

**APPENDIX O**  
**Present Worth Comparison**  
**of Alternative Evaluation**

**Battlefield Golf Club Water Project**  
**PRESENT WORTH OPINION OF COST EVALUATIONS**

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Expected System Life (yr)	30	30	30	30
Capital Cost	\$ 7,221,756	\$ 8,411,704	\$ 2,770,149	\$ 803,000
O&M Costs/yr	\$ 3,000	\$ 187,227	\$ 460,879	\$ 10,000
Present Worth Costs	\$ 7,267,873	\$ 11,289,844	\$ 9,854,989	\$ 956,725

**Alternative 1** Provide City Of Chesapeake Water via a Water Main Extension

**Alternative 2** Installation of Community System

**Alternative 3** Installation of Point of Entry (POE) Treatment Systems on Existing Private Wells

**Alternative 4** Development and Installation of New Individual Home Owner Supply Wells

**Assumptions**

Cost Opinions do not consider Engineering Time required for alternatives

Cost Opinions do not consider Permitting Time and Constraints

Cost Opinions make assumptions for market value of land acquisition

Cost Opinions are not actual determinations of project costs and are strictly for comparison

Cost Opinions do not consider cost of brine disposal

**Battlefield Golf Club Water Project**  
**Centerville Turnpike Water Main - Alternative 1**

<b>ITEM NO.</b>	<b>ITEM DESCRIPTION</b>	<b>UNIT</b>	<b>QTY</b>	<b>UNIT COST</b>	<b>LINE ITEM COST</b>
1	Mobilization	LS	1	\$92,000.00	\$100,000.00
2	16" Water Main - Ductile Iron Pipe	LF	8439	\$108.25	\$913,521.75
3	10" Water Main - Ductile Iron Pipe	LF	384	\$74.66	\$28,669.44
4	6" Water Main - Ductile Iron Pipe	LF	160	\$58.00	\$9,280.00
5	Water Main Undercut Excavation & Replacement with Bedding Stone	CY	1009	\$32.00	\$32,288.00
6	Select Backfill , CBR 15 - Pipe	CY	3844	\$20.00	\$76,880.00
7	Pipe Bedding	CY	570	\$54.00	\$30,780.00
8	Course Aggregate	TON	1976	\$50.00	\$98,800.00
9	16" Cross	EA	1	\$2,000.00	\$2,000.00
10	16" x 10" Tee	EA	2	\$1,836.00	\$3,672.00
11	16" x 6" Tee	EA	16	\$1,661.00	\$26,576.00
12	16" 45° Bend - Ductile Iron Pipe	EA	28	\$1,177.00	\$32,956.00
13	16" 22-1/2° Bend - Ductile Iron Pipe	EA	24	\$1,193.00	\$28,632.00
14	16" Butterfly Valve - Ductile Iron Pipe	EA	11	\$4,500.00	\$49,500.00
15	Fire Hydrant Assembly	EA	17	\$3,000.00	\$51,000.00
16	Crusher Run - Fire Hydrant Only	TON	299	\$25.00	\$7,475.00
17	Connect to Existing Water Main	EA	2	\$3,500.00	\$7,000.00
18	Service Connections	EA	30	\$2,500.00	\$75,000.00
	Utility Trench Pavement Patching	LF	1410		
19	2" SM-2A	Ton	130	\$90.00	\$11,700.00
20	7" BM-2	Ton	455	\$90.00	\$40,950.00
21	10" Aggregate Base	Ton	630	\$35.00	\$22,050.00
22	Traffic Control	LS	1	\$5,000.00	\$5,000.00
23	Erosion and Sediment Control Pipe line	LS	1	\$25,000.00	\$25,000.00
24	Curb and Gutter Replacement	LF	60	\$45.00	\$2,700.00
25	Storm Drain Pipe - 15" RCP	LF	330	\$44.00	\$14,520.00
26	Storm Drain Pipe - 18" RCP	LF	50	\$62.00	\$3,100.00
27	Storm Drain Pipe - 24" RCP	LF	442	\$77.00	\$34,034.00
28	Storm Drain Pipe - 30" RCP	LF	20	\$160.00	\$3,200.00
29	Flared End Section - 15" RCP	EA	19	\$750.00	\$14,250.00
30	Flared End Section - 18" RCP	EA	2	\$780.00	\$1,560.00
31	Flared End Section - 24" RCP	EA	17	\$800.00	\$13,600.00
32	Flared End Section - 30" RCP	EA	2	\$1,000.00	\$2,000.00
33	Drop Inlet	EA	1	\$5,000.00	\$5,000.00
34	Manhole	EA	2	\$4,000.00	\$8,000.00
35	Connect to Existing Storm Struct.	EA	2	\$1,000.00	\$2,000.00
36	Select Tree Removal	EA	10	\$585.00	\$5,850.00
37	Seeding, Fertilizing and Lime	LS	1	\$10,000.00	\$10,000.00
38	Sawcut and Remove Pavement	LF	1410	\$3.85	\$5,428.50
	Pavement Milling & Overlay for Utility Patch				
39	2" Mill	SY	3506	\$15.00	\$52,590.00
40	Asphalt Overlay	Ton	385	\$125.00	\$48,125.00
41	Traffic Control	LS	1	\$5,000.00	\$5,000.00
	Pavement Repair Along Centerville Tpk.				
42	2"-Mill 12'wide X 7831' long	SY	10441	\$15.00	\$156,615.00
43	Asphalt Overlay	Ton	1722	\$90.00	\$154,980.00
44	Traffic Control	LS	1	\$9,000.00	\$9,000.00
45	Isolated Pavement Repair	SY	1000	\$80.00	\$80,000.00
46	VDOT EC-1 For Ditch Stabalization	SY	12229	\$2.25	\$27,515.25
47	Excavation For Ditch	CY	4489	\$5.45	\$24,465.05
48	Topsoil	CY	2232	\$25.00	\$55,800.00
49	Select Borrow, CBR 15 - Ditch fill Only	CY	3707	\$20.00	\$74,140.00
50	Fine Grade Shoulder	SY	9166	\$1.50	\$13,749.00
51	Concrete Driveway Replacement	EA	3	\$2,800.00	\$8,400.00
52	Asphalt Driveway Replacement	EA	4	\$3,000.00	\$12,000.00
53	Gravel Driveway Replacement	EA	4	\$1,000.00	\$4,000.00

