

Draft

TECHNICAL MEMORANDUM
KYPIPE MODEL OPTIMIZATION FOR
AGRICULTURAL IRRIGATION SYSTEMS
(TM-P-7)

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SUBJ.: Santa Rosa Subregional Long-Term Wastewater Project

INTRODUCTION

The irrigation distribution systems for the Santa Rosa project was modeled using KYPIPE computer modeling to make preliminary determination of pipeline sizes and pump station horsepower requirements. The intent in utilizing this model is to provide a minimum residual pressure of 40 pounds per square inch (psi) at all demand points in the system (nodes). However, for a given distribution network, the model can be used to create numerous combinations of diameters and horsepowers which will meet this pressure criteria. Each combination has an associated total construction and present worth operating cost. The piping systems must be optimized to meet the following initial criteria:

- Minimize the total construction and present worth cost;
- Provide 40 psi at all delivery nodes in the system;
- Limit the maximum pressure to 150 psi and maximum velocity to 7 feet per second (fps) everywhere in the system to use low pressure class pipe and minimize friction loss; and
- Locate and size booster pump stations.

Using the Sebastopol irrigation distribution network as an example, this memo describes the approach used to optimize the irrigation system and set model design criteria.

APPROACH

Several steps make up the optimization process. First the irrigation demand for each area of the distribution system must be determined. Second, an optimization using KYPIPE computer modeling based on the criteria stated above must be made. Finally, the design criteria for pipeline sizing and pump station location and sizing must be determined based on the results of the optimization model runs.

Determine Irrigation Demand

When developing the modeling input, three questions were generated. These questions directly impact the irrigation demands that the systems, and portions of the systems must be able to deliver to meet the peak irrigation requirement. These questions were:

1. What is the expected irrigation rotation schedule for most of the irrigated lands served by the pipeline network?
2. How are the peak demands related?
3. What is the expected peak demand of the irrigated lands?

The results of each of the questions are addressed in order in this technical memorandum. The impacts of these conclusions will be discussed and recommendations for implementation provided. The resulting irrigation demand factors are then used to determine the irrigation demands to be supplied by the distribution system by applying the factor to the irrigation acreages to calculate a demand at that location.

Rotation Schedule

The rotation schedule is defined as the time it takes for a farmer to irrigate his land and the down time between irrigation cycles that he will require for maintenance. An example of this concept: a 12 day rotation could consist of 10 days of irrigation and 2 days for rest maintenance. Conversations with operations personnel of the City of Santa Rosa indicate that the rotation schedule for the existing irrigated lands ranges from 5 to 12 days. It was agreed that a design rotation cycle of 8 days should be used for the modeling. Recommendation from Parsons ES engineers experienced with agricultural operations concur with this assumption.

For the purposes of this preliminary evaluation, it was assumed that the water would be delivered to sprinkler systems. Sprinkler systems have efficiencies ranging from 60 percent to 85 percent depending upon the design requirements. Due to the requirements of “no surface runoff” and “zero impacts” on the estuaries in the West County area, efficiencies of 80 percent were assumed for Sebastopol and the South County and 85 percent for West County. An irrigation deficit of 10 percent was further assumed for West County.

The demand of an average individual farm with sprinklers is calculated by the following equation.

$$Q_d = (\text{Demand} \times \text{Acreage}) \times (\text{Rotation} / \text{Days Irrigation}) / \text{efficiency} \text{ (equation 1)}$$

Where:

Qd	=	amount of water to be delivered to the farm (gpm);
Demand	=	average demand per acre(gpm/acre);
Acres	=	Total acres of the farm (acres);
Rotation	=	Length of Rotation (days) (8);
Days Irrigation	=	Actual irrigation days per rotation (days) (7);
Efficiency	=	Irrigation Efficiency of the System

For pipes serving multiple farms, a rotation of watering turns between farmers begins to occur and the term (Rotation/Days Irrigation) is neutralized. The net total demand requirement that must be supplied by the reservoirs and treatment plant becomes:

$$Q_d = (\text{Demand} \times \text{Acreage}) \text{ (equation 2)}$$

To eliminate the challenge of addressing each individual farm, a minimum pipe size of 8 inches was assumed based upon friction loss in the pipe to serve a 40 acre farm. This restriction will also comply with design requirements for the actual physical features on the farm which will require a minimum diameter of 6 inches for the farm distribution laterals and appurtenances.

The remainder of the distribution lines were sized using KYPIPE computer model runs based upon the pressure required at the farm delivery points (40 psi) and the optimization rationale:

Expected Peak Demand

A comparison of the annual water demands currently estimated by Questa Engineering and previously estimated by CH2M Hill was completed. Those values are listed below in Table 1. As the data reflect, Questa suggests that there are three separate micro-climates within the proposed project area, with large variations in annual water demand. These variations will also be reflected in the peak demands within the project area.

Table 1

Expected Annual Water Demand

Area	Questa Estimate	CH2M Hill Estimate
West County	20 inches	24 inches
South County	28 inches	24 inches
Sebastopol	17 inches	24 inches

Comparing peak demands calculated based on annual demands estimated by Questa and the peak day demands previously estimated by CH2M Hill, the expected peak demand for each area was estimated. These results are shown in Table 2.

Table 2

Expected Peak Demands

Area	Questa Estimate	CH2M Hill Estimate
West County	5.83 gpm/acre	7 gpm/acre
South County	8.17 gpm/acre	7 gpm/acre
Sebastopol	4.95 gpm/acre	7 gpm/acre

A verification of these values was accomplished using three procedures. First, the Sebastopol area is near the lands currently being irrigated by reclaimed water. The amount of water currently being applied to these lands, based upon Reclamation Annual Report of 1994 (Utilities Department, Subregional Water Reclamation System, Santa Rosa California), appears to be approximately 4.85 gpm/acre. With the expected improvements in irrigation efficiencies, these values closely correlate to the proposed demand values for Sebastopol and West County.

Second, assumptions were made using a ratio of probable peak demand to annual water demand. Peak and average estimates for a similar climate were taken from Keller, Jack and Ron Bliesner, Sprinkler and Trickle Irrigation, Van Nostrand Reinhold, 1990, page 31. This ratio was applied to the CH2M Hill estimated annual average of 24 inches of water per year. This resulted in an average demand of 6.62 gpm/acre, close to the current estimate for South County.

Third, estimates of the peak demand based upon Keller and Bliesner were made for the expected crops (i.e., alfalfa, pasture, grain, grapes, and orchard). This was expected to provide an upper limit to the allowable water demands. Assuming 80 percent irrigation efficiency, the upper limit is 7.08 gpm/acre.

The final result of these calculations supports the proposed demands in Table 2. Considering these results, the demands estimated based upon the current Questa annual water estimates appear to be an accurate representation of the irrigation demands.

Demand Conclusions

The peak irrigation demands were calculated using projected water requirements and are listed in Table 2. These estimates were applied to equation 2 to estimate the demands at the proposed

irrigation distribution system nodes, as they would be seen by the reservoir and treatment plant supplies to the system.

In order to address those lands that fall within the realm of equation 1 (i.e., small diameter pipelines serving individual farms), a minimum pipe size of 8 inches has been assumed. This assumption further reflects the requirements of the expected on-farm physical features. This procedure reflects the water demands that will be exerted by the entire proposed irrigation distribution system once completed.

Optimization of Irrigation System

Obtain Relative System Costs

Continuing our use of the proposed Sebastopol irrigation system as an example of these network analyses, the irrigation system in the Sebastopol area can be characterized as a branching type network. At the far end of the system is node no. 142 in the model data. Model results consistently indicate this node to be the lowest pressure node in the system. Because it is a branch system, the diameter of the pipes from the pump station to node 142, (i.e., the trunkline) directly affect the pressure at that node and the horsepower required to achieve the minimum pressure required at that node. That is, the larger the trunk pipeline diameter, the smaller the required horsepower to obtain 40 psi at the node. Conversely, smaller diameter pipe along the trunkline would result in a greater pump station horsepower required to supply 40 psi at the node.

Initially, three scenarios, based on varying the trunkline velocity, were modeled to make a cost comparison between systems. These scenarios compared the present worth of the capital and operating costs. The three scenarios are as follows:

- No.1: Hold trunkline velocity to 1 to 2 ft/s. Maintain 40 psi at node 142. (Results contained in file SEB.OUT)
- No. 2: Hold trunkline velocity to 3 to 6 ft/s. Maintain 40 psi at node 142. (Results contained in file SEB1.OUT)
- No. 3: Hold trunkline velocity to 10 to 13 ft/s. Maintain 40 psi at node 142. (Results contained in file SEB2.OUT)

The results of each scenario are attached along with their relative costs. Pipes on the trunkline are indicated with arrows. From the tables it can be seen that the relative least cost system is produced by Scenario No. 1 with an associated 1,650 horsepower main pump station at Delta Pond. Relative total construction and present worth operating costs for each scenario are presented in Tables 3 through 5. The file names of the scenario are shown in the upper left corner of the tables. The tabulated pipe lengths and diameters are those of the trunkline for each of the scenarios and were obtained from the model output file.

Refine Least Cost System Scenario

The least cost scenario was then refined, decreasing the main pump station horsepower to produce a maximum pressure of 150 psi at nodes along the trunkline. Booster pumps are incorporated as required to supply the minimum required pressure at the extreme node. Diameters of pipes branching from the trunkline are then varied to produce the minimum required pressure at the nodes along the branch. If the minimum required pressure cannot be achieved while maintaining a minimum velocity of 1.5 fps, a booster pump is added. This process is repeated until the system meets all the criteria listed above. Results of this refinement are attached in the file SEBOPT.OUT. Table 6 presents the cost of the system.

Optimization Recommendations

This approach was used to also optimize South County and West County area distribution systems. It is considered necessary to perform the evaluation on only one of the reservoirs in each area. The pipeline lengths and elevations of each area are of similar magnitude. Thus it was concluded that multiple analyses would produce similar results. It is recommended that once a project is selected for actual design, additional model runs be performed for the different irrigation area networks to refine sizing of pipelines and location and sizing of booster pump stations. Additional optimization may result in elimination of some pump stations by tradeoffs between changes in pipe size or system operating pressure. For preliminary engineering purposes in support of preparation of the EIR, the current results from the model runs completed for the proposed irrigation areas are considered satisfactory.

