
Chesapeake, Virginia

Test Site	Monitoring Well	Slug Test Type	Slug Test Analytical Method	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (feet/day)	Saturated Thickness (feet)	Transmissivity (cm^2/sec)	Transmissivity ($feet^2$/day)
Columbia Aquifer - Unconfined Aquifer								
Site 3 (Landfill C)	SJS03-MW01S	Rising Head	Bouwer-Rice	3.95E-03	11.2	20	2.41	223.5
	SJS03-MW03S	Falling Head	Bouwer-Rice	4.10E-03	11.6	18	2.25	209.0
	SJS03-MW03S	Rising Head	Bouwer-Rice	4.97E-03	14.1	18	2.73	253.2
	SJS03-MW05S	Falling Head	Bouwer-Rice	3.24E-03	9.2	15	1.48	137.6
	SJS03-MW05S	Rising Head	Bouwer-Rice	3.77E-03	10.7	15	1.72	160.2
	SJS03-MW06S	Falling Head	Bouwer-Rice	3.08E-03	8.7	18.5	1.74	161.3
	SJS03-MW06S	Rising Head	Bouwer-Rice	3.28E-03	9.3	18.5	1.85	171.6
Site 3 Average:				**3.77E-03**	**10.7**		**2.02**	**188.1**
Site 3 Standard Deviation:				**6.55E-04**	**1.9**		**0.44**	**41.3**
Site 4 (Landfill D)	SJS04-MW01S	Falling Head	Bouwer-Rice	2.43E-04	0.7	24	0.18	16.5
	SJS04-MW01S	Rising Head	Bouwer-Rice	9.89E-04	2.8	24	0.72	67.2
	SJS04-MW02S	Falling Head	Bouwer-Rice	2.79E-02	79.0	23	19.57	1817.9
	SJS04-MW02S	Rising Head	Bouwer-Rice	2.39E-02	67.6	23	16.73	1554.1
	SJS04-MW03S	Falling Head	Bouwer-Rice	1.33E-02	37.7	31	12.59	1169.4
	SJS04-MW03S	Rising Head	Bouwer-Rice	1.38E-02	39.1	31	13.05	1212.4
	SJS04-MW04S	Falling Head	Bouwer-Rice	6.93E-04	2.0	27	0.57	53.0
	SJS04-MW04S	Rising Head	Bouwer-Rice	6.40E-04	1.8	27	0.53	48.9
Site 4 Average:				**1.02E-02**	**28.8**		**7.99**	**742.4**
Site 4 Standard Deviation:				**1.13E-02**	**31.9**		**8.29**	**770.7**
Site 5 (Burning Ground	SJS05-MW01S	Falling Head	Bouwer-Rice	2.02E-03	5.7	14	0.86	79.9
	SJS05-MW01S	Rising Head	Bouwer-Rice	2.30E-03	6.5	14	0.98	91.1
	SJS05-MW02S	Falling Head	Bouwer-Rice	5.34E-03	15.1	18	2.93	272.3
	SJS05-MW02S	Rising Head	Bouwer-Rice	2.88E-03	8.1	18	1.58	146.6
	SJS05-MW04S	Falling Head	Bouwer-Rice	2.95E-03	8.3	13	1.17	108.5
	SJS05-MW04S	Rising Head	Bouwer-Rice	2.70E-03	7.6	13	1.07	99.4
	SJS05-MW05S	Falling Head	Bouwer-Rice	4.39E-03	12.4	16	2.14	198.7
	SJS05-MW05S	Rising Head	Bouwer-Rice	2.03E-03	5.8	16	0.99	92.1
Site 5 Average:				**3.07E-03**	**8.7**		**1.46**	**136.1**
Site 5 Standard Deviation:				**1.19E-03**	**3.4**		**0.73**	**67.4**
Columbia Aquifer Average:				**5.76E-03**	**16.3**		**3.90**	**362.8**
Columbia Aquifer Standard Deviation:				**7.21E-03**	**20.4**		**5.61**	**521.3**
Yorktown Confining Unit								
Site 4 (Landfill D)	SJS04-MW01D	Falling Head	Bouwer-Rice	1.21E-03	3.4	41.5	1.53	141.9
	SJS04-MW01D	Rising Head	Bouwer-Rice	1.23E-03	3.5	41.5	1.55	144.2
Yorktown Confining Unit Average:				**1.22E-03**	**3.45E+00**		**1.54E+00**	**1.43E+02**
Yorktown Confining Unit Standard Deviation:				**1.41E-05**	**4.01E-02**		**1.79E-02**	**1.66E+00**
Yorktown Aquifer - Confined Aquifer								
Site 3 (Landfill C)	SJS03-MW01D	Falling Head	Bouwer-Rice	4.98E-03	14.1	14.9	2.26	209.9
	SJS03-MW01D	Rising Head	Bouwer-Rice	4.84E-03	13.7	14.9	2.20	204.2
	SJS03-MW02D	Falling Head	Cooper, et. al.	1.37E-03	3.9	13.5	0.56	52.4
	SJS03-MW02D	Rising Head	Cooper, et. al.	1.45E-03	4.1	13.5	0.60	55.3
Site 3 Average:				**3.16E-03**	**8.9**		**1.40**	**130.5**
Site 3 Standard Deviation:				**2.02E-03**	**5.7**		**0.95**	**88.5**
Site 4 (Landfill D)	SJS04-MW03D	Falling Head	Cooper, et. al.	3.86E-04	1.1	15	0.18	16.4
	SJS04-MW03D	Rising Head	Cooper, et. al.	7.77E-04	2.2	15	0.36	33.0
Site 4 Average:				**5.81E-04**	**1.6**		**0.27**	**24.7**
Site 4 Standard Deviation:				**2.77E-04**	**0.8**		**0.13**	**11.7**

Table 4-3
Slug Test Results
St. Juliens Creek Annex
Chesapeake, Virginia

Test Site	Monitoring Well	Slug Test Type	Slug Test Analytical Method	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (feet/day)	Saturated Thickness (feet)	Transmissivity (cm^2/sec)	Transmissivity ($feet^2$/day)
Site 5 (Burning Ground	SJS05-MW01D	Falling Head	Cooper, et. al.	2.10E-02	59.6	10	6.42	596.1
	SJS05-MW01D	Rising Head	Cooper, et. al.	1.75E-02	49.7	10	5.35	496.9
	SJS05-MW02D	Falling Head	Bouwer-Rice	9.09E-03	25.7	14	3.88	360.3
	SJS05-MW02D	Rising Head	Bouwer-Rice	1.05E-02	29.7	14	4.48	415.9
	SJS05-MW04D	Falling Head	Bouwer-Rice	1.13E-02	32.0	15	5.17	480.4
	SJS05-MW04D	Rising Head	Bouwer-Rice	3.70E-02	104.9	15	16.93	1573.0
Site 5 Average:				**1.78E-02**	**50.3**		**7.04**	**653.8**
Site 5 Standard Deviation:				**1.05E-02**	**29.8**		**4.92**	**457.3**
Yorktown Aquifer Average:				**1.00E-02**	**28.4**		**4.03**	**374.50**
Yorktown Aquifer Standard Deviation:				**1.08E-02**	**30.7**		**4.6**	**428.6**

Table 4-4
Vertical Gradients Measured At Sites 3, 4, and 5 and in Background Wells
St. Juliens Creek Annex
Chesapeake, Virginia

Monitoring Well	Screened Aquifer	Elevation Bottom of Screen (ft msl)	Vertical Distance Between Well Screens (ft)	05/17/1999 Water Elevation (ft msl)	05/17/1999 Vertical Gradient	08/16/2001 Water Elevation (ft msl)	08/16/2001 Vertical Gradient	Average Vertical Gradient	Direction of Vertical Groundwater Flow
Site 3 Landfill C									
SJS03-MW01S	Columbia Aquifer	-1.39	44.57	10.9	-0.18	9.14	-0.16	-0.17	Downward
SJS03-MW01D	Yorktown Aquifer	-45.96		2.73		1.88			
Site 4 Landfill D									
SJS04-MW01S	Columbia Aquifer	-3.43	37.77	9.22	-0.17	8.57	-0.17	-0.17	Downward
SJS04-MW01D	Yorktown Confining Unit	-41.2		2.67		1.97			
SJS04-MW03S	Columbia Aquifer	-9.21	43.19	3.22	-0.01	1.67	----	-0.01	Downward
SJS04-MW03D	Yorktown Aquifer	-52.4		2.82		-----			
Site 5 Burning Grounds									
SJS05-MW01S	Columbia Aquifer	-7.05	41.84	6.04	-0.08	3.78	-0.05	-0.06	Downward
SJS05-MW01D	Yorktown Aquifer	-48.89		2.75		1.89			
SJS05-MW02S	Columbia Aquifer	-8.95	43.49	3.55	-0.02	1.08	0.01	0.00	No Direction Determined
SJS05-MW02D	Yorktown Aquifer	-52.44		2.61		1.73			
SJS05-MW04S	Columbia Aquifer	-4.55	52.07	5.58	-0.06	3.54	-0.03	-0.04	Downward
SJS05-MW04D	Yorktown Aquifer	-56.62		2.68		1.84			
Background									
SJSBK-MW01S	Columbia Aquifer	-5.8	41.25	5.91	-0.07	3.21	-0.03	-0.05	Downward
SJSBK-MW01D	Yorktown Aquifer	-47.05		2.9		1.94			
SJSBK-MW02S	Columbia Aquifer	-5.94	41.75	4.1	-0.01	2.28	0.00	-0.01	Downward
SJSBK-MW02D	Yorktown Aquifer	-47.69		3.53		2.38			
SJSBK-MW03S	Columbia Aquifer	-4	32.24	5.38	-0.05	3.39	-0.03	-0.04	Downward
SJSBK-MW03D	Yorktown Aquifer	-36.24		3.61		2.38			

----- indicates depth to water not measured.
Monitoring well pair SJS03-MW02S and SJS03-MW02D were not included in the vertical gradient evaluation because water levels observed in SJS03-MW02S represent perched groundwater conditions.
Monitoring well pair SJS04-MW01S and SJS04-MW01D were not included in the vertical gradient evaluation because water levels observed in SJS04-MW01D represent Yorktown Confining Unit conditions