***Battlefield Golf Club Water Project***  
***Centerville Turnpike Water Main - Alternative 1***

<b><i>ITEM NO.</i></b>	<b><i>ITEM DESCRIPTION</i></b>	<b><i>UNIT</i></b>	<b><i>QTY</i></b>	<b><i>UNIT COST</i></b>	<b><i>LINE ITEM COST</i></b>
54	Traffic Control Non paving operations	LS	1	\$40,000.00	\$40,000.00
	Subtotal				\$2,570,351.99
	Contengency 10%				\$257,035.20
	Easement Acquisition				
55	Business	SF	10500	\$ 15.00	\$157,500.00
56	Other	SF	55380	\$ 8.00	\$443,040.00
	TOTAL				\$3,427,927.19

**Battlefield Golf Club Water Project**  
**Murray Drive & Whittamore Road Water Main - Alternative 1**

ITEM NO.	ITEM DESCRIPTION	UNIT	QTY	UNIT COST	LINE ITEM COST
1	Mobilization	LS	1	\$ 100,000.00	\$ 150,000.00
	<b>Whittamore Road</b>				
2	10" DI Pipe	LF	2250	\$ 68.00	\$ 153,000.00
3	8" DI Pipe	LF	5685	\$ 58.00	\$ 329,730.00
4	6" DI Pipe	LF	370	\$ 50.00	\$ 18,500.00
5	Hydrants & Appurtenances	EA	17	\$ 3,000.00	\$ 51,000.00
6	10" Gate Valve & Box	EA	2	\$ 2,500.00	\$ 5,000.00
7	8" Gate Valve & Box	EA	5	\$ 1,300.00	\$ 6,500.00
8	6" Gate Valve & Box	EA	17	\$ 931.00	\$ 15,827.00
9	Connect to existing Water Main	LA	1	\$ 3,500.00	\$ 3,500.00
10	Service Connections	EA	30	\$ 1,600.00	\$ 48,000.00
11	Water Main Undercut Excavation & Replacement with Bedding Stone	LF/6" depth	4000	\$ 7.43	\$ 29,720.00
12	Select Backfill, CBR 15 - Pipe Install	CY	7164	\$ 20.00	\$ 143,280.00
13	Temporary Pavement Patch Water Main	SY	5373	\$ 27.00	\$ 145,071.00
14	Sawcut Pavement	LF	16120	\$ 1.00	\$ 16,120.00
15	Erosion and Sed. Control	LS	1	\$ 10,000.00	\$ 10,000.00
16	Storm Drain Pipe-24" RCP	LF	376	\$ 130.00	\$ 48,880.00
17	Flared End Section 24" RCP	EA	47	\$ 2,350.00	\$ 110,450.00
18	Crusher Run Fill at Culverts	CY	47	\$ 50.00	\$ 2,350.00
19	Traffic Control	LS	1	\$ 15,000.00	\$ 15,000.00
	Water Line Sub Total				\$ 1,151,928.00
	<b>Rebuild Entire Roadway</b>				
20	Demolition and removal of pavement and subgrade. Haul off	CY	12935	\$ 20.00	\$ 258,700.00
21	24" Select Material, CBR=15, Sand Blanket	CY	11940	\$ 19.00	\$ 226,860.00
22	Grade/compact Subgrade	SY	17911	\$ 1.50	\$ 26,866.50
23	Subgrade Undercut & replacement W/ select material	CY	1000	\$ 40.00	\$ 40,000.00
24	8" Aggregate Base Material	Ton	7630	\$35.00	\$267,050.00
25	Grade Aggregate Base Material	SY	17911	\$2.00	\$35,822.00
26	2" Surface & 4" Binder Asphalt	Ton	6180	\$90.00	\$556,200.00
27	Geotextile Fabric Under Aggregate	SY	17911	\$2.50	\$44,777.50
28	Traffic Control for Roadway Construction	LS	1	\$ 20,000.00	\$20,000.00
	Subtotal Rebuild Roadway				\$1,476,276.00
	Sub Total Whittamore				\$2,628,204.00
	<b>Murray Drive</b>				
29	10" DI Pipe	LF	2127	\$ 68.00	\$ 144,636.00
30	8" DI Pipe	LF	4936	\$ 58.00	\$ 286,288.00
31	6" DI Pipe	LF	162	\$ 50.00	\$ 8,100.00
32	Hydrants & Appurtenances	EA	16	\$ 3,000.00	\$ 48,000.00
33	10" Gate Valve & Box	EA	1	\$ 2,500.00	\$ 2,500.00
34	8" Gate Valve & Box	EA	2	\$ 1,300.00	\$ 2,600.00
35	6" Gate Valve & Box	EA	16	\$ 931.00	\$ 14,896.00
36	Connect to existing Water Main	LA	1	\$ 3,500.00	\$ 3,500.00
37	Service Connections	EA	41	\$ 1,600.00	\$ 65,600.00
38	Select Borrow, CBR 15 - Pipe Install Only (Backfill)	CY	37	\$ 40.00	\$ 1,480.00
39	Sawcut Pavement	LF	170	\$ 10.00	\$ 1,700.00
40	Curb and Gutter Replacement	LF	50	\$ 45.00	\$ 2,250.00
41	Erosion and Sed. Control	LS	1	\$ 4,000.00	\$ 4,000.00
42	Traffic Control	LS	1	\$ 2,000.00	\$ 2,000.00
	Pavement Repair				
43	1.5" SM-2A	TON	4	\$ 1,000.00	\$ 4,000.00

**Battlefield Golf Club Water Project**  
**Murray Drive & Whittamore Road Water Main - Alternative 1**

<b>ITEM NO.</b>	<b>ITEM DESCRIPTION</b>	<b>UNIT</b>	<b>QTY</b>	<b>UNIT COST</b>	<b>LINE ITEM COST</b>
44	4" BM-2	TON	9	\$ 1,000.00	\$ 9,000.00
45	Aggregate Base Mat.	TON	12	\$ 50.00	\$ 600.00
46	Grading	SY	7850	\$ 1.50	\$ 11,775.00
47	2" Topsoil	AC	1.62	\$ 26,000.00	\$ 42,120.00
48	Seeding	AC	1.62	\$ 2,500.00	\$ 4,050.00
	Sub Total Murray Drive				\$659,095.00
	Total Murray, Whittamore and Mobilization				\$3,437,299.00
	10% Contingency				\$343,729.90
	<b>Easement Acquisition *</b>				
48	Residential (FH and Water Meters)	SF	1600	\$ 8.00	\$ 12,800.00
	Total				\$3,793,828.90