Selected Design Criteria

Based on the optimization analyses performed, the issues related to irrigation demand, and the irrigation system minimum mechanical requirements, the following design criteria were selected for use in the KYPIPE modeling:

- Pipeline velocity: 3 to 5 fps;
- Minor system losses: Losses at bends and tees are insignificant until the final design process and will be ignored in this analysis;
- Friction losses: Friction loss per 1,000 feet of pipe to be less than 3 feet per 1,000 feet;
- Minimum pipe diameter: 8 inches;
- Roughness coefficient: $C=140$ for pipe diameters 8 through 24 inch, $C=130$ for pipe diameters greater than 24 inch;
- Minimum pressure at demand point: 40 psi;
- Maximum pressure: 150 psi;

- Pressure reducing valves (PRV): Demand points with pressures greater than 60 psi will require PRVs;
- Maximum flow from the plant: Reservoir supply - 26.00 MGD, Irrigation system supply - 21.00 MGD; and
- Maximum flow from each ASR study area: 5.56 MGD.

CONCLUSIONS AND RECOMMENDATIONS

The demand factors have been analyzed using available data and accepted agricultural irrigation practices. The peak demand factors used in the KYPIPE models are :

- West County: 5.83 gpm/acre
- South County: 8.17 gpm/acre; and
- Sebastopol: 4.95 gpm/acre.

An optimization procedure to meet all the requirements stated in the Introduction has been developed. From this optimization process system design criteria have been developed. These criteria are presented above. These criteria were used in the KYPIPE modeling of the following systems:

- Transmission to the following reservoirs:

Tolay A
 Adobe Road
 Lakeville
 Tolay C
 Sears Point
 Two Rock
 Bloomfield
 Carroll Road
 Valley Ford
 Huntley

- Distribution Systems:

2A - Tolay A to: all South County / Lakeville & Bay Flats irrigation areas
 2B - Adobe & Lakeville to: all South County / Lakeville & Bay Flats
 2C - Tolay C to: all South County / Lakeville & Bay Flats
 2D - Sears Point & Lakeville to: all South County / Lakeville & Bay Flats
 2E - Smaller Tolay A and ASR to: all South County / Lakeville & Bay Flats
 3A - Two Rock to: Stemple Creek / Americano Creek

- 3B - Bloomfield to: Stemple Creek / Americano Creek
- 3C - Carroll Road to: Stemple Creek / Americano Creek
- 3D - Valley Ford to: Stemple Creek / Americano Creek
- 3E - Huntley to: Stemple Creek / Americano Creek
- 3F - Smaller Two Rock and ASR to: Stemple Creek / Americano Creek

The results of all of these irrigation network model analyses for the proposed South County, West County, and Sebastopol irrigation areas are presented in Tables 7 and 8. Table 7 presents a summary of the pump and booster stations for each of the systems resulting from the model. Table 8 presents a summary of the pipelines and associated costs for each of the modeled systems. The determination of the diameter for each pipeline and the location and sizing of each booster pump station is presented. Again, these are results from this preliminary level of analyses in support of the preparation of the EIR. They are considered satisfactory to establish viable project alternatives and to obtain preliminary cost estimates, but would need to be refined in detail design for the actual selected project. Graphical representations of the irrigation systems are included for information purposes in the appendix.

Table 3

SEB.DAT pipe sizes, lengths and pump station power

Pipe No.	Node No.	Node No.	Pipe Length (ft)	Diameter (in)
95	79	95	3400	54
110	151	95	12200	54
149	0	151	1	54
79	78	79	2300	48
84	78	84	2800	40
87	84	87	1300	36
88	87	88	1700	36
89	88	89	1000	36
98	89	98	2500	36
100	98	124	1500	32
101	100	101	2300	32
126	124	100	700	32
107	101	107	2300	30
108	107	150	1500	30
127	150	149	2600	30
128	149	126	5200	30
130	126	128	4400	24
131	128	129	1500	24
132	129	130	700	24
139	130	137	1600	16
141	137	139	1400	14
142	139	140	500	12
144	140	142	4200	12

Item	Unit	No. Units	Unit Cost	Total
Pipe Dia. (in.)				
54	L.F.	15,601	181	\$2,823,781
48	L.F.	2,300	146	335,800
40	L.F.	2,800	131	366,800
36	L.F.	6,500	121	786,500
32	L.F.	4,500	100	450,000
30	L.F.	11,600	117	1,357,200
24	L.F.	6,600	67	442,200
16	L.F.	1,600	45	71,467
14	L.F.	1,400	39	54,717
12	L.F.	4,700	34	157,450
Pump Station (1650 Hp)	EA.	1	4,000,000	4,000,000
			Capital Costs	10,845,914
			Energy Cost	13,373,872
			Total	24,219,786

PW Factor 12.4031
 i= 7.5
 n= 30

Energy Use (kW-hr/yr) 10,782,684
 Energy Cost (\$/kW-hr) 0.1

Table 4

SEB1.DAT pipe sizes, lengths and pump station power

Pipe No. Node No. Node No. Pipe Length Diameter
(ft) (in)

79	78	79	2300	30
95	79	95	3400	30
110	151	95	12200	30
149	0	151	1	30
84	78	84	2800	24
87	84	87	1300	22
88	87	88	1700	22
89	88	89	1000	22
98	89	98	2500	22
100	98	124	1500	20
101	100	101	2300	20
126	124	100	700	20
107	101	107	2300	18
108	107	150	1500	18
127	150	149	2600	18
128	149	126	5200	18
130	126	128	4400	16
131	128	129	1500	14
132	129	130	700	14
139	130	137	1600	10
141	137	139	1400	8
142	139	140	500	8
144	140	142	4200	6

Item	Unit	No. Units	Unit Cost	Total
Pipe Dia. (in.)				
30	L.F.	17,901	117	\$2,094,417
24	L.F.	2,800	67	187,600
22	L.F.	6,500	61	399,208
20	L.F.	4,500	61	276,375
18	L.F.	11,600	50	582,900
16	L.F.	4,400	45	196,533
14	L.F.	2,200	39	85,983
10	L.F.	1,600	28	44,667
8	L.F.	1,900	22	42,433
6	L.F.	4,200	17	70,350

Pump Station (2400 Hp)	EA.	1	5,000,000	5,000,000
Capital Costs				8,980,467
Energy Cost				19,452,904
Total Cost				28,433,371

PW Factor 12.4031
i= 7.5
n= 30

Energy Use (kW-hr/yr) 15,683,904
Energy Cost (\$/kW-hr) 0.1

Table 5

SEB2.DAT pipe sizes, lengths and pump station power

Pipe No.	Node No.	Node No.	Pipe Length (ft)	Diameter (in)
149	0	151	1	22
110	151	95	12200	22
95	79	95	3400	22
79	78	79	2300	20
89	88	89	1000	16
88	87	88	1700	16
87	84	87	1300	16
84	78	84	2800	16
126	124	100	700	14
101	100	101	2300	14
100	98	124	1500	14
98	89	98	2500	14
128	149	126	5200	12
127	150	149	2600	12
108	107	150	1500	12
107	101	107	2300	12
131	128	129	1500	10
130	126	128	4400	10
132	129	130	700	8
141	137	139	1400	6
139	130	137	1600	6
142	139	140	500	5
144	140	142	4200	4

Item	Unit	No. Units	Unit Cost	Total
Pipe Dia. (in.)				
22	L.F.	15,601	61	958,161
20	L.F.	2,300	56	128,417
16	L.F.	6,800	45	303,733
14	L.F.	7,000	39	273,583
12	L.F.	11,600	34	388,600
10	L.F.	5,900	28	164,708
8	L.F.	700	22	15,633
6	L.F.	3,000	17	50,250
5	L.F.	500	14	6,979
4	L.F.	4,200	11	46,900
Pump Station (7000 Hp)	EA.	1	9,000,000	9,000,000
Capital Costs				11,336,966
Energy Cost				56,737,637
Total Cost				68,074,603

PW Factor 12.4031
 i= 7.5
 n= 30

Energy Use (kW-hr/yr) 45,744,720
 Energy Cost (\$/kW-hr) 0.1

Table 6

SEBOPT.DAT pipe sizes, lengths and pump station power

Pipe No.	Node No.	Node No.	Pipe Length (ft)	Diameter (in)
97	97	89	97	1.5
94	93	94	4000	2
99	96	99	1000	3
109	108	9	450	3
135	131	33	900	3
71	70	71	3500	4
96	79	96	1400	4
111	150	8	1000	4
125	124	25	2000	4
136	135	36	1400	4
140	137	38	2300	4
143	140	41	1500	4
86	85	86	3700	5
90	89	90	1100	5
91	90	91	750	5
92	91	92	2300	5
137	134	35	1300	5
148	75	48	2500	5
72	71	72	2900	6
85	84	85	2200	6
93	91	93	1200	6
103	102	3	400	6
105	104	5	300	6
106	104	6	1100	6
129	127	28	3200	6
138	132	34	6100	6
73	72	73	1500	8
76	75	76	3400	8
80	79	80	2100	8
81	80	81	2100	8
82	81	82	3800	8
83	82	83	1700	8
102	101	2	1700	8
104	102	4	900	8
74	73	74	2700	12
133	130	31	2500	12
134	131	32	900	12
142	139	40	500	12
144	140	42	4200	12
75	74	75	6900	14
141	137	39	1400	14
139	130	37	1600	16
77	75	77	1300	20
78	77	78	1500	20
130	126	28	4400	24
131	128	29	1500	24
132	129	30	700	24
107	101	7	2300	30
108	107	50	1500	30
127	150	49	2600	30
128	149	26	5200	30
100	98	24	1500	32
101	100	1	2300	32
126	124	0	700	32
87	84	87	1300	36
88	87	88	1700	36
89	88	89	1000	36
98	89	98	2500	36
84	78	84	2800	40
79	78	79	2300	48
95	79	95	3400	54
110	151	95	12200	54
149	0	51	1	54