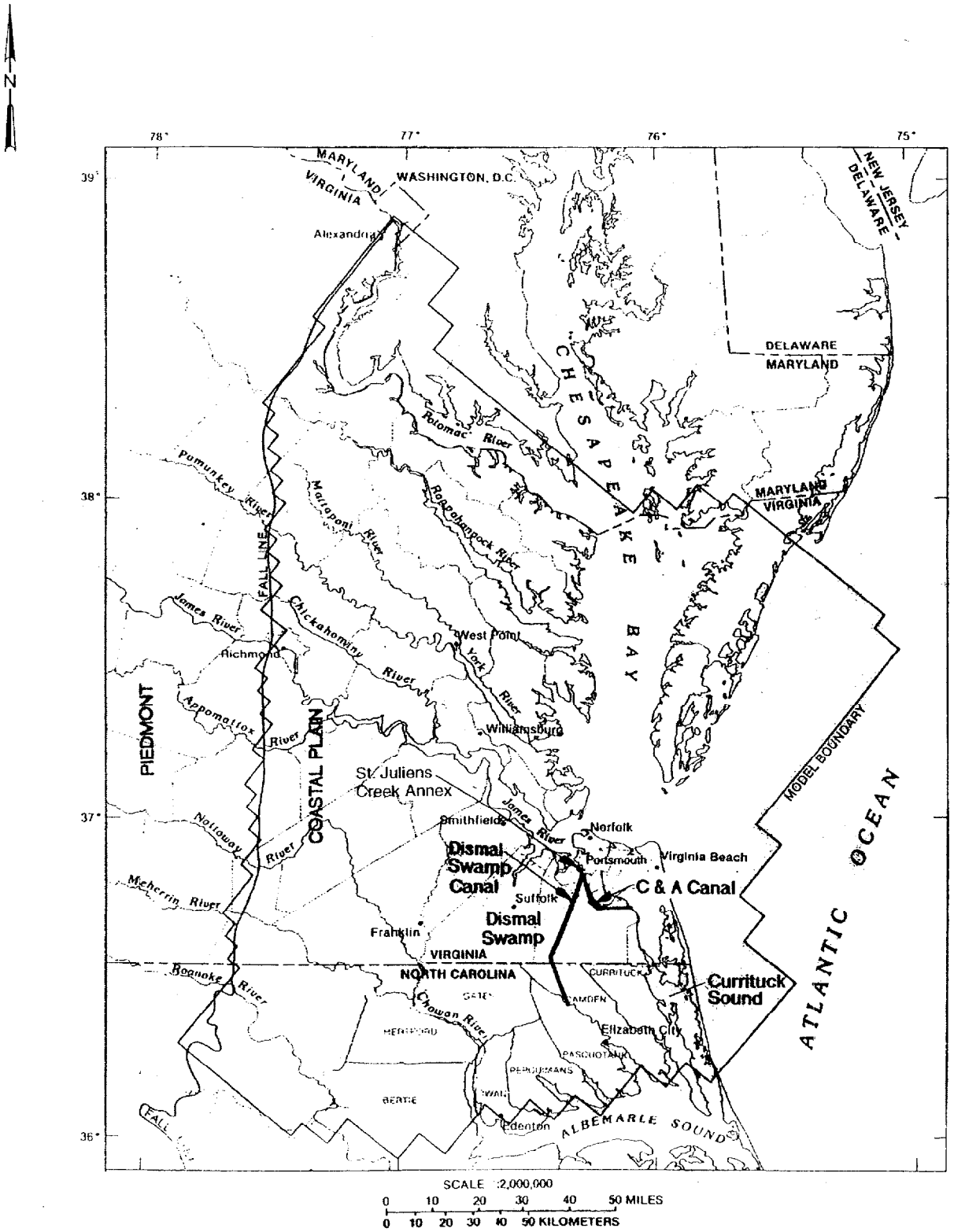


FIGURE 4-1
PHYSIOGRAPHIC PROVINCES
OF SOUTHERN VIRGINIA
ST. JULIENS CREEK ANNEX
CHESAPEAKE, VIRGINIA

SOURCES:

BASE FROM U.S. GEOLOGICAL SURVEY
STATE BASE MAPS 1:1,000,000 AND USGS
SURVEY PROFESSIONAL PAPER 1404-F

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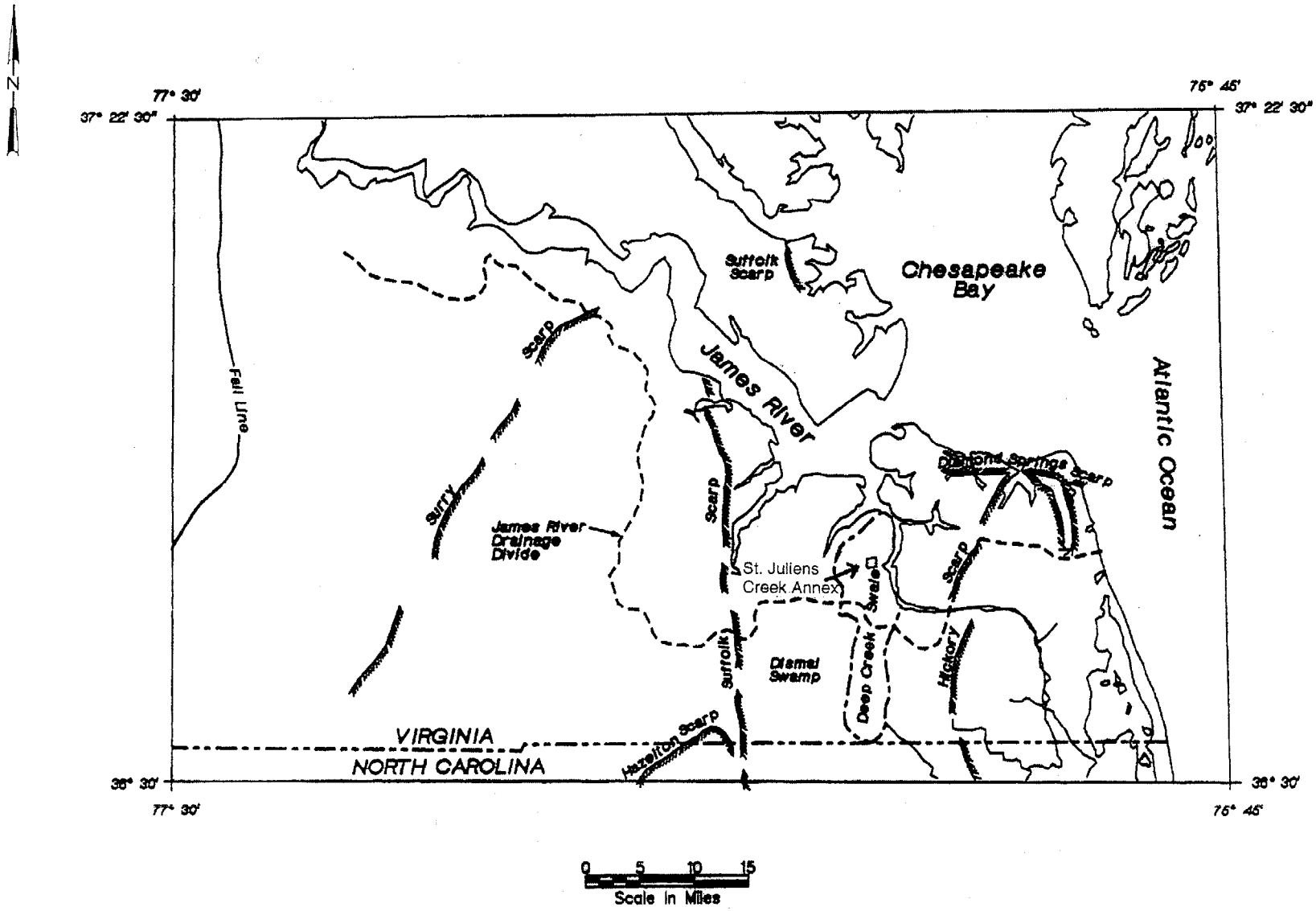

FIGURE 4-2
CHESAPEAKE REGION PHYSIOGRAPHY
AND HYDROLOGY FEATURES
ST. JULIENS CREEK ANNEX
CHESAPEAKE, VIRGINIA

SOURCE:

FIGURE 6" OF POST-MIOCENE STRATIGRAPHIC AND MORPHOLOGY, SOUTHERN VIRGINIA, BULLETIN 82, DATED 1973.

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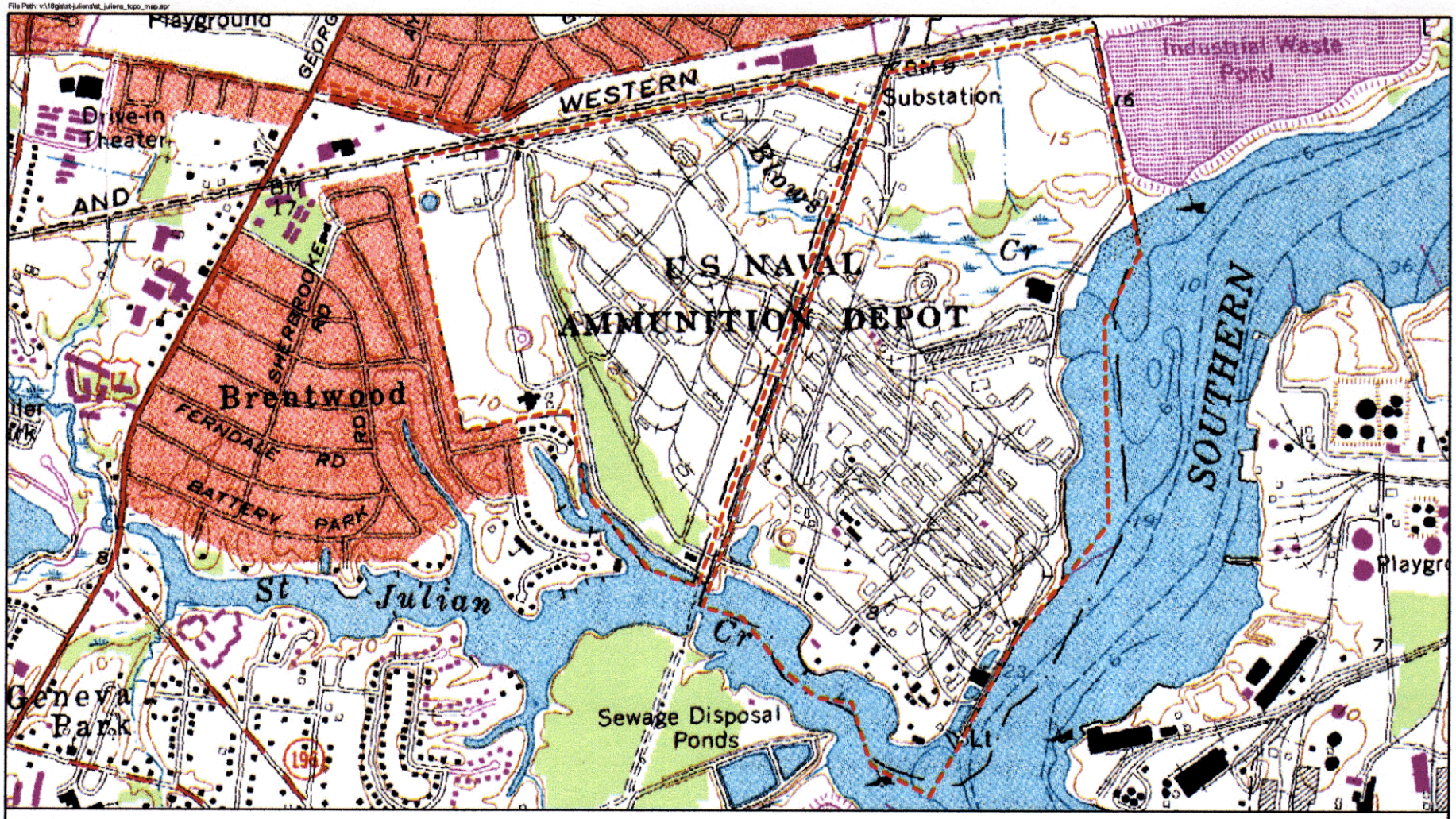

LEGEND

- St. Juliens Creek Annex Boundary
- Contours (5 foot intervals)

N

500 0 500 1000 Feet

Source: USGS 7.5 minute Norfolk South, VA quadrangle map.