**Battlefield Golf Club Water Project**  
**Community Supply Water Distribution System - Alternative 2**

<b>ITEM NO.</b>	<b>ITEM DESCRIPTION</b>	<b>UNIT</b>	<b>QTY</b>	<b>UNIT COST</b>	<b>LINE ITEM COST</b>
1	Mobilization	LS	1	\$100,000.00	\$150,000.00
	<b>Whittamore Road</b>				
2	8" DI Pipe	LF	7935	\$58.00	\$460,230.00
3	6" DI Pipe	LF	370	\$50.00	\$18,500.00
4	Hydrants & Appurtenances	EA	17	\$3,000.00	\$51,000.00
5	10" Gate Valve & Box	EA	2	\$2,500.00	\$5,000.00
6	8" Gate Valve & Box	EA	5	\$1,300.00	\$6,500.00
7	6" Gate Valve & Box	EA	17	\$931.00	\$15,827.00
8	Service Connections	EA	30	\$1,600.00	\$48,000.00
9	Water Main Undercut Excavation & Replacement with Bedding Stone	LF/6" depth	4000	\$7.43	\$29,720.00
10	Select Backfill, CBR 15 - Pipe Install	CY	7164	\$20.00	\$143,280.00
11	Temporary Pavement Patch Water Main	SY	5373	\$27.00	\$145,071.00
12	Sawcut Pavement	LF	16120	\$1.00	\$16,120.00
13	Erosion and Sed. Control	LS	1	\$10,000.00	\$10,000.00
14	Storm Drain Pipe-24" RCP	LF	376	\$130.00	\$48,880.00
15	Flared End Section 24" RCP	EA	47	\$2,350.00	\$110,450.00
16	Crusher Run Fill at Culverts	CY	47	\$50.00	\$2,350.00
17	Traffic Control	LS	1	\$15,000.00	\$15,000.00
	Water Line Sub Total				\$1,125,928.00
	<b>Rebuild Entire Roadway-Whittamore</b>				
18	Demolition and removal of pavement and subgrade. Haul off-site	CY	12935	\$20.00	\$258,700.00
19	24" Select Material, CBR=15, Sand Blanket	CY	11940	\$19.00	\$226,860.00
20	Grade/compact Subgrade	SY	17911	\$1.50	\$26,866.50
21	Subgrade Undercut & replacement W/ select material	CY	1000	\$40.00	\$40,000.00
22	8" Aggregate Base Material	Ton	7630	\$35.00	\$267,050.00
23	Grade Aggregate Base Material	SY	17911	\$2.00	\$35,822.00
24	2" Surface & 4" Binder Asphalt	Ton	6180	\$90.00	\$556,200.00
25	Geotextile Fabric Under Aggregate	SY	17911	\$2.50	\$44,777.50
26	Traffic Control for Roadway Construction	LS	1	\$20,000.00	\$20,000.00
	Subtotal Rebuild Roadway				\$1,476,276.00
	Sub Total Whittamore				\$2,602,204.00
	<b>Murray Drive</b>				
27	8" DI Pipe	LF	7063	\$58.00	\$409,654.00
28	6" DI Pipe	LF	162	\$50.00	\$8,100.00
29	Hydrants & Appurtenances	EA	16	\$3,000.00	\$48,000.00
30	10" Gate Valve & Box	EA	1	\$2,500.00	\$2,500.00
31	8" Gate Valve & Box	EA	2	\$1,300.00	\$2,600.00
32	6" Gate Valve & Box	EA	16	\$931.00	\$14,896.00
33	Service Connections	EA	41	\$1,600.00	\$65,600.00
34	Select Borrow, CBR 15 - Pipe Install Only (Backfill)	CY	37	\$40.00	\$1,480.00
35	Sawcut Pavement	LF	170	\$10.00	\$1,700.00
36	Curb and Gutter Replacement	LF	50	\$45.00	\$2,250.00
37	Erosion and Sed. Control	LS	1	\$4,000.00	\$4,000.00
38	Traffic Control	LS	1	\$2,000.00	\$2,000.00
	Pavement Repair				
39	1.5" SM-2A	TON	4	\$1,000.00	\$4,000.00
40	4" BM-2	TON	9	\$1,000.00	\$9,000.00
41	Aggregate Base Mat.	TON	12	\$50.00	\$600.00
42	Grading	SY	7850	\$1.50	\$11,775.00