Item	Unit	No. Units	Unit Cost	Total
Pipe Dia. (in.)				
1.5	L.F.	97	4	406
2	L.F.	4,000	6	22,333
3	L.F.	2,350	8	19,681
4	L.F.	13,100	11	144,100
5	L.F.	11,850	14	163,100
6	L.F.	8,100	17	137,700
8	L.F.	17,200	22	378,400
12	L.F.	10,800	34	367,200
14	L.F.	8,300	39	323,700
16	L.F.	1,800	45	72,000
20	L.F.	2,800	61	170,800
24	L.F.	6,800	67	442,200
30	L.F.	11,600	117	1,357,200
32	L.F.	4,500	100	450,000
36	L.F.	6,500	121	786,500
40	L.F.	2,800	131	366,800
48	L.F.	2,300	146	335,800
54	L.F.	15,601	181	2,823,781
Pump Station (900 Hp)	EA.	1	9,000,000	9,000,000
Booster Pump Stations				
10 Hp	EA.	1	200,000	200,000
2.5 Hp	EA.	1	9,000	9,000
40 Hp	EA.	1	450,000	450,000
35 Hp	EA.	1	420,000	420,000

Capital Costs 18,440,702

Energy Cost 8,400,000

Total Cost 26,840,702

PW Factor 12.4031

j= 7.5

n= 30

Energy Use (kW-hr/yr) 6,453,273

Energy Cost (\$/kW-hr) 0.1

Table 2
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

				Pump Eff (%)	80	
				Motor Eff. (%)	92	
Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta. Flow rate	Pump Sta. TDH (ft)
					(gpm)	
Sebastopol	SEB - 1	Pipe No. 149	850	1,155	9,681	348
	BPS -1	Pipe No. 76	3	4	220	54
	BPS -2	Pipe No. 87	125	170	5,059	98
	BPS -3	Pipe No. 133	25	34	749	132
	BPS -4	Pipe No. 144	25	34	420	236
South County						
Alternative 2A						
Tolay A Reservoir - All South County	PS-S	Pipe No. 152	1230	1,671	18,056	270
	SBPS-4	Pipe No. 7	20	27	1,289	61
	SBPS-6	Pipe No. 13	5	7	606	33
	SBPS-10	Pipe No. 18	70	95	2,346	118
	SBPS-12	Pipe No. 23	125	170	16,534	30
	SBPS-32	Pipe No. 155	2100	2,853	22,430	371
	SBPS-33	Pipe No. 163	5	7	810	24
	SBPS-36	Pipe No. 300	60	82	2,414	98
Tolay A Reservoir - Lakeville & Bay Flats	PS-S	Pipe No. 152	1230	1,671	18,056	270
	SBPS-32	Pipe No. 155	600	815	13,082	182
	SBPS-33	Pipe No. 163	10	14	810	49
	SBPS-36	Pipe No. 300	50	68	2,414	82

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

			Pump Eff (%)	80		
			Motor Eff. (%)	92		
Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta. Flow rate (gpm)	Pump Sta. TDH (ft)
Alternative 2B						
Adobe Rd. & Lakeville Reservoirs - All South County						
	PS-S	Pipe No. 152	1325	1,800	18,056	291
	SBPS-4	Pipe No. 7	20	27	1,289	61
	SBPS-6	Pipe No. 13	5	7	606	33
	SBPS-10	Pipe No. 18	80	109	2,346	135
	SBPS-12	Pipe No. 23	650	883	18,400	140
	SBPS-13	Pipe No. 28	30	41	22,430	5
	SBPS-14	Pipe No. 34	5	7	1,235	16
	SBPS-18	Pipe No. 51	375	510	7,547	197
	SBPS-20	Pipe No. 58	25	34	1,678	59
	SBPS-22	Pipe No. 63	5	7	499	40
	SBPS-23	Pipe No. 65	250	340	4,513	219
	SBPS-28	Pipe No. 116	5	7	1,821	11
	SBPS-30	Pipe No. 153	100	136	36,635	11
	SBPS-31	Pipe No. 154	250	340	17,015	58
	SBPS-36	Pipe No. 300	75	102	3,136	95
Adobe Rd. & Lakeville Reservoirs - Lakeville & Bay Flats						
	PS-S	Pipe No. 152	1325	1,800	18,056	291
	SBPS-18	Pipe No. 51	250	340	7,547	131
	SBPS-21	Pipe No. 60	5	7	1,134	17
	SBPS-22	Pipe No. 63	5	7	499	40
	SBPS-23	Pipe No. 65	200	272	4,513	175
	SBPS-28	Pipe No. 116	5	7	2,091	9
	SBPS-30	Pipe No. 153	200	272	8,385	94
	SBPS-31	Pipe No. 154	300	408	11,211	106
	SBPS-36	Pipe No. 300	75	102	3,136	95

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

				Pump Eff (%)	80	
				Motor Eff. (%)	92	
Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta.	Pump Sta. TDH (ft)
					Flow rate (gpm)	
Alternative 2C						
Tolay C Reservoir - All South County	PS-S	Pipe No. 152	1200	1,630	18,056	263
	SBPS-3	Pipe No. 3	30	41	2,472	48
	SBPS-4	Pipe No. 7	40	54	1,289	123
	SBPS-5	Pipe No. 12	30	41	1,815	65
	SBPS-7	Pipe No. 14	4.5	6	1,059	17
	SBPS-8	Pipe No. 15	2	3	865	9
	SBPS-10	Pipe No. 18	95	129	2,346	160
	SBPS-12	Pipe No. 23	390	530	16,534	93
	SBPS-13	Pipe No. 28	25	34	3,178	31
	SBPS-14	Pipe No. 34	6	8	1,235	19
	SBPS-16	Pipe No. 42	2	3	852	9
	SBPS-19	Pipe No. 52	158	215	6,574	95
	SBPS-23	Pipe No. 65	76	103	4,186	72
	SBPS-25	Pipe No. 67	128	174	2,809	180
	SBPS-26	Pipe No. 112	385	523	50,570	30
	SBPS-32	Pipe No. 155	775	1,053	50,570	61
Tolay C Reservoir - Lakeville & Bay Flats	PS-S	Pipe No. 152	1200	1,630	18,056	263
	SBPS-19	Pipe No. 52	160	217	6,574	96
	SBPS-20	Pipe No. 58	30	41	2,242	53
	SBPS-22	Pipe No. 63	11	15	946	46
	SBPS-23	Pipe No. 65	120	163	3,791	125
	SBPS-25	Pipe No. 67	110	149	2,414	180
	SBPS-26	Pipe No. 112	390	530	18,000	86
	SBPS-27	Pipe No. 113	5	7	1,633	12

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

			Pump Eff (%)	80		
			Motor Eff. (%)	92		
Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta. Flow rate (gpm)	Pump Sta. TDH (ft)
Alternative 2D						
Sears Pt. & Lakeville Reservoirs - All South County	PS-S	Pipe No. 152	975	1,325	18,056	214
	SBPS-1	Pipe No. 1	1	1	480	8
	SBPS-4	Pipe No. 7	22	30	1,289	68
	SBPS-6	Pipe No. 13	3.5	5	606	23
	SBPS-8	Pipe No. 15	9	12	865	41
	SBPS-9	Pipe No. 16	164	223	9,383	69
	SBPS-10	Pipe No. 18	31	42	2,346	52
	SBPS-11	Pipe No. 22	17	23	2,605	26
	SBPS-12	Pipe No. 23	290	394	16,534	69
	SBPS-13	Pipe No. 28	30	41	3,178	37
	SBPS-14	Pipe No. 34	6	8	1,235	19
	SBPS-15	Pipe No. 40	5	7	1,642	12
	SBPS-16	Pipe No. 42	2.5	3	852	12
	SBPS-17	Pipe No. 48	285	387	7,546	150
	SBPS-23	Pipe No. 65	35	48	4,967	28
	SBPS-24	Pipe No. 66	480	652	12,718	149
	SBPS-25	Pipe No. 67	170	231	3,590	188
	SBPS-29	Pipe No. 124	2660	3,614	40,196	262
Sears Pt. & Lakeville Reservoirs - Lakeville & Bay Flats	PS-S	Pipe No. 152	975	1,325	18,056	214
	SBPS-17	Pipe No. 48	355	482	7,546	186
	SBPS-21	Pipe No. 60	15	20	1,701	35
	SBPS-22	Pipe No. 63	3	4	946	13
	SBPS-23	Pipe No. 65	116	158	4,967	92
	SBPS-24	Pipe No. 66	110	149	5,186	84
	SBPS-25	Pipe No. 67	172	234	3,590	190
	SBPS-29	Pipe No. 124	765	1,039	14,939	203

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

			Pump Eff (%)	80		
			Motor Eff. (%)	92		
Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta. Flow rate (gpm)	Pump Sta. TDH (ft)
Alternative 2E						
Smaller Tolay A Reservoir & ASR - All South County	PS-S	Pipe No. 152	1500	2,038	18,056	329
	SBPS-2	Pipe No. 2	11	15	2,038	21
	SBPS-4	Pipe No. 7	20	27	1,289	61
	SBPS-5	Pipe No. 12	17	23	1,815	37
	SBPS-10	Pipe No. 18	80	109	2,346	135
	SBPS-12	Pipe No. 23	485	659	16,534	116
	SBPS-13	Pipe No. 28	20	27	3,178	25
	SBPS-14	Pipe No. 34	4	5	1,105	14
	SBPS-16	Pipe No. 42	0.5	1	852	2
	SBPS-18	Pipe No. 51	15	20	684	87
	SBPS-32	Pipe No. 155	1910	2,595	36,922	205
	SBPS-34	Pipe No. 166	175	238	4,436	156
	SBPS-35	Pipe No. 167	195	265	4,483	172
	SBPS-36	Pipe No. 999	45	61	2,414	74
Smaller Tolay A Reservoir & ASR - Lakeville & Bay Flats	PS-S	Pipe No. 152	1500	2,038	18,056	329
	SBPS-18	Pipe No. 51	5	7	684	29
	SBPS-32	Pipe No. 155	450	611	9,000	198
	SBPS-33	Pipe No. 163	3.5	5	810	17
	SBPS-34	Pipe No. 166	620	842	3,873	634
	SBPS-36	Pipe No. 999	55	75	2,414	90