Figure 4-3
Topographic Features of St. Juliens Creek Annex
St. Juliens Creek Annex
Chesapeake, Virginia

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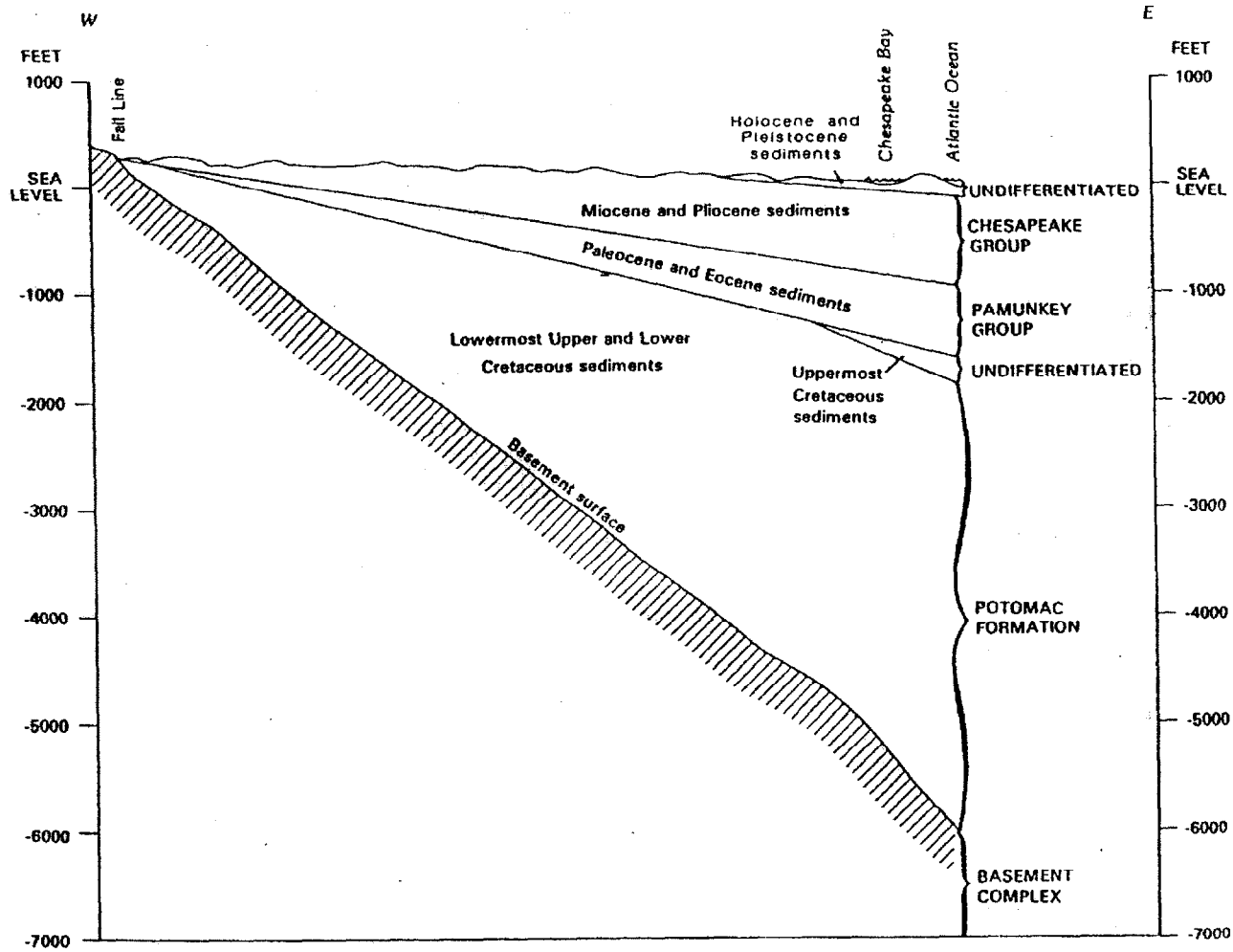

FIGURE 4-4
GENERALIZED GEOLOGIC SECTION
SHOWING EASTWARD-THICKENING SEDIMENTARY WEDGE
OF VIRGINIA COSTAL PLAIN

ST. JULIENS CREEK ANNEX
CHESAPEAKE, VIRGINIA

SOURCE:

FIGURE 5 OF REGIONAL AQUIFER-SYSTEM ANAYLSIS
USGS SURVEY PROFESSIONAL PAPER 1404-C.

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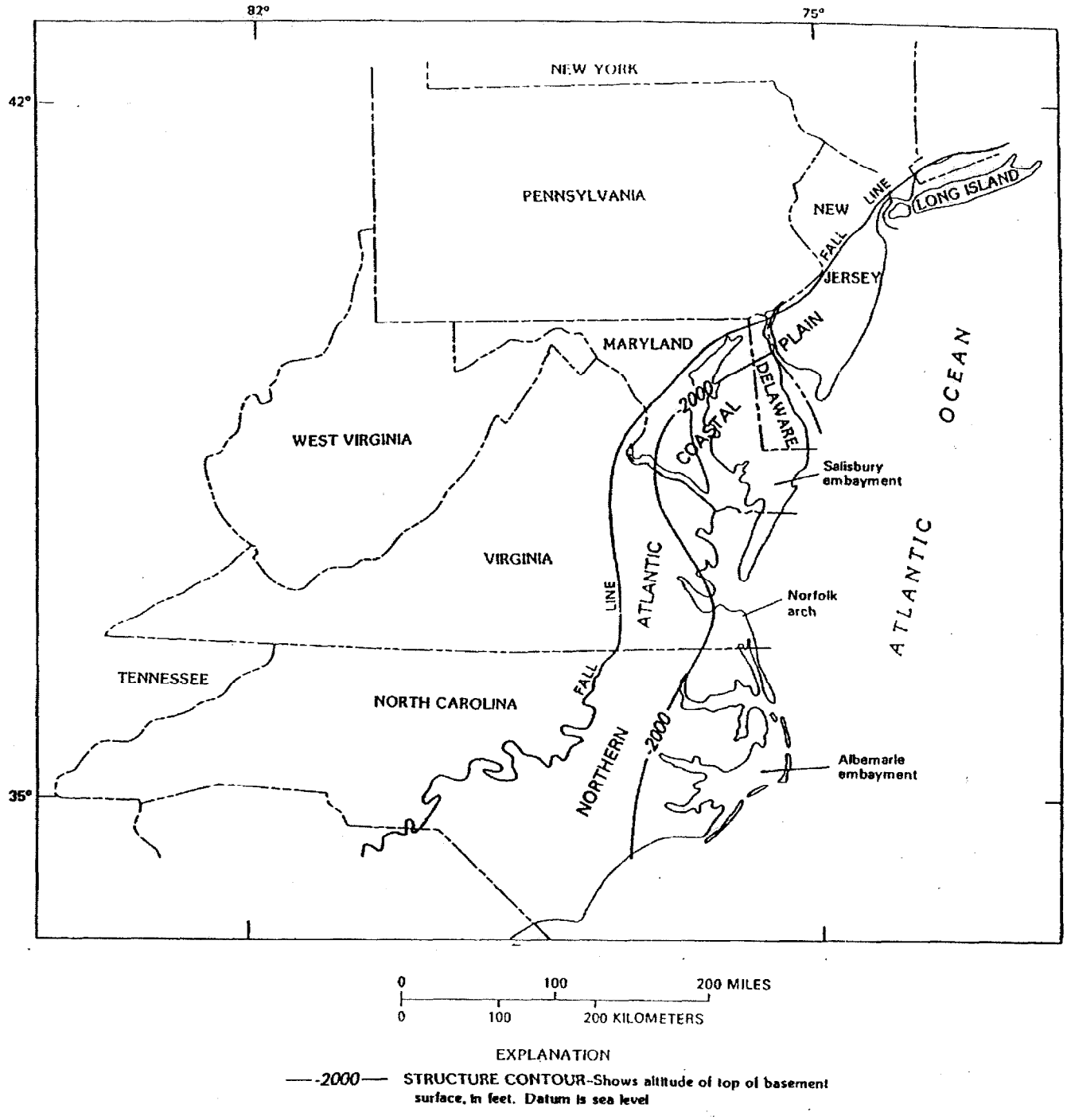

EXPLANATION

—-2000— STRUCTURE CONTOUR-Shows altitude of top of basement surface, in feet. Datum is sea level

FIGURE 4-5
MAJOR STRUCTURAL BASEMENT-DEFORMATION FEATURES OF THE VIRGINIA COSTAL PLAIN AND ADJOINING AREAS

ST. JULIENS CREEK ANNEX
CHESAPEAKE, VIRGINIA

SOURCE:

FIGURE 6" OF REGIONAL AQUIFER-SYSTEM ANALYSIS
USGS SURVEY PROFESSIONAL PAPER 1404-C

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SYSTEM	SERIES		Geological units this report	Hydrogeologic units: Meng and Harsh (1988)	Virginia RASA model unit	Laczniak and Meng (1988)	Brockman and others (1997): Lackey Plain	Brockman and others (1997): Croaker Flat
QUATERNARY	Holocene		Alluvium, swamp, + beach	Columbia aquifer	AQ10	Columbia aquifer	Columbia aquifer	Columbia aquifer
	Pleistocene	U	Tabb Formation					
		M	Shirley Formation					
			Chuckatuck Formation					
		L	Charles City Formation				Columbia aquifer	Yorktown confining unit[2]
			Windsor Formation					
TERTIARY	Pliocene	U	Bacons Castle Formation	Yorktown confining unit	CU9	Yorktown confining unit	Cornwallis Cave confining unit	
			CHESAPEAKE GROUP – Yorktown Formation: Moore House Member	Yorktown-Eastover aquifer	AQ9		Cornwallis Cave aquifer	
			Mogarts Beach Member				Yorktown confining unit	
			Rushmere Member					
		L	Sunken Meadow Member			Yorktown-Eastover aquifer		Yorktown confining unit
	Miocene	U	Unnamed beds[1] ?				Yorktown-Eastover aquifer	
			Eastover Formation: Cobham Bay Member					
			Claremont Manor Member	St. Marys confining unit	CU8	St. Marys confining unit	Eastover-Calvert confining unit	
			St. Marys Formation					
		M	Calvert Formation: Choptank Formation (not present in study area)	St. Marys-Choptank aquifer	AQ8	Calvert confining unit		
			Calvert Beach Member	Calvert confining unit	CU7			
			Plum Point Member					
			Fairhaven Member					
		L	Newport News unit	Chickahominy-Piney Point aquifer	AQ7	Chickahominy-Piney Point aquifer	Not covered in report	
	Oligocene	U	Old Church Formation					

[1]Unpublished data D.S. Powars and T. Cronin (1995).
[2]Yorktown-Eastover aquifer.