**Battlefield Golf Club Water Project**  
**Community Supply Water Distribution System - Alternative 2**

ITEM NO.	ITEM DESCRIPTION	UNIT	QTY	UNIT COST	LINE ITEM COST
43	2" Topsoil	AC	1.62	\$26,000.00	\$42,120.00
44	Seeding	AC	1.62	\$2,500.00	\$4,050.00
	Sub Total Murray Drive				\$634,325.00
	Centerville				
45	8" Water Main - Ductile Iron Pipe	LF	3102	\$58.00	\$179,916.00
46	Water Main Undercut Excavation & Replacement with Bedding Stone	CY	355	\$32.00	\$11,360.00
47	Select Backfill , CBR 15 - Pipe	CY	1355	\$20.00	\$27,100.00
48	Pipe Bedding	CY	200	\$54.00	\$10,800.00
49	Course Aggregate	TON	670	\$50.00	\$33,500.00
50	8" Gate Valve Valve	EA	3	\$4,500.00	\$13,500.00
51	Fire Hydrant Assembly	EA	3	\$3,000.00	\$9,000.00
52	Crusher Run - Fire Hydrant Only	TON	105	\$25.00	\$2,625.00
53	Service Connections	EA	5	\$2,500.00	\$12,500.00
	Utility Trench Pavement Patching	LF	497		
54	2" SM-2A	Ton	15	\$90.00	\$1,350.00
55	7" BM-2	Ton	160	\$90.00	\$14,400.00
56	10" Aggregate Base	Ton	222	\$35.00	\$7,770.00
57	Traffic Control	LS	1	\$3,000.00	\$3,000.00
58	Erosion and Sediment Control Pipe line	LS	1	\$5,000.00	\$5,000.00
59	Curb and Gutter Replacement	LF	20	\$45.00	\$900.00
60	Seeding, Fertilizing and Lime	LS	1	\$2,500.00	\$2,500.00
61	Sawcut and Remove Pavement	LF	730	\$3.85	\$2,810.50
62	Storm Drain Pipe - 15" RCP	LF	69	\$44.00	\$3,036.00
63	Storm Drain Pipe - 18" RCP	LF	52	\$62.00	\$3,224.00
64	Storm Drain Pipe - 24" RCP	LF	145	\$77.00	\$11,165.00
65	Flared End Section - 15" RCP	EA	3	\$750.00	\$2,250.00
66	Flared End Section - 18" RCP	EA	6	\$780.00	\$4,680.00
67	Flared End Section - 24" RCP	EA	4	\$800.00	\$3,200.00
68	Drop Inlet	EA	1	\$5,000.00	\$5,000.00
69	Manhole	EA	1	\$4,000.00	\$4,000.00
70	Pavement Milling & Overlay for Utility Patch				
71	2" Mill	SY	1500	\$15.00	\$22,500.00
72	Asphalt Overlay	Ton	240	\$125.00	\$30,000.00
73	Traffic Control	LS	1	\$3,000.00	\$3,000.00
74	Pavement Repair Along Centerville Tpk.				
75	2"-Mill 12'wide X 3300' long	SY	4400	\$15.00	\$66,000.00
76	Asphalt Overlay	Ton	484	\$90.00	\$43,560.00
77	Isolated Pavement Repair	SY	100	\$80.00	\$8,000.00
78	VDOT EC-1 For Ditch Stabalization	SY	433	\$2.25	\$974.25
79	Excavation For Ditch	CY	1500	\$5.45	\$8,175.00
80	Topsoil	CY	786	\$25.00	\$19,650.00
81	Select Borrow, CBR 15 - Ditch fill Only	CY	1300	\$20.00	\$26,000.00
82	Fine Grade Shoulder	SY	3231	\$1.50	\$4,846.50
83	Concrete Driveway Replacement	EA	1	\$2,800.00	\$2,800.00
84	Gravel Driveway Replacement	EA	1	\$1,000.00	\$1,000.00
	Subtotal Centerville Turnpike				\$611,092.25
	Total of Construction				\$3,847,621.25
	10% Contingency				\$384,762.13

***Battlefield Golf Club Water Project  
Community Supply Water Distribution System - Alternative 2***

<b><i>ITEM NO.</i></b>	<b><i>ITEM DESCRIPTION</i></b>	<b><i>UNIT</i></b>	<b><i>QTY</i></b>	<b><i>UNIT COST</i></b>	<b><i>LINE ITEM COST</i></b>
	Easement Acquisition				
	Centerville Turnpike				
85	Residential	SF	23930	\$8.00	\$191,440.00
	Murry Drive				
86	Residential	SF	1600	\$8.00	\$12,800.00
	Total Estimate				\$4,436,623.38