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

				Pump Eff (%)	80	
				Motor Eff. (%)	92	
					Pump Sta.	
	Irrigation	Pump Sta.	Pump Sta.	Delivered	Installed	Pump Sta.
	Area	No.	Location.	HP	HP	Flow rate
						(gpm)
						Pump Sta.
						TDH (ft)
<hr/>						
West County						
Alternative 3A						
Two Rock Reservoir - Stemple						
	PS-S	Pipe No. 147	1500	2,038	18,056	329
	PS-TR	Pipe No. 1	350	476	17,660	78
	WBPS-1	Pipe No. 30	2.5	3	223	44
	WBPS-2	Pipe No. 40	150	204	1,474	403
	WBPS-3	Pipe No. 55	7.5	10	296	100
	WBPS-4	Pipe No. 58	70	95	1,556	178
	WBPS-5	Pipe No. 62	325	442	7,555	170
Two Rock Reservoir - Americano						
	PS-S	Pipe No. 147	1500	2,038	18,056	329
	PS-TR	Pipe No. 1	750	1,019	7,566	393
	WBPS-6	Pipe No. 127	12.5	17	679	73
	WBPS-7	Pipe No. 129	5	7	572	35
	WBPS-8	Pipe No. 137	7.5	10	509	58
	WBPS-9	Pipe No. 140	11	15	664	66
	WBPS-10	Pipe No. 144	2.5	3	136	73
Alternative 3B						
Bloomfield Reservoir - Stemple						
	PS-S	Pipe No. 147	1450	1,970	18,056	318
	PS-B	Pipe No. 107	750	1,019	17,494	170
	WBPS-1	Pipe No. 30	2.5	3	223	44
	WBPS-2	Pipe No. 40	150	204	1,474	403
	WBPS-3	Pipe No. 55	7.5	10	296	100
	WBPS-4	Pipe No. 58	70	95	1,556	178
	WBPS-5	Pipe No. 62	325	442	7,555	170

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

				Pump Eff (%)	80	
				Motor Eff. (%)	92	
Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta. Flow rate (gpm)	Pump Sta. TDH (ft)
Bloomfield Reservoir - Americano	PS-S	Pipe No. 147	1450	1,970	18,056	318
	PS-B	Pipe No. 107	350	476	7,564	183
	WBPS-6	Pipe No. 127	15	20	679	87
	WBPS-8	Pipe No. 137	5	7	509	39
	WBPS-9	Pipe No. 140	5	7	664	30
	WBPS-10	Pipe No. 144	1.5	2	136	44
Alternative 3C						
Carroll Road Reservoir - Stemple	PS-S	Pipe No. 147	1200	1,630	18,056	263
	PS-CR	Pipe No. 112	750	1,019	17,571	169
	WBPS-1	Pipe No. 30	2.5	3	223	44
	WBPS-2	Pipe No. 40	150	204	1,474	403
	WBPS-3	Pipe No. 55	7.5	10	296	100
	WBPS-4	Pipe No. 58	70	95	1,556	178
	WBPS-5	Pipe No. 62	315	428	7,555	165
Carroll Road Reservoir - Americano	PS-S	Pipe No. 147	1200	1,630	18,056	263
	PS-CR	Pipe No. 112	350	476	7,960	174
	WBPS-11	Pipe No. 91	5	7	820	24
	WBPS-6	Pipe No. 127	10	14	679	58
	WBPS-7	Pipe No. 129	2.5	3	572	17
	WBPS-8	Pipe No. 137	7.5	10	509	58
	WBPS-9	Pipe No. 140	12.5	17	664	75
	WBPS-10	Pipe No. 144	5	7	136	146

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

				Pump Eff (%)	80	
				Motor Eff. (%)	92	
Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta.	Pump Sta. TDH (ft)
					Flow rate (gpm)	
Alternative 3D						
Valley Ford Reservoir - Stemple	PS-S	Pipe No. 147	950	1,291	18,056	208
	PS-VF	Pipe No. 119	900	1,223	17,592	203
	WBPS-1	Pipe No. 30	2.5	3	223	44
	WBPS-2	Pipe No. 40	150	204	1,474	403
	WBPS-3	Pipe No. 55	10	14	296	134
	WBPS-4	Pipe No. 58	75	102	1,556	191
	WBPS-5	Pipe No. 62	350	476	7,555	183
Valley Ford Reservoir - Americano	PS-S	Pipe No. 147	950	1,291	18,056	208
	PS-VF	Pipe No. 119	350	476	6,219	223
	WBPS-11	Pipe No. 91	5	7	820	24
	WBPS-6	Pipe No. 127	11	15	679	64
	WBPS-7	Pipe No. 129	2.5	3	572	17
	WBPS-8	Pipe No. 137	7.5	10	509	58
	WBPS-9	Pipe No. 140	10	14	664	60
	WBPS-10	Pipe No. 144	2.5	3	136	73
Alternative 3E						
Huntley Reservoir - Stemple	PS-S	Pipe No. 147	1600	2,174	18,056	351
	PS-H	Pipe No. 32	650	883	17,508	147
	WBPS-2	Pipe No. 40	150	204	1,474	403
	WBPS-3	Pipe No. 55	9	12	296	120
	WBPS-4	Pipe No. 58	80	109	1,556	204
	WBPS-5	Pipe No. 62	350	476	7,555	183

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

Pump Eff (%) **80**
Motor Eff. (%) **92**

Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta. Flow rate	Pump Sta. TDH (ft)
					(gpm)	
Huntley Reservoir - Americano	PS-S	Pipe No. 147	1600	2,174	18,056	351
	PS-H	Pipe No. 32	450	611	7,788	229
	WBPS-6	Pipe No. 127	10	14	679	58
	WBPS-7	Pipe No. 129	5	7	572	35
	WBPS-8	Pipe No. 137	7.5	10	509	58
	WBPS-9	Pipe No. 140	12.5	17	664	75
	WBPS-10	Pipe No. 144	2.5	3	136	73
Alternative 3F						
Two Rock Reservoir & ASR - Stemple	PS-S	Pipe No. 147	1500	2,038	18,056	329
	PS-TW	Pipe No. 1	175	238	12,516	55
	PS-ASR2	Pipe No. 220	200	272	4,635	171
	WBPS-1	Pipe No. 30	2.5	3	223	44
	WBPS-2	Pipe No. 40	150	204	1,474	403
	WBPS-3	Pipe No. 55	7.5	10	296	100
	WBPS-4	Pipe No. 58	70	95	1,556	178
	WBPS-5	Pipe No. 62	250	340	7,555	131
	WBPS-19	Pipe No. 75	15	20	979	61

Table 7
Summary of Irrigation Pump Stations
by Area, Reservoir and Irrigation Watershed

				Pump Eff (%)	80	
				Motor Eff. (%)	92	
Irrigation Area	Pump Sta. No.	Pump Sta. Location.	Delivered HP	Installed HP	Pump Sta. Flow rate (gpm)	Pump Sta. TDH (ft)
Two Rock Reservoir & ASR - Americano	PS-S	Pipe No. 147	1500	2,038	18,056	329
	PS-TW	Pipe No. 1	50	68	3,956	50
	PS-ASR2	Pipe No. 220	100	136	4,645	85
	WBPS-12	Pipe No. 96	0.5	1	29	68
	WBPS-13	Pipe No. 100	35	48	1,838	75
	WBPS-14	Pipe No. 110	5	7	243	81
	WBPS-15	Pipe No. 117	2.5	3	136	73
	WBPS-16	Pipe No. 125	100	136	2,599	152
	WBPS-7	Pipe No. 129	20	27	572	138
	WBPS-17	Pipe No. 136	25	34	548	181
	WBPS-9	Pipe No. 140	30	41	664	179
	WBPS-18	Pipe No. 143	25	34	490	202



TABLE 8
Alternative South and West County Pipe Costs

Alternative South County Projects Summary
2A2-2E2
Lakeville and Bay Flats

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	27	30	36	42	48	54	60	Total
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05	Length
	Length (Ft)																	
Alternative 2A-2																		
Length (ft)	7,600	8,800	9,800	0	0	20	0	8,600	0	0	0	2,000	10,500	21,820	108,520	0	0	178,660
Cost (\$1000)	153	248	285	0	0	1	0	587	0	0	0	315	1,725	3,822	20,403	0	0	
Total Cost (\$1000)	27,540																	
Alternative 2B-2																		
Length (ft)	1,700	1,000	4,300	4,100	0	5,600	0	11,520	0	7,900	0	31,300	8,400	7,500	96,040	20	0	179,380
Cost (\$1000)	34	25	125	159	0	261	0	786	0	753	0	4,929	1,380	1,314	18,056	4	0	
Total Cost (\$1000)	27,828																	
Alternative 2C-2																		
Length (ft)	1,700	1,100	7,500	0	8,400	0	2,900	0	3,700	9,300	0	17,100	0	18,320	115,020	0	0	185,040
Cost (\$1000)	34	28	218	0	359	0	162	0	286	886	0	2,693	0	3,209	21,625	0	0	
Total Cost (\$1000)	28,501																	
Alternative 2D-2																		
Length (ft)	800	1,100	3,000	0	2,700	0	2,900	0	7,500	13,000	0	18,900	59,600	6,400	103,120	0	0	219,020
Cost (\$1000)	16	28	87	0	115	0	162	0	580	1,239	0	2,976	9,793	1,121	19,388	0	0	
Total Cost (\$1000)	38,506																	
Alternative 2E-2																		
Length (ft)	1,700	1,100	11,400	0	7,800	0	2,910	0	4,300	27,440	12,700	9,420	22,500	105,020	0	0	0	206,290
Cost (\$1000)	34	28	332	0	333	0	163	0	332	2,615	1,605	1,483	3,697	18,396	0	0	0	
Total Cost (\$1000)	29,020																	