NOTE:

TABLE COPIED FROM THE EFFECTS OF THE CHESAPEAKE BAY IMPACT CRATER ON THE GEOLOGICAL FRAMEWORK AND CORRELATION OF THE HYDROGEOLOGIC UNIT OF THE LOWER YORK-JAMES PENINSULA, VIRGINIA, BY: DAVID S. POWARS AND T. SCOTT BRUCE, U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1612.

FIGURE 4-6
SIGNIFICANT STRATIGRAPHIC NOMENCLATURE IN RELATION TO HYDROGEOLOGIC FRAMEWORK
ST. JULIENS CREEK ANNEX
CHESAPEAKE, VIRGINIA

CH2MHILL

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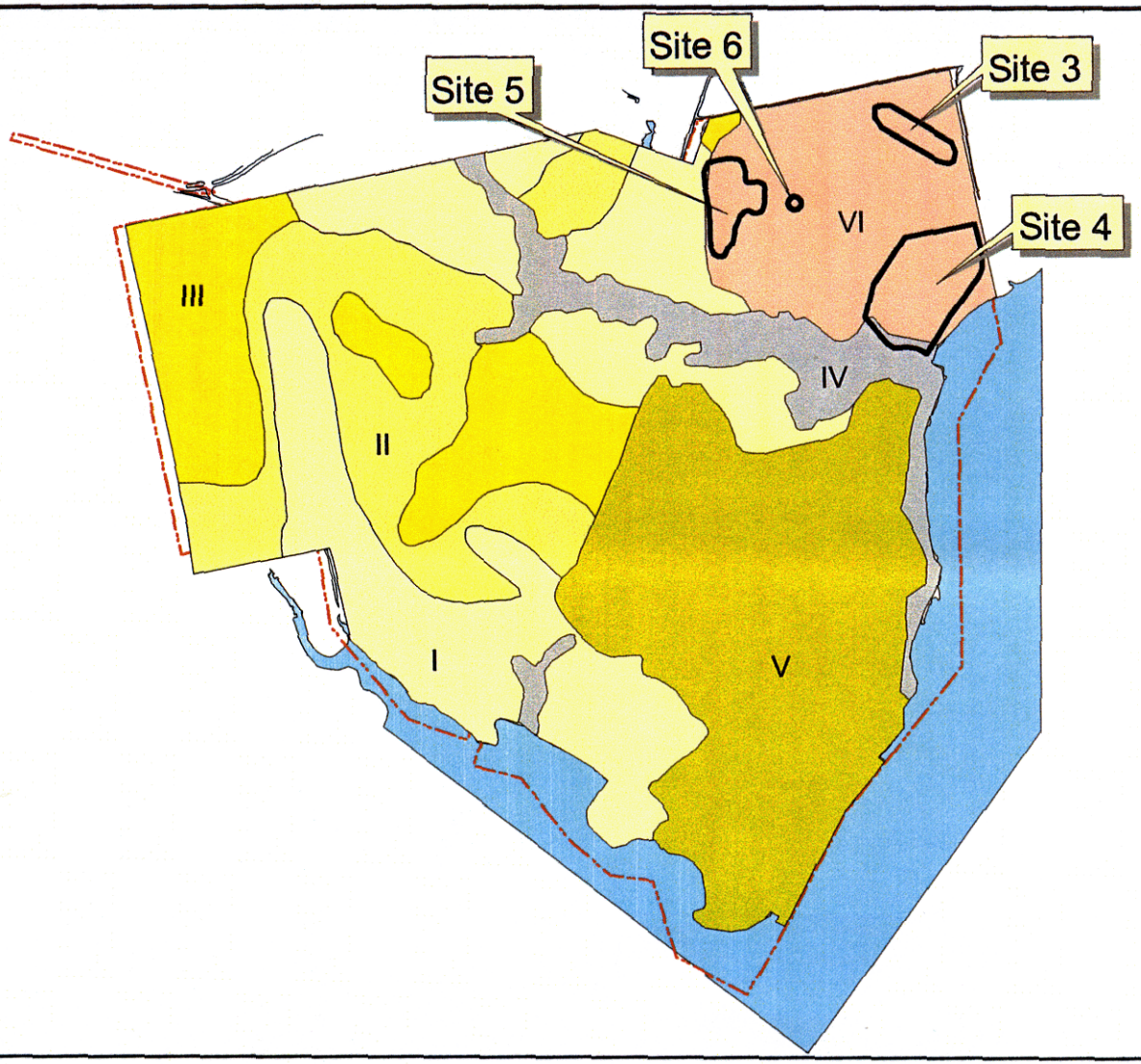

LEGEND

- I - Munden Teotum Soil Group
- II - Dragston - Augusta Soil Group
- III - Nimmo Soil Group
- IV - Bohicket Soil Group
- V - Urban - Udorthents Soil Group
- VI - Dredge Fill

Site Boundary

N

0 500 1000 Feet

Figure 4-7
Surface Soil Types
St. Juliens Creek Annex

CH2MHILL

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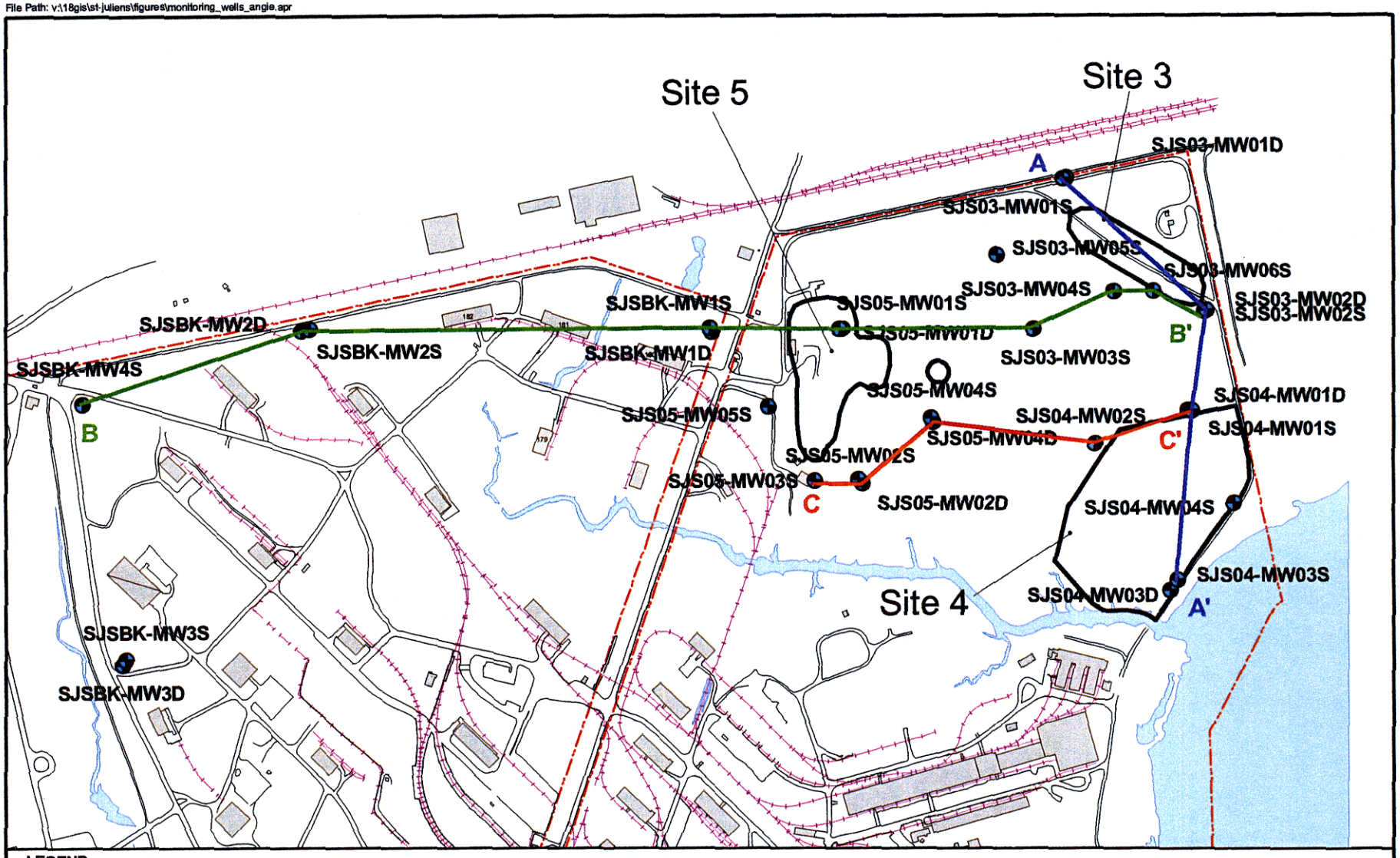


LEGEND

- Monitoring Wells
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- *Water Bodies*