**Battlefield Golf Club Water Project**  
**Community Water Supply and Treatment System - Alternative 2**

Item	Quantity	Unit Cost	Unit	Total Cost
<b>Item 1 - Mobilization/Demobilization</b>				
Setup Charge Trailer	1	\$920	EA	\$920
Trailer/Furniture	6	\$2,875	Month	\$17,250
Port-a-john	180	\$6	Days	\$1,035
Water	180	\$6	Days	\$1,035
Mobilization	1	\$80,500	LS	\$80,500
Site Cleanup	1	\$5,750	LS	\$5,750
<b>Item 2 - Erosion and Sediment</b>				
Stabilized construction entrance	1	\$5,750	EA	\$5,750
Silt fence	200	\$2	LF	\$460
LOD Fence	2,000	\$2	LF	\$4,600
R-3 / R4 riprap pad	2	\$2,300	EA	\$4,600
Dirtbag	1	\$1,000	EA	\$1,000
Dirtbag discharge area (Pad)	400	\$6	SF	\$2,300
<b>Item 3 - Earthwork</b>				
Grading	1	\$29,000	LS	\$29,000
Borrow	1	\$2,500	LS	\$2,500
<b>Item 4 - Groundwater Withdrawal Permit</b>				
Engineering Support preparing plan, hydrogeologic information, etc.	1	\$75,000	LS	\$75,000
Permit Fee	1	\$6,000	LS	\$6,000
<b>Item 5 - Well Field</b>				
Property Acquisition for Siting of Wells	3	\$75,000	EA	\$225,000
Well Construction	3	\$40,000	EA	\$120,000
Well Pipe, Well Pumps, Motors, Pitless Adapter, Wiring Etc	3	\$40,000	EA	\$120,000
<b>Item 6 - Raw Water Transmission Mains</b>				
4" SDR 21	3,000	\$58	LF	\$174,000
<b>Item 7 - Paving and Surfacing</b>				
Paving	1	\$3,000	LS	\$3,000
Gravel road	1	\$2,500	LS	\$2,500
<b>Item 8 - Exterior Piping</b>				
Exterior DIP Piping Fittings and Valves	1	\$85,000	LS	\$85,000
Misc Fittings / Thrust Blocks	1	\$10,000	LS	\$10,000
<b>Item 9 - Landscaping and Site Improvements</b>				
Landscaping and Site Improvements (incl fencing)	1	\$20,000	LS	\$20,000
<b>Item 10 - Concrete</b>				
Tank foundation, Footers, Slab, Door Landing Slabs	9	\$518	CY	\$30,000
<b>Item 11 - Water Treatment Plant Structure and Finishings</b>				
Trusses, CMU, Doors, Etc.	800	\$150	SF	\$120,000
Fixtures and furniture	1	\$20,000	LS	\$20,000
Emergency Generator	1	\$80,000	LS	\$80,000
<b>Item 12 - Fe and Mn Pressure Filters Unit Process Equipment</b>				
Manganese Greensand Filters	1	\$187,900	LS	\$187,900
<b>Item 13 - RO Unit Process Equipment</b>				

Vantage M84-024RO	1	\$137,600	LS	\$137,600
Vantage M83-006RO	1	\$90,100	LS	\$90,100
<b>Item 14 - Equipment and Mechanical Work</b>				
Interior Process Piping and Fittings	1	\$60,000	LS	\$60,000
Disinfection and hydrostatic pressure testing	1	\$11,500	LS	\$11,500