Alternative West County Projects Summary
Americano Creek System
3A2-3F2

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60	Total
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.28	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05	Length
Length (ft)																	
Two Rock To Americano																	
Alternative 3A-2																	
Length (ft)	13,500	25,800	14,650	1,850	0	3,350	2,300	2,300	0	11,600	25,250	35,950	0	24,650	0	0	161,000
Cost (\$1000)	273	648	426	72	0	156	128	157	0	1,106	3,976	5,907	0	4,634	0	0	
Total Cost (\$1000)	17,484																
Bloomfield-Americano																	
Alternative 3B-2																	
Length (ft)	13,500	28,300	22,500	6,750	10,500	6,450	8,700	2,300	7,800	10,150	12,550	3,000	4,800	42,200	0	0	179,500
Cost (\$1000)	273	716	655	262	449	301	486	157	603	967	1,976	493	841	7,934	0	0	
Total Cost (\$1000)	18,112																
Carol Rd.-Americano																	
Alternative 3C-2																	
Length (ft)	8,200	27,500	16,250	6,750	0	6,450	2,300	2,300	0	7,500	5,250	0	0	65,150	0	0	147,650
Cost (\$1000)	166	696	473	262	0	301	128	157	0	715	827	0	0	12,249	0	0	
Total Cost (\$1000)	15,973																
Valley Ford-Americano																	
Alternative 3D-2																	
Length (ft)	13,500	27,500	14,450	8,550	0	6,450	2,300	2,300	0	0	6,400	0	0	68,150	0	0	148,600
Cost (\$1000)	273	696	421	332	0	301	128	157	0	0	1,008	0	0	12,813	0	0	
Total Cost (\$1000)	18,128																
Huntley-Americano																	
Alternative 3E-2																	
Length (ft)	13,500	25,800	14,650	1,850	0	3,350	2,300	2,300	0	11,600	50,800	8,900	0	50,900	0	0	186,780
Cost (\$1000)	273	648	426	72	0	156	128	157	0	1,106	8,000	1,462	0	9,570	0	0	
Total Cost (\$1000)	21,998																
Two Rock/ASR-Americano																	
Alternative 3F-2																	
Length (ft)	13,500	25,800	14,650	1,850	0	3,350	6,400	20,600	0	7,500	6,950	19,050	16,900	4,120	20,150	0	160,620
Cost (\$1000)	273	648	426	72	0	156	357	1,406	0	715	1,094	3,130	2,960	775	4,284	0	
Total Cost (\$1000)	18,297																

Alternative South County Projects Summary
2A1-2E1
All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	28	30	36	42	48	54	60	Total
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05	Length
	Length (ft)																	
Alternative 2A-1																		
Length (ft)	14,100	11,300	15,900	14,800	0	8,120	9,700	16,600	0	6,500	0	16,600	7,300	12,400	152,320	10,800	6,020	302,760
Cost (\$1000)	285	286	463	574	0	379	542	1,147	0	620	0	2,614	1,200	2,172	28,638	2,318	1,511	
Total Cost (\$1000)	42,747																	
Alternative 2B-1																		
Length (ft)	15,300	9,600	8,900	11,000	0	14,300	14,100	9,520	0	16,400	0	52,100	5,800	16,600	101,380	0	0	274,980
Cost (\$1000)	309	243	259	427	0	668	787	650	0	1,563	0	8,205	953	2,908	19,057	0	0	
Total Cost (\$1000)	36,828																	
Alternative 2C-1																		
Length (ft)	3,800	8,200	14,100	0	26,400	0	25,600	0	9,900	21,800	3,000	19,500	9,100	12,400	107,520	0	19,720	288,840
Cost (\$1000)	73	207	410	0	1,128	0	1,430	0	765	2,078	379	3,071	1,495	2,172	20,215	0	4,951	
Total Cost (\$1000)	38,374																	
Alternative 2D-1																		
Length (ft)	3,700	8,200	11,900	0	17,700	0	25,600	0	6,700	22,100	3,000	15,100	40,800	5,300	122,220	32,300	0	314,620
Cost (\$1000)	75	207	346	0	756	0	1,430	0	518	2,106	379	2,378	6,704	928	22,979	6,868	0	
Total Cost (\$1000)	45,875																	
Alternative 2E-1																		
Length (ft)	4,800	8,200	20,300	0	22,800	0	28,010	0	6,100	39,040	3,000	16,000	26,000	108,520	26,900	6,020	0	315,490
Cost (\$1000)	93	207	591	0	974	0	1,564	0	471	3,721	379	2,520	4,272	19,009	5,057	1,280	0	
Total Cost (\$1000)	48,148																	
Sebastopol																		
Length (ft)	59,270	14,500	3,900	11,200	0	3,500	13,700	6,100	0	11,500	0	2,300	14,620	0	0	0	0	140,590
Cost (\$1000)	1,197	367	114	434	0	163	765	416	0	1,096	0	362	2,402	0	0	0	0	
Total Cost (\$1000)	7,317																	

Alternative West County Projects Summary
Stemple Creek System
3A1-3F1

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60	Total
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05	Length
	Length (Ft)																
Two Rock-Stemple																	
Alternative 3A-1																	
Length (ft)	25,500	22,050	24,450	0	12,100	0	12,250	0	9,700	12,850	17,900	1,200	0	80,200	0	7,400	226,600
Cost (\$1000)	515	558	712	0	517	0	684	0	750	1,225	2,819	197	0	15,078	0	1,858	
Total Cost (\$1000)	24,912																
Bloomfield-Stemple																	
Alternative 3B-1																	
Length (ft)	31,700	18,950	25,250	4,000	8,100	700	11,700	3,350	6,350	12,850	17,900	1,200	6,000	42,200	34,800	0	226,650
Cost (\$1000)	640	479	735	155	346	33	653	229	491	1,225	2,819	197	1,051	7,934	7,400	0	
Total Cost (\$1000)	24,387																
Carrol Rd.-Stemple																	
Alternative 3C-1																	
Length (ft)	26,400	22,250	27,250	0	12,100	0	12,400	0	9,700	12,850	17,900	1,200	37,000	35,150	0	21,400	235,600
Cost (\$1000)	533	563	793	0	517	0	693	0	750	1,225	2,819	197	6,481	6,609	0	5,372	
Total Cost (\$1000)	26,551																
Valley Ford-Stemple																	
Alternative 3D-1																	
Length (ft)	26,400	22,250	27,250	0	12,100	0	12,400	0	9,700	12,850	17,900	1,200	37,000	37,650	0	21,400	238,100
Cost (\$1000)	533	563	793	0	517	0	693	0	750	1,225	2,819	197	6,481	7,079	0	5,372	
Total Cost (\$1000)	27,021																
Huntley-Stemple																	
Alternative 3E-1																	
Length (ft)	30,100	16,400	27,250	0	12,100	0	11,700	0	5,100	9,650	6,700	28,300	18,150	61,400	0	0	224,850
Cost (\$1000)	608	415	793	0	517	0	653	0	394	920	1,055	4,650	2,829	11,544	0	0	
Total Cost (\$1000)	24,378																
Two Rock/ASR Stemple																	
Alternative 3F-1																	
Length (ft)	30,800	16,950	24,450	0	12,100	0	12,400	0	9,700	12,850	17,900	1,200	51,000	28,820	0	7,400	226,370
Cost (\$1000)	618	429	712	0	517	0	693	0	750	1,225	2,819	197	8,934	5,418	0	1,858	
Total Cost (\$1000)	24,168																

**Cost Summary
Alternative
Sebastapol**

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.3	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-71	3500															
S-72	2900															
S-73		1500														
S-74				2700												
S-75				6900												
S-76	3400															
S-77						1300										
S-78							1500									
S-79											2300					
S-80		2100														
S-81	2800															
S-82	3800															
S-83	1700															
S-84										2800						
S-85		2200														
S-86	3700															
S-87										1300						
S-88										1700						
S-89										1000						
S-90	1100															
S-91	750															
S-92	2300															
S-93	1200															
S-94	4500															
S-95												3400				
S-96	1400															
S-97	970															
S-98										2500						
S-99	1000									1500						
S-100																
S-101								2300								
S-102		1700														
S-103	400															
S-104		900														
S-105	300															
S-106	1100															
S-107								2300								
S-108								1500								
S-109	450															
S-110												11200				
S-111	1000															

Cost Summary
Alternative
Sebastapol

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.3	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-125	2000									700						
S-126							2600									
S-127							5200									
S-128																
S-129	3200						4400									
S-130						1500										
S-131						700										
S-132			2500													
S-133		900														
S-134																
S-135	900															
S-136	1400															
S-137	1300															
S-138	6100			1600												
S-139																
S-140	2300		1400													
S-141		1000														
S-142																
S-143	1500															
S-144		4200														
S-148	2500											20				
S-149																
Totals																
length (ft)	58,270	14,500	3,900	11,200	0	3,500	13,700	6,100	0	11,500	2,300	14,620	0	0	0	0
Cost (\$1000)	1,197	367	114	434	0	163	765	416	0	1,096	362	2,402	0	0	0	0
Total Cost (\$1000)	7,317															

Cost Summary
Alternative 2A-1
Tolay A - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-1	1400							500								
S-2								2100								
S-3										1300						
S-4											1400					
S-5											1600					
S-6																
S-7				2800												
S-8	1900															
S-9		2000														
S-10		1500														
S-11	1300						2800									
S-12																
S-13		1300														
S-14			2700													
S-15		1000									2400					
S-16																
S-17				2300												
S-18								7600								
S-19												3900				
S-20													2600			
S-21													1200			
S-22							2800							5300		
S-23															2200	
S-24															12400	
S-25											11200					
S-26																
S-27								2800								
S-28								2000							900	
S-29																
S-30			2000												15200	
S-31																
S-32	1300						600									
S-33																
S-34																
S-35		2500														
S-36	1300															
S-37																
S-38								1800								
S-39							3100									
S-40							3000									
S-41	3100															
S-42			1100													
S-43															4800	
S-44															5000	
S-45															1900	
S-46															5300	
S-49															3200	