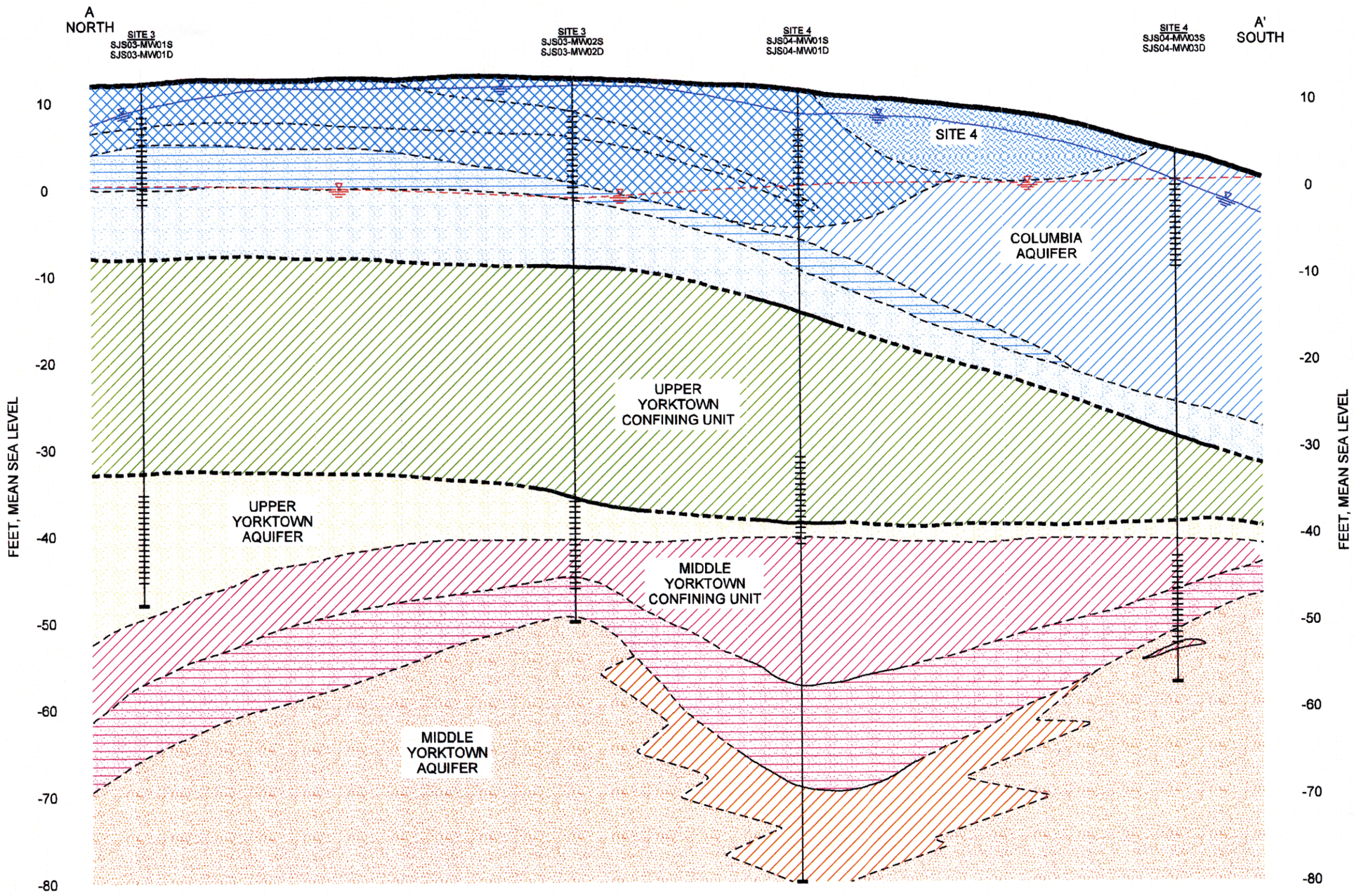
A - A' Locations of Geologic Cross Sections

N

0 400 800 Feet

Figure 4-8
Locations of Geologic
Cross Sections
St. Julien's Creek Naval Depot

CH2MHILL



LITHOLOGY

- DREDGE FILL
- SITE 4
- CLAY/SILT/SILTY CLAY/CLAYEY SILT
- SILTY/CLAYEY SAND
- SAND

STRATIGRAPHY

- GROUND SURFACE
- CONTACT BETWEEN HYDROGEOLOGIC UNITS (COLUMBIA AQUIFER, YORKTOWN CONFINING UNIT, YORKTOWN AQUIFER)
- INFERRED CONTACT BETWEEN HYDROGEOLOGIC UNITS (COLUMBIA AQUIFER, YORKTOWN CONFINING UNIT, YORKTOWN AQUIFER)
- CONTACT BETWEEN LITHOLOGIC UNITS
- INFERRED CONTACT BETWEEN LITHOLOGIC UNITS

LEGEND

- SCREENED GROUNDWATER MONITORING WELL
- COLUMBIA AQUIFER WATER TABLE SURFACE: AUGUST 16, 2001
- YORKTOWN AQUIFER WATER TABLE SURFACE: AUGUST 16, 2001
- END OF BORING
- COLUMBIA AQUIFER
- UPPER YORKTOWN CONFINING UNIT
- UPPER YORKTOWN AQUIFER
- MIDDLE YORKTOWN CONFINING UNIT
- MIDDLE YORKTOWN AQUIFER

VERTICAL SCALE: 0, 10

HORIZONTAL SCALE: 0, 80, 160

SCALE IN FEET

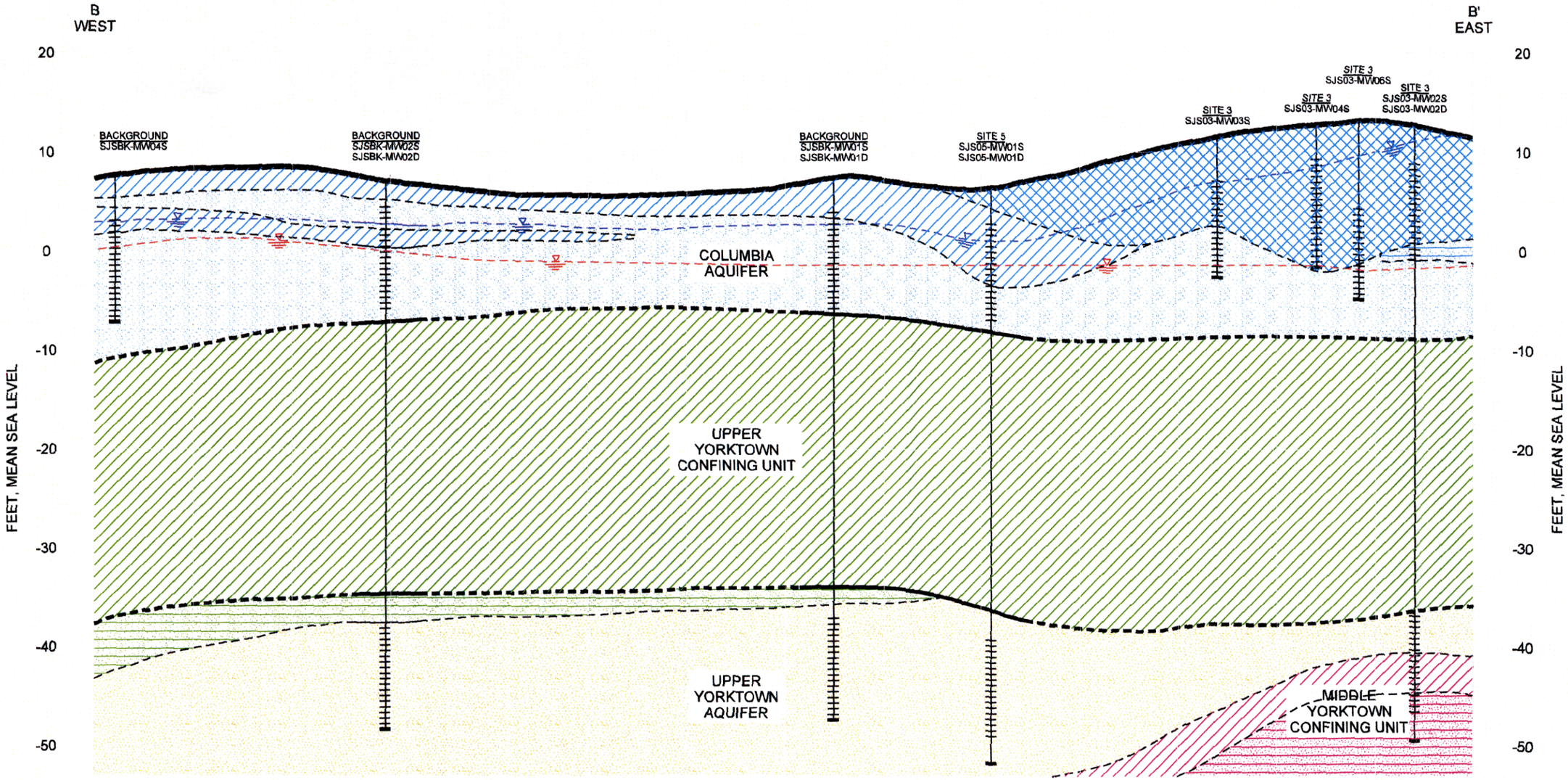
NOTE:

THIS CROSS-SECTION IS INTERPRETIVE AND WAS PREPARED BY INTERPOLATION BETWEEN BORING LOCATIONS. ACTUAL CONDITIONS BETWEEN BORINGS MAY DIFFER FROM THOSE SHOWN HERE. SOIL DESCRIPTIONS FOR THE FOUR GEOLOGIC UNITS (FILL, CLAY/SILT/SILTY CLAY/CLAYEY SILT, SILTY/CLAYEY SAND, AND SAND) ARE GENERALIZED.

FIGURE 4-9
GEOLOGIC CROSS-SECTION A-A'
ST. JULIENS CREEK ANNEX
CHESAPEAKE, VIRGINIA

CH2MHILL

8802f001.dlv



LITHOLOGY

- DREDGE FILL
- CLAY/SILT/SILTY CLAY/CLAYEY SILT
- SILTY/CLAYEY SAND
- SAND

STRATIGRAPHY

- GROUND SURFACE
- CONTACT BETWEEN HYDROGEOLOGIC UNITS (COLUMBIA AQUIFER, YORKTOWN CONFINING UNIT, YORKTOWN AQUIFER)
- INFERRED CONTACT BETWEEN HYDROGEOLOGIC UNITS (COLUMBIA AQUIFER, YORKTOWN CONFINING UNIT, YORKTOWN AQUIFER)
- CONTACT BETWEEN LITHOLOGIC UNITS
- INFERRED CONTACT BETWEEN LITHOLOGIC UNITS
- ? INFERRED BOUNDARY

LEGEND

- SCREENED GROUNDWATER MONITORING WELL
- COLUMBIA AQUIFER WATER TABLE SURFACE: AUGUST 16, 2001
- YORKTOWN AQUIFER WATER TABLE SURFACE: AUGUST 16, 2001
- END OF BORING
- COLUMBIA AQUIFER
- UPPER YORKTOWN CONFINING UNIT
- UPPER YORKTOWN AQUIFER
- MIDDLE YORKTOWN CONFINING UNIT

VERTICAL SCALE 10 0

80 350

HORIZONTAL SCALE
SCALE IN FEET

NOTE:

THIS CROSS-SECTION IS INTERPRETIVE AND WAS PREPARED BY INTERPOLATION BETWEEN BORING LOCATIONS. ACTUAL CONDITIONS BETWEEN BORINGS MAY DIFFER FROM THOSE SHOWN HERE. SOIL DESCRIPTIONS FOR THE FOUR GEOLOGIC UNITS (FILL, CLAY/SILT/SILTY CLAY/CLAYEY SILT, SILTY/CLAYEY SAND, AND SAND) ARE GENERALIZED.