Fittings and Supports	1	\$11,500	LS	\$11,500
Controls	1	\$25,000	LS	\$25,000
Chlorination System	1	\$5,000	EA	\$5,000
Chlorine/Fluoride Residual Analyzer	1	\$5,000	EA	\$5,000
Fluoridation System	1	\$5,000	EA	\$5,000
Dehumidifiers (3)	1	\$6,000	LS	\$6,000
Exhaust Fan w/ Louvers	1	\$4,500	LS	\$4,500
Gas Service Pipe	1	\$11,500	LS	\$11,500
Water heater	1	\$1,150	LS	\$1,150
<b>Item 15 - Raw Water "Reservoir", Backwash/Brine Holding Tank, Pump Station</b>				
20,000 gal Tank for Raw Water for Chemical Pre-treatment	1	\$50,000	LS	\$50,000
50,000 gal Tank includes excavation, foundation, handrails, etc.	1	\$200,000	LS	\$200,000
<b>Item 16 - Community Water Distribution System</b>				
From URS Virginia Beach	1	\$ 4,436,623	LS	\$4,436,623
<b>Item 17 - Ground Level Water Storage Tank</b>				
High Service Fire Pump	1	\$10,000	EA	\$10,000
VFD service pumps (one for redundancy)	2	\$10,000	EA	\$20,000
Property Acquisition for Siting of Tank	1	\$75,000	EA	\$75,000
120,000 gal Tank includes foundation, painting, etc.	1	\$144,000	LS	\$144,000
<b>Item 18 - Electrical</b>				
Service Meter/Entrance	1	\$4,000	LS	\$4,000
Panelboard (1) - 120/240V, 24 Ckt	1	\$5,000	LS	\$5,000
Service & Equipment Grounding	1	\$3,000	LS	\$3,000
Emergency Lights (2)	1	\$1,500	LS	\$1,500
Lighting (11)	1	\$5,500	LS	\$5,500
Receptacles (10)	1	\$3,000	LS	\$3,000
Misc. Wiring, Unit Htrs, Exh Fans	1	\$4,000	LS	\$4,000
Alarm Panel (2) & Wiring	1	\$6,000	LS	\$6,000
Alarm/Intlk Wiring to Treatment Bldg	1	\$10,000	LS	\$10,000
Flow Switch, Pressure Switch, Flooded Floor Sensor, etc	1	\$4,000	LS	\$4,000
Telephone Dialer	1	\$1,200	LS	\$1,200
Elect Unit Heater, 5KW 480V, 3 PH (2)	1	\$3,500	LS	\$3,500
Well Starter Replacement (5)	5	\$5,000	EA	\$25,000
Programmable Logic Controller	1	\$15,000	EA	\$15,000
Well Feeder Line	1	\$100,000	LS	\$100,000
Electric Work for Reverse Osmosis System	1	\$150,000	LS	\$150,000
<b>Item 19 - HVAC/Plumbing</b>				
Ventilation	1	\$7,260	LS	\$7,260
Plumbing	1	\$27,720	LS	\$27,720
Controls	1	\$10,000	LS	\$10,000
Water heater	2	\$2,500	LS	\$5,000
<b>Item 20 - Indirects</b>				
Survey	64	\$144	HR	\$9,200
Project Manager	120	\$863	Days	\$103,500
Superintendent	180	\$748	Days	\$134,550
Administrative	100	\$518	Days	\$51,750
Insurance	1	\$106,375	LS	\$106,375
Bonds	1	\$106,375	LS	\$106,375
<b>Subtotal</b>				\$7,647,003
<b>Contingency (10%)</b>				\$764,700
<b>Total</b>				\$8,411,704