Cost Summary
Alternative 2A-1
Tolay A - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-50														1200		
S-51													1900	700		
S-53																
S-54		1200														
S-55														500		
S-56														3000		
S-57														1800		
S-58							1700									
S-59	1100															
S-60				400										5200		
S-61															2000	
S-62																
S-63			1000												700	
S-64															700	
S-65															7500	
S-67																
S-68																
S-69																
S-113				1600												
S-114				700												
S-115	800															
S-116				800												
S-117							2300									
S-118				4100												
S-119			2000													
S-120	900															
S-146																
S-147																
S-150																
S-151																
S-152																
S-155																
S-156																
S-158		700														
S-159						1400										
S-160																
S-163			8200													
S-169	1000															
S-300						20										
Totals																
Length (ft)	14,100	11,300	15,900	14,800	0	8,120	9,700	16,800	0	6,500	16,600	7,300	12,400	152,320	10,800	6,020
Cost (\$1000)	285	286	463	574	0	379	542	1,147	0	620	2,614	1,200	2,172	28,638	2,318	1,511
Total Cost (\$1000)	42,747															

Cost Summary
Alternative 2B-1
Adobe Road & Lakeville - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-1		1400					500									
S-2							2100									
S-3										1300						
S-4											1400					
S-5											1600					
S-6				2800												
S-7																
S-8	1900															
S-9	2000															
S-10	1500															
S-11	1300															
S-12						2800										
S-13			1300													
S-14		2700														
S-15	1000											2400				
S-16																
S-17				2300												
S-18							7000									
S-19													3900			
S-20													2600			
S-21													1200			
S-22						2900									5300	
S-23															2200	
S-24															12400	
S-25											11200					
S-26							2800									
S-27								2000								
S-28															900	
S-29																
S-30			2000												15200	
S-31																
S-32	1300						600									
S-33																
S-34				1100												
S-35		2500														
S-36	1300															
S-37																
S-38							3100				1800					
S-39										3000						
S-40							1000									
S-41			3100													
S-42			1100											4800		
S-43																
S-44											5000					
S-45											1900					
S-46											2600					
S-47											1600					

Cost Summary
Alternative 2B-1
Adobe Road & Lakeville - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	28.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-48											5300					
S-49											3200					
S-51											700					
S-53											1900					
S-54	1200										500					
S-55											3000					
S-56											1800					
S-57							1700									
S-58																
S-59	1100					400					5200					
S-60													2000			
S-61																
S-62																
S-63		1000											700			
S-64										700						
S-65																
S-66								7500								
S-67																
S-68											5200					
S-69																
S-113						1600										
S-114						700										
S-115	800															
S-116						1200										
S-117										2300						
S-118																
S-119			2000	4100												
S-120	900															
S-145																
S-146																
S-147																
S-150																
S-151																
S-152																
S-153																
S-154																
S-158																
S-159			1400	700												
S-160																
S-161																
S-162																
S-169																
S-300	1000															
Totals																
Length (ft)	15,300	9,600	8,900	11,000	0	14,300	14,100	9,520	0	16,400	52,100	5,800	16,800	101,360	0	0
Cost (\$1000)	309	243	259	427	0	668	787	650	0	1,563	8,205	953	2,908	19,057	0	0
Total Cost (\$1000)	36,028															

Cost Summary
Alternative 2C-1
Tolay C - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	28	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)																
S-1		1400					500										
S-2							2100										
S-3										1300							
S-4											1400						
S-5											1600						
S-6						2800											
S-7																	
S-8	1900					2000											
S-9																	
S-10			1500														
S-11		1300															
S-12							2800										
S-13			1300														
S-14						2700											
S-15			1000														
S-16																	
S-17						2300											
S-18							7000										
S-19																	
S-20																	
S-21																	
S-22									2400								
S-23																	
S-24																	
S-25																	
S-26																	
S-27							2800										
S-28									2000								
S-29																	
S-30						2000											
S-31																	
S-32		1300															
S-33						600											
S-34						1100											
S-35						2500											
S-36			1300														
S-37																	
S-38							3100										
S-39							3000										
S-40						1000											
S-41		3100															
S-42			1100														
S-43																	
S-44																	
S-45			1900														
S-46			2600														
S-47						1600											

Cost Summary
Alternative 2C-1
Tolay C - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	28	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)																
S-51			700									1000					
S-52														1900			
S-53																	1200
S-54																	
S-55															500		
S-56															3000		
S-57															1800		
S-58							1700										
S-59		1100															
S-60					400										5200		
S-61										2000							
S-62																	
S-63					1000				700								
S-64									700								
S-65												7500					
S-67												3400					
S-68												5200					
S-69																	
S-70																	6200
S-112																	4500
S-113					1600												
S-114					700												
S-115	800																
S-116							1200										
S-117									2300								
S-118					4100												
S-119			2000														
S-120	900																
S-146																	
S-147																	
S-150																	
S-151																	
S-152																	
S-155																	20
S-156																	7800
S-158			700														
S-159							1400										
S-160													1400				
S-161										3300							
S-162										4000							
S-169																1000	
Totals																	
Length (ft)	3,600	8,200	14,100	0	28,400	0	25,600	0	9,900	21,800	3,000	19,500	9,100	12,400	107,520	0	19,720
Cost (\$1000)	73	207	410	0	1,128	0	1,430	0	765	2,078	379	3,071	1,495	2,172	20,215	0	4,951
Total Cost (\$1000)	38,374																

Cost Summary
Alternative 2D-1
Sears Point & Lakeville - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	28	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)																
S-1		1400					500										
S-2							2100										
S-3										1300							
S-4											1400						
S-5											1600						
S-6						2800											
S-7																	
S-8	1900																
S-9			2000														
S-10			1500														
S-11		1300															
S-12							2800										
S-13			1300														
S-14						2700											
S-15			1000									2400					
S-16																	
S-17						2300											
S-18							7000										
S-19													3900				
S-20													2600				
S-21													1200				
S-22									2900						5300		
S-23																2200	
S-24																12400	
S-25																	
S-26							2800										
S-27									2000								
S-28																900	
S-29						2000										15200	
S-30																	
S-31																	
S-32		1300															
S-33						800											
S-34						1100											
S-35						2500											
S-36			1300														
S-37										1800							
S-38							3100										
S-39							3000										
S-40						1000											
S-41		3100															
S-42			1100														
S-43																4800	
S-44																5000	
S-45																	
S-46												1900					
S-47												2600					
S-48										1600					5300		

Cost Summary
Alternative 2D-1
Sears Point & Lakeville - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	28	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)																
S-49												700	3200				
S-51															1900		
S-53													1200				
S-54															500		
S-55															3000		
S-56															1800		
S-57							1700										
S-58		1100															
S-59						400											
S-60															5200		
S-61													2000				
S-62																	
S-63			1000														
S-64													700				
S-65										700							
S-66													1600				
S-67												7500					
S-68															3400		
S-69															5200		
S-70													6200				
S-112													4500				
S-113						1600											
S-114						700											
S-115	800																
S-116								1200									
S-117																	
S-118																	
S-119			2000														
S-120																	
S-121																	
S-122																	
S-123																	
S-124																	
S-146															28300		
S-147															12400		
S-150															4000		
S-151															16000		
S-152															20		
S-157													7000				
S-158																	
S-159			700														
S-160																	
S-161													1400				
S-162																	
S-169	1000																
Totals																	
Length (ft)	3,700	8,200	11,900	0	17,700	0	25,600	0	6,700	22,100	3,000	15,100	40,800	5,300	122,220	32,300	0
Cost (\$1000)	75	207	346	0	756	0	1,430	0	518	2,106	379	2,378	6,704	928	22,979	6,868	0
Total Cost (\$1000)	45,675																

Cost Summary
Alternative 2E-1
Smaller Tolay A & ASR - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	28	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)																
S-1		1400					500										
S-2							2100										
S-3										1300							
S-4											1400						
S-5											1600						
S-6						2800											
S-7																	
S-8	1900																
S-9			2000														
S-10			1500														
S-11		1300															
S-12							2800										
S-13			1300														
S-14					2700												
S-15			1000									2400					
S-16																	
S-17					2300												
S-18							7000										
S-19													3900				
S-20													2600				
S-21													1200				
S-22							2400								5300		
S-23															2200		
S-24															12400		
S-25										11200							
S-26																	
S-27							2800										
S-28									2000						900		
S-29																	
S-30					2000										15200		
S-31																	
S-32		1300															
S-33						600											
S-34						1100											
S-35						2500											
S-36			1300														
S-37										1800							
S-38							3100										
S-39							3000										
S-40					1000												
S-41		3100															
S-42			1100														
S-43															4800		
S-44												5000			1900		
S-45																	
S-46													5300				
S-47													3200				
S-48													1200				
S-49																	
S-50																	

Cost Summary
Alternative 2E-1
Smaller Tolay A & ASR - All South County

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	28	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)																
S-51													700		1900		
S-53													1200				
S-54			1200										500				
S-55													3000				
S-56													1800				
S-57																	
S-58																	
S-59																	
S-60																	
S-61																	
S-62																	
S-63																	
S-64																	
S-65																	
S-67																	
S-68																	
S-69																	
S-113																	
S-114																	
S-115																	
S-116																	
S-117																	
S-118																	
S-119																	
S-120																	
S-121																	
S-146																	
S-147																	
S-150																	
S-151																	
S-152																	
S-155																	
S-158																	
S-158																	
S-159																	
S-160																	
S-163																	
S-164																	
S-166																	
S-167																	
S-168																	
S-169																	
S-999																	
Totals																	
Length (ft)	4,600	8,200	20,300	0	22,800	0	28,010	0	6,100	39,040	3,000	16,000	28,000	108,520	26,900	6,020	0
Cost (\$1000)	93	207	591	0	974	0	1,564	0	471	3,721	379	2,520	4,272	19,009	5,057	1,280	0
Total Cost (\$1000)	40,140																

Cost Summary
Alternative 2A-2
Tolay A - Lakeville & Bay Flats

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-24														2200		
S-25														12400		
S-29														900		
S-31														15200		
S-43														4800		
S-44													5000	1900		
S-45														5300		
S-48														3200		
S-49														1200		
S-50														700		
S-51													1900			
S-53			1200													
S-54												500				
S-55												3000				
S-56												1800				
S-57																
S-58	1700															
S-59	1100															
S-60	400															
S-61																
S-62											2000					
S-63			1000													
S-64													700			
S-65													700			
S-67													7500			
S-68								3400								
S-69								5200								
S-113		1600														
S-114	700															
S-115	800															
S-116			1200													
S-117			2300													
S-118			4100													
S-119	2000															
S-120	900															
S-146														28300		
S-147														12400		
S-150														4000		
S-151														16000		
S-152														20		
S-155													20			
S-156													6000			
S-163		8200														
S-300						20										
Totals																
Length (ft)	7,600	9,800	9,800	0	0	20	0	8,600	0	0	2,000	10,500	21,820	108,520	0	0
Cost (\$1000)	153	248	285	0	0	1	0	587	0	0	315	1,725	3,822	20,403	0	0
Total Cost (\$1000)	27,540															