FIGURE 4-10
GEOLOGIC CROSS-SECTION B-B'
ST. JULIENS CREEK ANNEX
CHESAPEAKE, VIRGINIA

CH2MHILL

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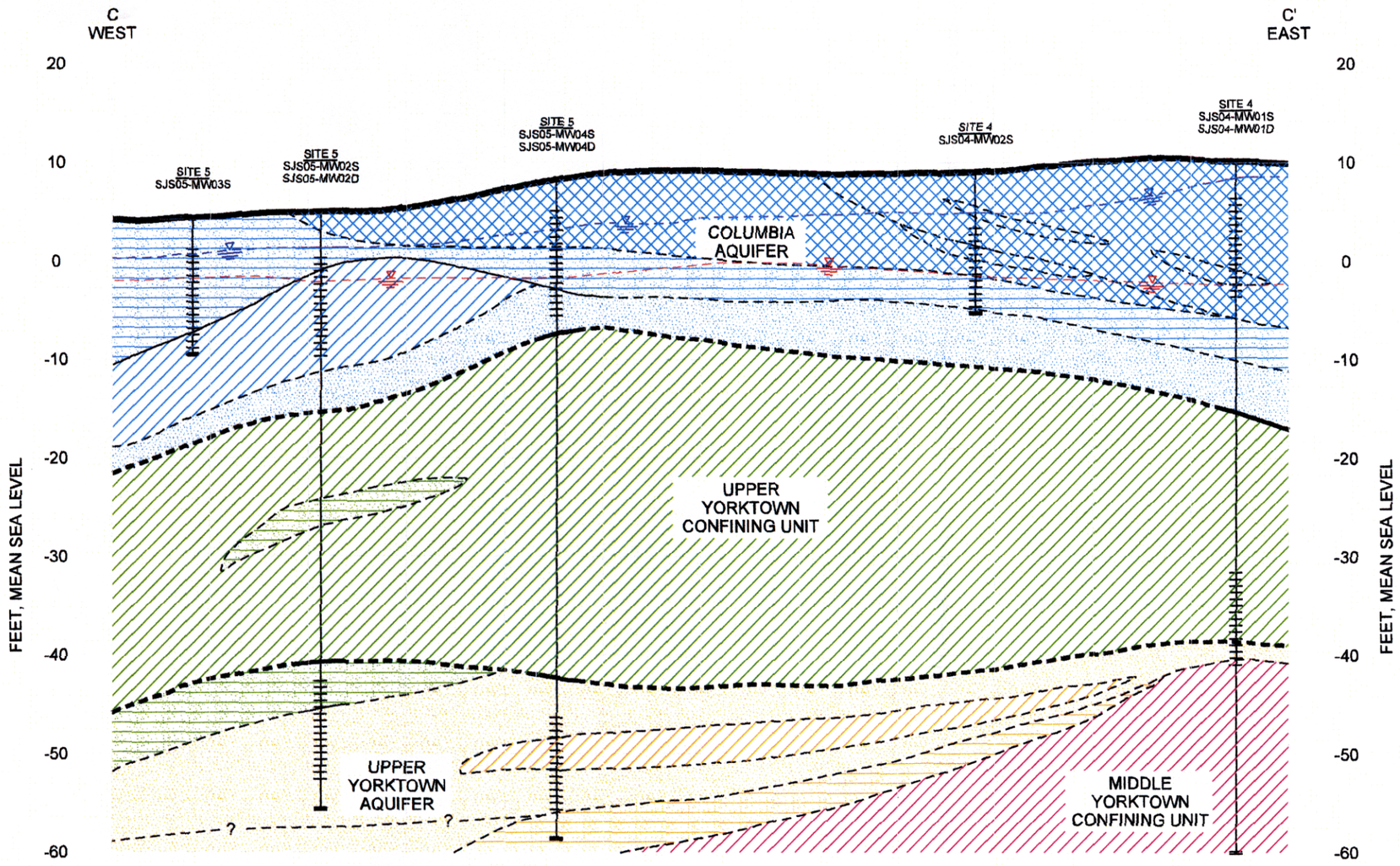

LITHOLOGY

- DREDGE FILL
- CLAY/SILT/SILTY CLAY/CLAYEY SILT
- SILTY/CLAYEY SAND
- SAND

STRATIGRAPHY

- GROUND SURFACE
- CONTACT BETWEEN HYDROGEOLOGIC UNITS (COLUMBIA AQUIFER, YORKTOWN CONFINING UNIT, YORKTOWN AQUIFER)
- INFERRED CONTACT BETWEEN HYDROGEOLOGIC UNITS (COLUMBIA AQUIFER, YORKTOWN CONFINING UNIT, YORKTOWN AQUIFER)
- CONTACT BETWEEN LITHOLOGIC UNITS
- INFERRED CONTACT BETWEEN LITHOLOGIC UNITS

LEGEND

- SCREENED GROUNDWATER MONITORING WELL
- COLUMBIA AQUIFER WATER TABLE SURFACE: AUGUST 16, 2001
- YORKTOWN AQUIFER WATER TABLE SURFACE: AUGUST 16, 2001
- END OF BORING
- COLUMBIA AQUIFER
- UPPER YORKTOWN CONFINING UNIT
- UPPER YORKTOWN AQUIFER
- MIDDLE YORKTOWN CONFINING UNIT
- MIDDLE YORKTOWN AQUIFER

VERTICAL SCALE
10
0

75 150
HORIZONTAL SCALE
SCALE IN FEET

NOTE:

THIS CROSS-SECTION IS INTERPRETIVE AND WAS PREPARED BY INTERPOLATION BETWEEN BORING LOCATIONS. ACTUAL CONDITIONS BETWEEN BORINGS MAY DIFFER FROM THOSE SHOWN HERE. SOIL DESCRIPTIONS FOR THE FOUR GEOLOGIC UNITS (FILL, CLAY/SILT/SILTY CLAY/CLAYEY SILT, SILTY/CLAYEY SAND, AND SAND) ARE GENERALIZED.

FIGURE 4-11
GEOLOGIC CROSS-SECTION C-C'
ST. JULIENS CREEK ANNEX
CHESAPEAKE, VIRGINIA

CH2MHILL

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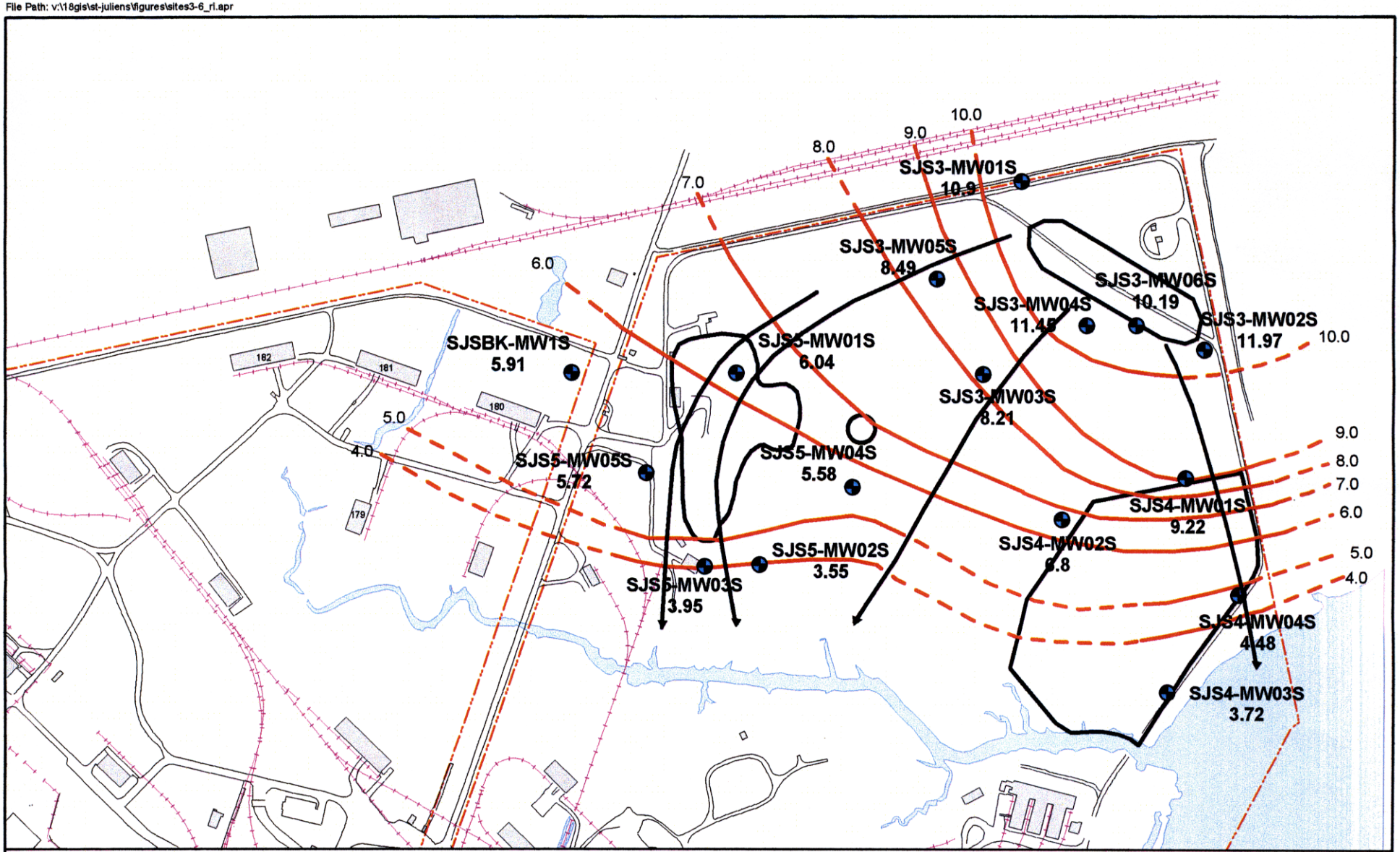