**Battlefield Golf Club Water Project**  
**Community Water Supply System O & M Cost Comparison - Alternative 2**

Combined Wells	180	gpm
Pumping Duration per Day	3.70	hr
Q=	0.040	MGD
Q=	40,000.0	gpd

**Alternative #2 Community Water Supply System**

Treatment Process	<i>Chemical Costs</i>		
<b>Oxidation</b>	<b>NaOCl (12.5%)</b>		<b>Cost (\$/yr)</b>
	12.5% chlorine (lbs/gal)	1.26	Dose (mg/L)
	\$/gal =	0.85	3.50
			\$ 287.50
<b>Disinfection</b>	<b>NaOCl (12.5%)</b>		<b>Cost (\$/yr)</b>
	12.5% chlorine (lbs/gal)	1.26	Dose (mg/L)
	\$/gal =	0.85	1.00
			\$ 82.14
<b>Fluoridation</b>	<b>NaF</b>		<b>Cost (\$/yr)</b>
	\$/lb =	1.12	Dose (mg/L)
			1.00
			\$ 307.53
<b>Alkalinity and pH Adjustment</b>	<b>Na<sub>2</sub>CO<sub>3</sub></b>		<b>Cost (\$/yr)</b>
	\$/gal =	0.90	Dose (mg/L)
			4.00
			\$ 328.57
			\$ 1,005.74

Chemical Costs Sub-Total

Pumps	<i>Energy Costs</i>		
<b>Production Wells</b>	Horsepower (HP) per well	25	
	Kilowatt (kW)	18.6425	
	Hours Pumping / day	3.7	
	# of Wells Operationing	2	Cost per kW-Hr(\$/kw Hr.)
	kW-hrs/year	50403.7	0.12
			\$ 6,048.45
<b>Booster Pumps</b>	Horsepower (HP)	25	
	Kilowatt (kW)	18.6425	
	Hours Pumping / day	3.7	
	kW-hrs/year	25,201.9	Cost per kW-Hr(\$/kw Hr.)
			0.12
			\$ 3,024.22
<b>Supermatant Recycle Pump</b>	Horsepower (HP)	7.5	
	Kilowatt (kW)	18.6425	
	Hours Pumping / day	0.4	
	kW-hrs/year	2,520.2	Cost per kW-Hr(\$/kw Hr.)
			0.12
			\$ 302.42
<b>Pump Station Pumps</b>	Horsepower (HP)	25	
	Kilowatt (kW)	18.6425	
	Hours Pumping / day	3.7	
	kW-hrs/year	25,201.9	Cost per kW-Hr(\$/kw Hr.)
			0.12
			\$ 3,024.22
			\$ 12,399.32

Energy Costs Sub-Total

Reverse Osmosis	<i>Process Equipment Costs</i>		
<b>Vantage M83 RO System</b>	Vender Supplied Information		<b>Cost (\$/yr)</b>
			\$ 3,452.1
<b>Vantage M84 RO System</b>	Vender Supplied Information		<b>Cost (\$/yr)</b>
			\$ 11,569.99
			\$ 15,022.07

WTP Operations	<i>Water Treatment Plant Personnel</i>		
<b>WTP Operator</b>	Number of Operators	Hours/Week/Operator	Payrate (\$/hr)
	2	40.00	30
			\$ 124,800.00
<b>Sampling/Water Quality Analysis</b>	# of Analyses	Cost per Test	Additional Miscellaneous
	24	\$ 1,000.00	\$10,000.00
			\$ 34,000.00
			\$ 158,800.00