Cost Summary
Alternative 2B-2
Adobe Road & Lakeville - Lakeville & Bay Flats

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/L.F)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-24														2200		
S-25														12400		
S-29														900		
S-31														15200		
S-43													4800			
S-44												5000				
S-45											1900					
S-46										1600	2600					
S-47											5300					
S-48											3200					
S-49											700					
S-51											1900					
S-53			1200													
S-54											500					
S-55											3000					
S-56											1800					
S-57						1700										
S-58																
S-59			1100			400										
S-60											5200					
S-61													2000			
S-62		1000											700			
S-63										700						
S-64														1600		
S-65																
S-66								7500								
S-67												3400				
S-68											5200					
S-69						1600										
S-113						700										
S-114																
S-115	800															
S-116						1200				2300						
S-117																
S-118				4100												
S-119			2000													
S-120	900															
S-145														3000		
S-146														28300		
S-147														12400		
S-150														4000		
S-151														16000		
S-152														20		
S-153														20		
S-154										3300					20	
S-161																
S-162								4000								
S-300								20								
Totals																
Length (ft)	1,700	1,000	4,300	4,100	0	5,600	0	11,520	0	7,900	31,300	8,400	7,500	96,040	20	0
Cost (\$1000)	34	25	125	159	0	261	0	786	0	753	4,929	1,380	1,314	18,056	4	0
Total Cost (\$1000)	27,828															

Cost Summary
Alternative 2C-2
Tolay C - Lakeville & Bay Flats

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-24														2200		
S-25														12400		
S-29														900		
S-31														15200		
S-43														4800		
S-44														5000		
S-45			1900													
S-46			2600													
S-47					1600						1000					
S-52														1900		
S-53														1200		
S-54													500			
S-55													3000			
S-56													1800			
S-57							1700									
S-58																
S-59		1100				400										
S-60													5200			
S-61										2000						
S-62																
S-63			1000													
S-64									700							
S-65									700							
S-67											7500					
S-68											3400					
S-69											5200					
S-70														6200		
S-112														4500		
S-113						1600										
S-114						700										
S-115	800															
S-116							1200									
S-117									2300							
S-118						4100										
S-119			2000													
S-120	900															
S-146														28300		
S-147														12400		
S-150														4000		
S-151														16000		
S-152														20		
S-155													20			
S-156													7800			
S-161										3300						
S-162										4000						
Totals																
Length (ft)	1,700	1,100	7,500	0	8,400	0	2,900	0	3,700	9,300	17,100	0	18,320	115,020	0	0
Cost (\$1000)	34	28	218	0	359	0	162	0	286	886	2,693	0	3,209	21,625	0	0
Total Cost (\$1000)	29,501															

Cost Summary
Alternative 2D-2
Sears Point & Lakeville - Lakeville & Bay Flats

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
S-24														2200		
S-25														12400		
S-29														900		
S-31														15200		
S-43														4800		
S-44														5000		
S-45																
S-46																
S-47																
S-48																
S-49																
S-51																
S-53																
S-54																
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S-69																
S-70																
S-112																
S-113																
S-114																
S-115																
S-116																
S-117																
S-118																
S-119																
S-120																
S-121																
S-123																
S-124																
S-146																
S-147																
S-150																
S-151																
S-152																
S-157																
S-161																
S-162																
Totals																
Length (ft)	800	1,100	3,000	0	2,700	0	2,900	0	7,500	13,000	18,900	59,600	6,400	103,120	0	0
Cost (\$1000)	16	28	87	0	115	0	162	0	580	1,239	2,976	9,793	1,121	19,388	0	0
Total Cost (\$100)	35,606															

Cost Summary
Alternative 2E-2
Smaller Tolay A & ASR - Lakeville & Bay Flats

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	27	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	126.40	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)																
S-24														2200			
S-25														12400			
S-29														900			
S-31														15200			
S-43														4800			
S-44														5000			
S-45														1900			
S-48													5300				
S-49													3200				
S-50													1200				
S-51													700				
S-53														1900			
S-54			1200														
S-55													500				
S-56													3000				
S-57							1700						1800				
S-58																	
S-59		1100															
S-60					400								5200				
S-61									2000								
S-62																	
S-63					1000					700							
S-64										700							
S-65																	
S-66											7500						
S-67												3400					
S-68											5200						
S-69																	
S-113					1600												
S-114					700												
S-115	800																
S-116							1200										
S-117					4100				2300								
S-118																	
S-119			2000														
S-120	900																
S-146														28300			
S-147														12400			
S-150														4000			
S-151														16000			
S-152														20			
S-155												20					
S-156												6000					
S-163			8200							20000							
S-164										20							
S-166										20							
S-167										6000							
S-168																	
S-999							10										
Totals																	
Length (ft)	1,700	1,100	11,400	0	7,800	0	2,910	0	4,300	27,440	12,700	9,420	22,500	105,020	0	0	0
Cost (\$1000)	34	28	332	0	333	0	163	0	332	2,615	1,605	1,483	3,697	18,396	0	0	0
Total Cost (\$1000)	29,020																

Cost Summary
Alternative 3A-1
Two Rock - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-1-A/S														4300		
W-2-A/S														1100		
W-3-A/S														2800		
W-4-A/S																1300
W-5-S		2100														2700
W-6-A/S																2500
W-7-A/S																
W-8-S	700															
W-9-S	2200															900
W-10-A/S											1800					
W-11-A/S											1900					
W-12-A/S																
W-13-S	900										1800					
W-14-A/S											1600					
W-15-A/S		2800														
W-16-S											4100					
W-17-A/S										1400						
W-18-A/S																
W-19-S	1200									1800						
W-20-A/S																
W-21-S		3600														
W-22-A/S									650							
W-23-A/S									1500							
W-24-S	2500															
W-25-A/S									1300							
W-26-A/S									1150							
W-27-S			1300													
W-28-A/S							700									
W-29-A/S		550														
W-30-A/S	1800															
W-31-S	450															
W-33-S					700									1000		
W-34-S																
W-35-S	4100													750		
W-36-S														4250		
W-37-S										3000						
W-38-S																
W-39-S									3750							
W-40-S					3300											
W-41-S			1700													
W-42-S		1000														

Cost Summary
Alternative 3A-1
Two Rock - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-43-S		1800														
W-44-S		1300														
W-45-S		2800														
W-46-S																
W-47-S																
W-48-S																
W-49-S																
W-50-S																
W-51-S			2400													
W-52-S	1500															
W-53-S		500														
W-54-S	1200															
W-55-S	1900															
W-56-S	650															
W-57-S																
W-58-S																
W-59-S			3700													
W-60-S			4150													
W-61-S																
W-62-S																
W-63-S	1100															
W-64-S																
W-65-S	500															
W-66-S																
W-67-S		1200														
W-68-S																
W-69-S			2000													
W-70-S		800														
W-71-S																
W-72-S																
W-73-S	3600															
W-74-S																
W-75-S			2200													
W-76-S			4800													
W-77-S																
W-78-S																
W-79-S																
W-80-S																
W-81-S	1200															
W-82-S																

Cost Summary
Alternative 3A-1
Two Rock - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-83-S			750													
W-84-S			750				1300									
W-85-S					2400											
W-86-S																
W-87-S		2000														
W-88-S		1800														
W-89-A/S														2500		
W-90-A/S														1900		
W-91-A/S														2750		
W-92-A/S														1700		
W-93-A/S														1050		
W-94-A/S														1000		
W-95-A/S														3100		
W-131-A/S														2650		
W-132-A/S														6000		
W-133-A/S														1800		
W-138-A/S														1300		
W-139-A/S														5100		
W-142-A/S														10500		
W-145-A/S														6250		
W-146-A/S														800		
W-147-A/S														2600		
W-149-A																
W-150-A																
W-151-A		200		700												
W-200-A/S																
W-204-A/S																
W-205-A/S																
W-206-A/S																
W-207-A/S																
Totals																
Length (ft)	25,500	22,050	24,450	0	12,100	0	12,250	0	9,700	12,850	17,900	1,200	0	80,200	0	7,400
Cost (\$1000)	515	558	712	0	517	0	684	0	750	1,225	2,819	197	0	15,078	0	1,858
Total Cost (\$1000)	24,912															

Cost Summary
Alternative 3B-1
Bloomfield - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-2-A/S	1100		2800												1300	
W-3-A/S																
W-4-A/S		2100													2700	
W-5-S															2500	
W-6-A/S																
W-7-A/S																
W-8-S	700															
W-9-S	2200														900	
W-10-A/S											1800					
W-11-A/S											1900					
W-12-A/S																
W-13-S	900										1800					
W-14-A/S											1600					
W-15-A/S		2800														
W-16-S											4100					
W-17-A/S										1400						
W-18-A/S																
W-19-S	1200									1800						
W-20-A/S																
W-21-S		3600							650							
W-22-A/S									1500							
W-23-A/S																
W-24-S	2500							1300								
W-25-A/S								1150								
W-26-A/S																
W-27-S			1300													
W-28-A/S						700										
W-29-A/S		550														
W-30-A/S	1800															
W-31-S	450															
W-33-S				700												
W-34-S														1000		
W-35-S	4100													750		
W-36-S														4250		
W-37-S																
W-38-S																
W-39-S									3750	3000						
W-40-S																
W-41-S			1700		3300											
W-42-S	1000															
W-43-S		1800														