LEGEND

- 2001 Deep Well Contours
- Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies
- Groundwater Flow Direction

N

0 300 600 Feet

Figure 4-12
Columbia Aquifer Potentiometric Surface
and Groundwater Flow Map (May 17,1999)
St. Juliens Creek Naval Depot
Chesapeake, Virginia

CH2MHILL

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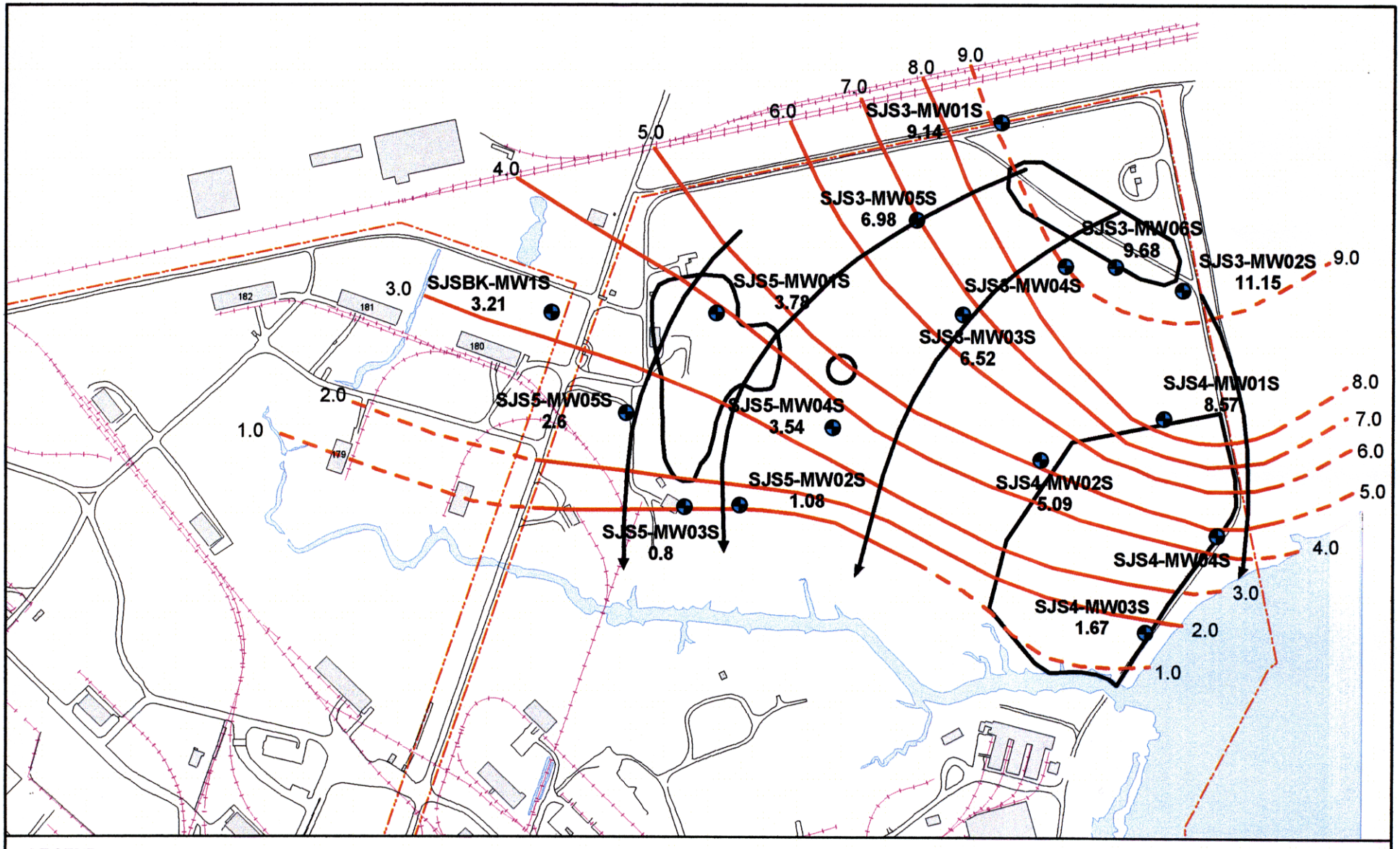

LEGEND

- 2001 Deep Well Contours
- Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies
- Groundwater Flow Direction

N

0 300 600 Feet

Figure 4-13
Columbia Aquifer Potentiometric Surface
and Groundwater Flow Map (August 16,2001)
St. Juliens Creek Naval Depot
Chesapeake, Virginia

CH2MHILL

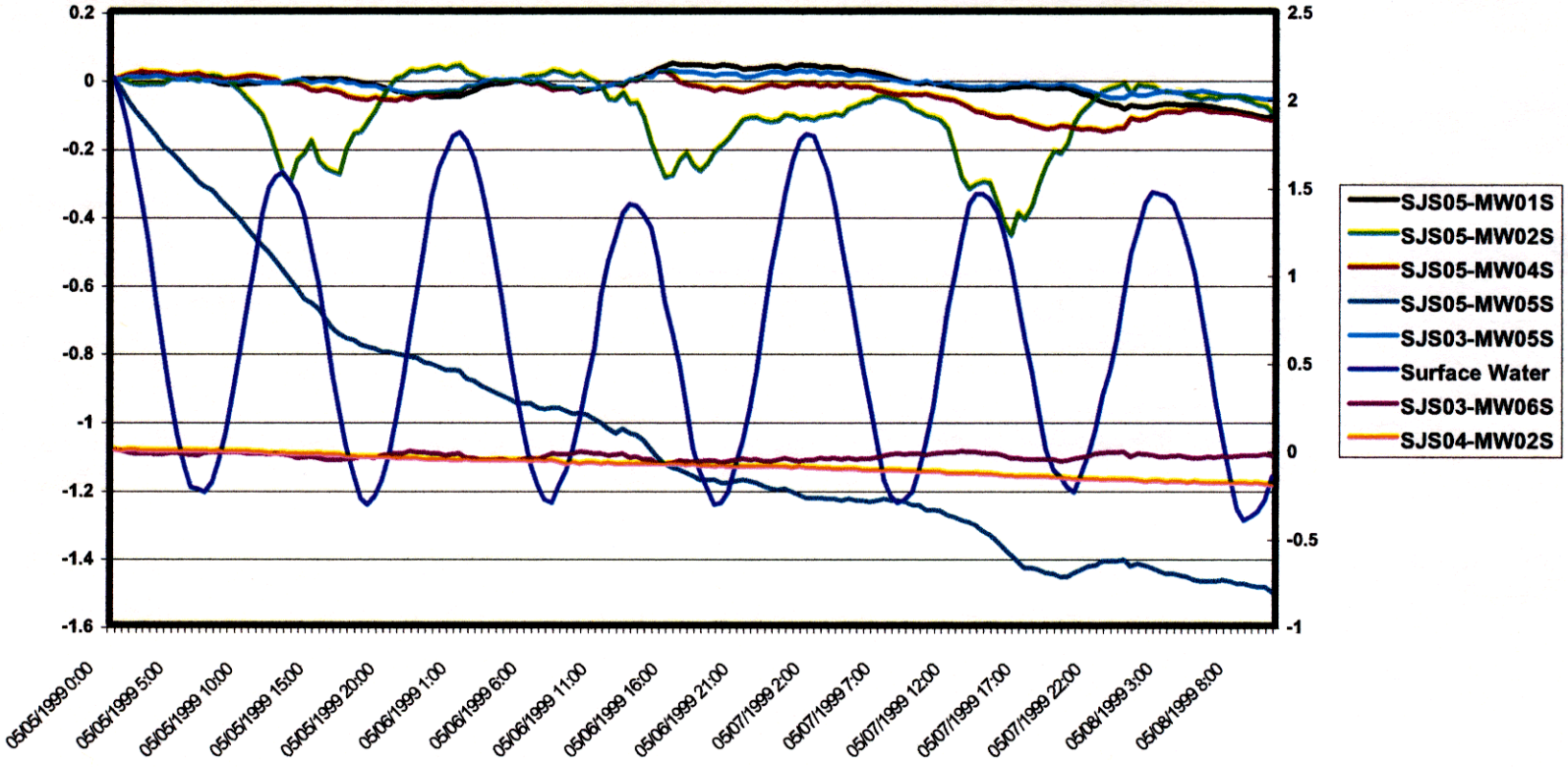

Figure 4-14
Tidal Survey Results (May 5 through May 8, 1999)
St. Juliens Creek Annex
Chesapeake, Virginia

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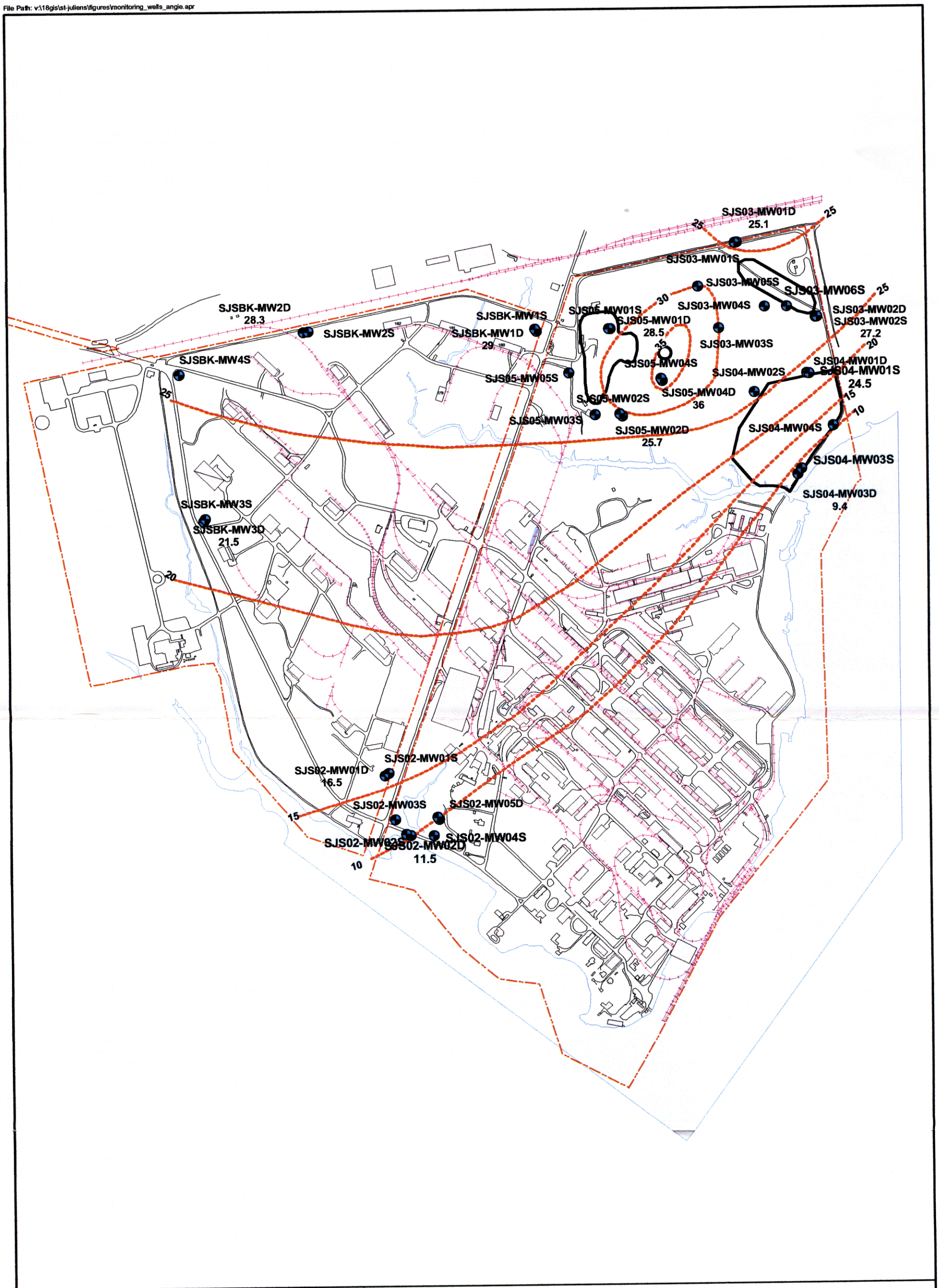