**\$ 187,227.13 Total Cost**

*Battlefield Golf Club Water Project*  
*Residential RO Systems - Point of Entry - Alternative 3*

Item	Quantity	Unit Cost	Unit	Total Cost
<b>Item 1 - Individual RO System with booster pumps, tanks, etc.</b>	100	\$ 4,813.17	EA	\$481,317
<b>Item 2 - RO System Housing</b>				
Building Shed	100	\$5,000	EA	\$500,000
<b>Item 3 - Piping, Mechanical, and Electrical Work</b>				
Piping from well and to home	100	\$5,000	EA	\$500,000
Control System for RO	100	\$2,500	EA	\$250,000
Mechanical/Electrical work in RO Building	100	\$3,500	EA	\$350,000
<b>Item 4: Indirects</b>				
Survey	64	\$144	HR	\$9,200
Project Manager	120	\$863	Days	\$103,500
Superintendent	180	\$748	Days	\$134,550
Administrative	100	\$518	Days	\$51,750
Insurance	1	\$69,000	LS	\$69,000
Bonds	1	\$69,000	LS	\$69,000
<b>Subtotal</b>				\$2,518,317
<b>Contingency (10%)</b>				\$251,832
<b>Total</b>				\$2,770,149

**Battlefield Golf Club Water Project**  
**Residential Point of Entry O & M Cost Comparison - Alternative 3**

Number of Homes (ERCs)	100		
Daily Water	400	gpd	
RO Efficiency	40	%	
Waste Water	1000.000	gpd	

**Alternative #3 Point of Use Treatment Systems on Individual Wells**

<b>Energy Costs</b>				
<b>Heating and Electric for Shed</b>			Cost per kW-Hr(\$/kw Hr.)	<b>Cost (\$/yr)</b>
	kW-hrs/year	1,500.0	0.12	\$ 180.00
<b>Booster Pumps</b>	Watts (W)	1120		
	Horsepower (HP)	1.50		
	Kilowatt (kW)	1.12		
	Hours Pumping / day	6.7	Cost per kW-Hr(\$/kw Hr.)	<b>Cost (\$/yr)</b>
	kW-hrs/year	2,725.3	0.12	\$ 327.04
				\$ 50,704.00

Energy Costs for 100 ERC.

<b>Reverse Osmosis</b>				<b>Process Equipment Costs</b>	
			Per Individual Unit		<b>Cost (\$/yr)</b>
<i>Individual RO System</i>	Replacement Filter Cartridges		1380	\$	138,000.00
<i>Individual RO System</i>	Replacement Membrances		143.75	\$	14,375.00
<i>Individual RO System</i>	Membrane Cleaning Supplies		230	\$	23,000.00
				\$	175,375.00

<b>Operations</b>		<b>City of Chesapeake Personnel</b>			<b>Cost (\$/yr)</b>	
<i>WTP Operator</i>	Number of Operators	Hours/Week/Operator	Payrate (\$/hr)			
	2	40.00	30	\$	124,800.00	
<i>Sampling/Water Quality Analysis</i>	# of Analyses	Cost per Test	Additional Miscellaneous			
	100	\$ 1,000.00	\$10,000.00	\$	110,000.00	
				\$	234,800.00	

**460,879.00 Total Cost**

*Battlefield Golf Club Water Project*  
*New Private Wells into the Yorktown Eastover Aquifer - Alternative 4*

Item	Quantity	Unit Cost	Unit	Total Cost
<b>Item 1</b>				
Abandon Existing Well	100	\$ 1,500.00	EA	\$150,000
<b>Item 2 - New Wells</b>				
Permitting	100	\$100	EA	\$10,000
Drilling and Well Installation Cost (incl. pump and wiring)	100	\$3,000	EA	\$300,000
Disinfection	100	\$200	EA	\$20,000
Water Quality Testing	100	\$1,000	EA	\$100,000
<b>Item 3 - Home Water System</b>				
Pressure Tank and Water Conditioner	100	\$1,000	EA	\$100,000
Plumbing	100	\$500	EA	\$50,000
<b>Subtotal</b>				\$730,000
<b>Contingency (10%)</b>				\$73,000
<b>Total</b>				\$803,000

*Battlefield Golf Club Water Project*  
*New Private Wells (O & M) - Alternative 4*

Item	Quantity	Unit Cost	Unit	Total Cost
Item 1				
Filter Replacement, electricity, repairs, new pump replacement ten years, etx.	100	\$ 100.00	EA	\$10,000
<b>Total</b>				\$10,000