LEGEND

- Monitoring Wells
- IR Sites
- Buildings
- Roads
- Railroads
- Activity Boundary
- Water Bodies
- Lines of Equal Yorktown Confining Unit Thickness
- Inferred Lines of Equal Yorktown Confining Unit Thickness

N

0 500 1000 Feet

Figure 4-15
Thickness of Yorktown Confining Unit
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

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LEGEND

- 1999 Deep Well Contours
- Sites
- Buildings
- Roads
- Groundwater Flow Direction
- Activity Boundary
- Water Bodies

N

0 800 1600 Feet

Figure 4-16
Yorktown Aquifer Potentiometric Surface and Groundwater Flow Map (05/17/99)
Site 2 RI/ERA/HHRA
St. Juliens Creek Annex
Chesapeake, Virginia

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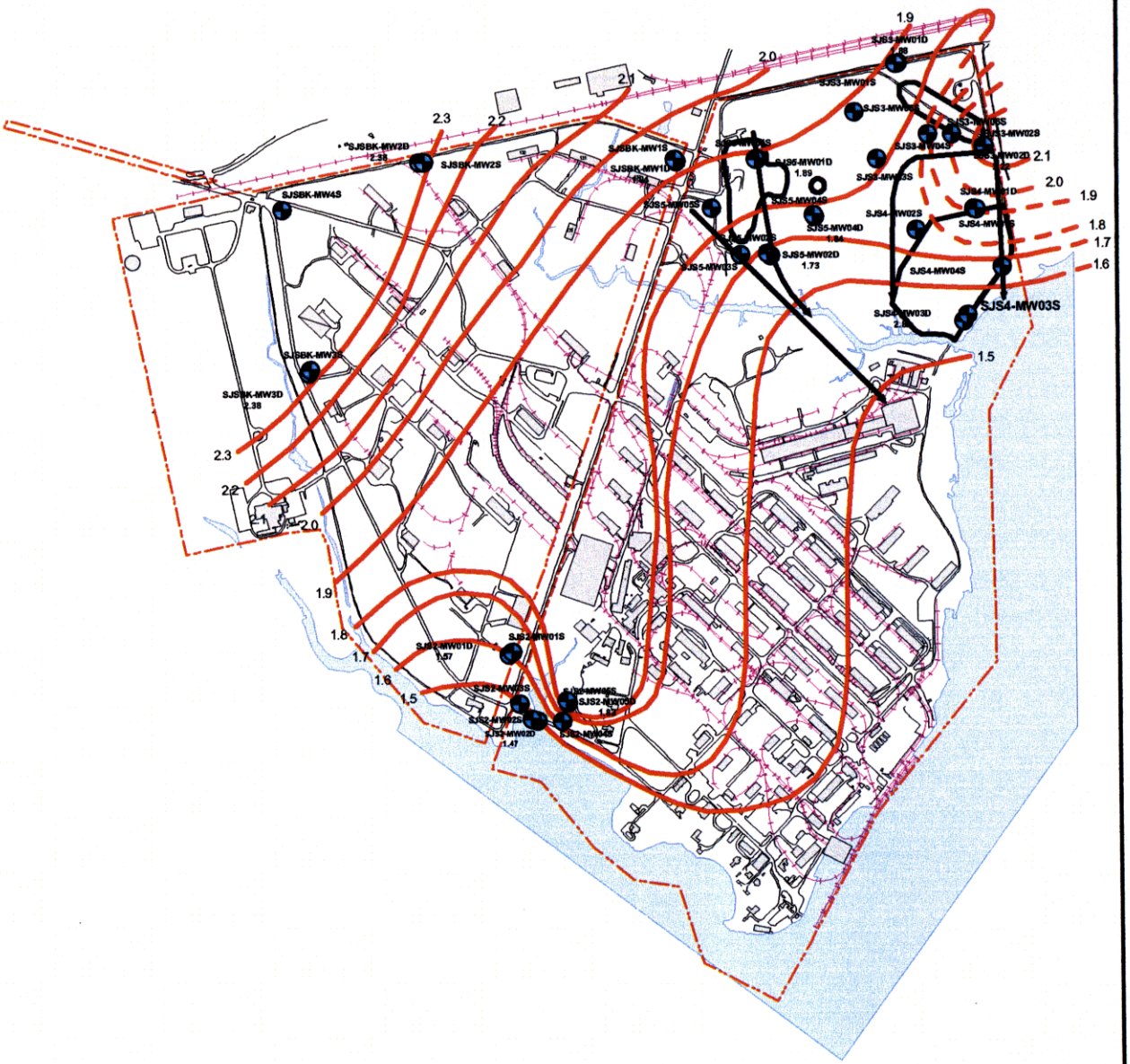

LEGEND

- 2001 Deep Well Contours
- Sites
- Buildings
- Roads
- Groundwater Flow Direction
- Activity Boundary
- Water Bodies

N

0 800 1600 Feet

Figure 4-17
Yorktown Aquifer Potentiometric Surface
Groundwater Flow Map (08/16/01)
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

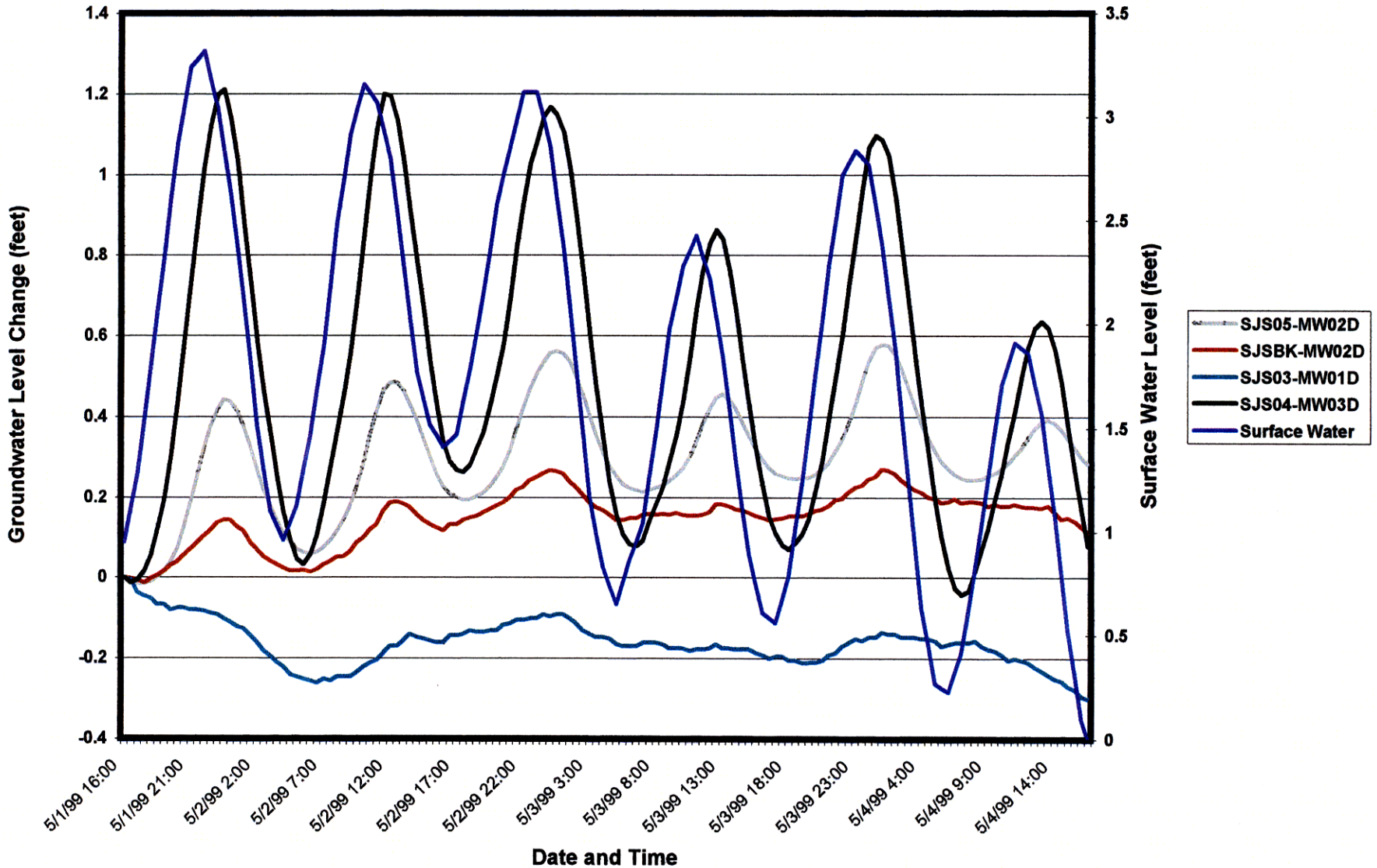

Figure 4-18
Tidal Survey Results (May 1 through May 4, 1999)
St. Juliens Creek Annex
Chesapeake, Virginia