Cost Summary
Alternative 3B-1
Bloomfield - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-44-S	1300															
W-45-S	2800											1200				
W-46-S								900								
W-47-S							550									
W-48-S							1750									
W-49-S							2250									
W-50-S			2400													
W-51-S	1500															
W-52-S		500														
W-53-S																
W-54-S	1200															
W-55-S	1900															
W-56-S	650															
W-57-S						2200										
W-58-S						2050										
W-59-S			3700													
W-60-S			4150													
W-61-S											1400					
W-62-S											2800					
W-63-S	1100															
W-64-S											1750					
W-65-S	500										750					
W-66-S																
W-67-S		1200														
W-68-S																
W-69-S		2000														
W-70-S		600														
W-71-S																
W-72-S									450							
W-73-S	3600															
W-74-S							1900									
W-75-S			2200													
W-76-S			4800													
W-77-S							1900									
W-78-S							400									
W-79-S							1000									
W-80-S							650									
W-81-S	1200															
W-82-S					750											
W-83-S			750													

Cost Summary
Alternative 3B-1
Bloomfield - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-84-S			750				1300									
W-85-S					2400											
W-86-S																
W-87-S		2000														
W-88-S		1800													2500	
W-89-A/S															1900	
W-90-A/S															2750	
W-91-A/S															1700	
W-92-A/S															1050	
W-93-A/S															1000	
W-94-A/S															3100	
W-95-A/S															3000	
W-97-A/S															2650	
W-105-A/S															2950	
W-108-A/S															4800	
W-107-A/S					700											
W-149-A			700													
W-150-A																
W-151-A	200													3700		
W-200-A/S														17,000		
W-201-A/S														12,500		
W-202-A/S														9000		
W-203-A/S																
Totals																
Length (ft)	31,700	18,950	25,250	4,000	8,100	700	11,700	3,350	6,350	12,850	17,900	1,200	6,000	42,200	34,800	0
Cost (\$1000)	640	479	735	155	346	33	653	229	491	1,225	2,819	197	1,051	7,834	7,400	0
Total Cost (\$1000)	24,387															

Cost Summary
Alternative 3C-1
Carroll Road - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-2-A/S	1100		2800													1300
W-3-A/S																
W-4-A/S		2100														2700
W-5-S																2500
W-6-A/S																
W-7-A/S																
W-8-S	700															
W-9-S	2200															900
W-10-A/S											1800					
W-11-A/S											1900					
W-12-A/S																
W-13-S	900										1800					
W-14-A/S											1600					
W-15-A/S		2800														
W-16-S											4100					
W-17-A/S										1400						
W-18-A/S		1200								1800						
W-19-S																
W-20-A/S		3800														
W-21-S									650							
W-22-A/S									1500							
W-23-A/S																
W-24-S	2500								1300							
W-25-A/S									1150							
W-26-A/S																
W-27-S			1300				700									
W-28-A/S		550														
W-29-A/S																
W-30-A/S	1800															
W-31-S	450					700										
W-33-S														1000		
W-34-S																
W-35-S	4100													750		
W-36-S														4250		
W-37-S																
W-38-S																
W-39-S									3750	3000						
W-40-S						3300										
W-41-S			1700													
W-42-S	1000															
W-43-S		1800														

Cost Summary
Alternative 3C-1
Carroll Road - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	48.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-44-S		1300														
W-45-S		2800										1200				
W-46-S									900							
W-47-S							550									
W-48-S							1750									
W-49-S							2250									
W-50-S																
W-51-S			2400													
W-52-S	1500															
W-53-S		500														
W-54-S	1200															
W-55-S	1900															
W-56-S	650															
W-57-S					2200											
W-58-S					2050											
W-59-S			3700													
W-60-S			4150								1400					
W-61-S											2800					
W-62-S																
W-63-S	1100															
W-64-S											1750					
W-65-S	500										750					
W-66-S																
W-67-S		1200														
W-68-S										2500						
W-69-S			2000													
W-70-S		600														
W-71-S																
W-72-S									450	4150						
W-73-S	3600															
W-74-S							1900									
W-75-S			2200													
W-76-S			4800													
W-77-S							1900									
W-78-S							400									
W-79-S							1000									
W-80-S							650									
W-81-S	1200															
W-82-S					750											
W-83-S			750													

Cost Summary
Alternative 3C-1
Carroll Road - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-84-S			750				1300									
W-85-S					2400											
W-86-S		2000														
W-87-S		1800														
W-88-S																2500
W-89-A/S																1900
W-90-A/S																2750
W-91-A/S																1700
W-92-A/S																1050
W-93-A/S																1000
W-94-A/S																3100
W-95-A/S														3000		
W-97-A/S														2650		
W-105-A/S														2950		
W-106-A/S														1850		
W-107-A/S														850		
W-108-A/S														2450		
W-109-A/S														2850		
W-110-A/S														2050		
W-112-A/S													2650			
W-131-A/S													6000			
W-132-A/S													1800			
W-133-A/S													1300			
W-138-A/S													5100			
W-139-A/S													10500			
W-142-A/S													6250			
W-145-A/S													800			
W-146-A/S													2600			
W-147-A/S					700											
W-149-A																
W-150-A			700													
W-151-A	200													3300		
W-200-A/S														5300		
W-204-A/S														1900		
W-207-A/S																
Totals																
Length (ft)	26,400	22,250	27,250	0	12,100	0	12,400	0	9,700	12,850	17,900	1,200	37,000	35,150	0	21,400
Cost (\$1000)	533	563	793	0	517	0	693	0	750	1,225	2,819	197	6,481	6,609	0	5,372
Total Cost (\$1000)	26,561															

Cost Summary
Alternative 3D-1
Vally Ford - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-2-A/S	1100		2800													1300
W-3-A/S		2100														2700
W-4-A/S																2500
W-5-S																
W-6-A/S																
W-7-A/S																
W-8-S	700															
W-9-S	2200															900
W-10-A/S											1800					
W-11-A/S											1900					
W-12-A/S																
W-13-S	900										1800					
W-14-A/S											1600					
W-15-A/S																
W-16-S		2800									4100					
W-17-A/S										1400						
W-18-A/S										1800						
W-19-S		1200														
W-20-A/S																
W-21-S		3800														
W-22-A/S									650							
W-23-A/S									1500							
W-24-S	2500								1300							
W-25-A/S									1150							
W-26-A/S																
W-27-S			1300													
W-28-A/S							700									
W-29-A/S		550														
W-30-A/S	1800															
W-31-S	450															
W-33-S					700											
W-34-S														1000		
W-35-S	4100													750		
W-36-S														4250		
W-37-S																
W-38-S										3000						
W-39-S									3750							
W-40-S					3300											
W-41-S			1700													
W-42-S	1000															
W-43-S		1800														

Cost Summary
Alternative 3D-1
Vally Ford - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-44-S		1300														
W-45-S		2800										1200				
W-46-S									900							
W-47-S							550									
W-48-S							1750									
W-49-S							2250									
W-50-S			2400													
W-51-S	1500															
W-52-S		500														
W-53-S																
W-54-S	1200															
W-55-S	1900															
W-56-S	650															
W-57-S					2200											
W-58-S					2050											
W-59-S			3700													
W-60-S			4150								1400					
W-61-S											2800					
W-62-S	1100															
W-63-S											1750					
W-64-S		500									750					
W-65-S																
W-66-S			1200													
W-67-S										2500						
W-68-S																
W-69-S			2000													
W-70-S		600														
W-71-S																
W-72-S									450		4150					
W-73-S	3800															
W-74-S							1900									
W-75-S			2200													
W-76-S			4800													
W-77-S							1900									
W-78-S							400									
W-79-S							1000									
W-80-S							650									
W-81-S	1200															
W-82-S					750											
W-83-S																

Cost Summary
Alternative 3D-1
Vally Ford - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	36.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-84-S			750				1300									
W-85-S																
W-86-S					2400											
W-87-S		2000														
W-88-S		1800														2500
W-89-A/S																1900
W-90-A/S																2750
W-91-A/S																1700
W-92-A/S																1050
W-93-A/S																1000
W-94-A/S																3100
W-95-A/S														3000		
W-97-A/S														2650		
W-105-A/S														2950		
W-106-A/S														1850		
W-108-A/S														850		
W-109-A/S														2650		
W-113-A/S														2600		
W-114-A/S														1100		
W-118-A/S														3100		
W-119-A/S													2650			
W-131-A/S													6000			
W-132-A/S													1800			
W-133-A/S													1300			
W-138-A/S													5100			
W-139-A/S													10500			
W-142-A/S													6250			
W-145-A/S													800			
W-146-A/S													2600			
W-147-A/S																
W-149-A					700											
W-150-A			700													
W-151-A	200													3700		
W-200-A/S														5300		
W-204-A/S														1900		
W-207-A/S																
Totals																
Length (ft)	26,400	22,250	27,250	0	12,100	0	12,400	0	9,700	12,850	17,900	1,200	37,000	37,650	0	21,400
Cost (\$1000)	533	563	793	0	517	0	693	0	750	1,225	2,819	197	6,481	7,079	0	5,372
Total Cost (\$1000)	27,021															

Cost Summary
Alternative 3E-1
Huntley - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-2-A/S	1100		2800									1300				
W-3-A/S																
W-4-A/S		2100										2700				
W-5-S												2500				
W-6-A/S																
W-7-A/S																
W-8-S	700															
W-9-S	2200															
W-10-A/S												900				
W-11-A/S												1800				
W-12-A/S												1900				
W-13-S	900											1800				
W-14-A/S												1600				
W-15-A/S																
W-16-S		2800										4100				
W-17-A/S												1400				
W-18-A/S																
W-19-S	1200											1800				
W-20-A/S																
W-21-S		3800										650				
W-22-A/S												1500				
W-23-A/S																
W-24-S	2500											1300				
W-25-A/S												1150				
W-26-A/S																
W-27-S			1300									700				
W-28-A/S													550			
W-29-A/S													1600			
W-30-A/S																
W-31-S	450														4500	
W-32-A/S																
W-33-S					700										1000	
W-34-S																
W-35-S	4100														750	
W-36-S															4250	
W-37-S																
W-38-S																
W-39-S									3750	3000						
W-40-S					3300											
W-41-S			1700													
W-42-S	1000															

Cost Summary
Alternative 3E-1
Huntley - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-43-S		1800														
W-44-S	1300															
W-45-S	2800															
W-46-S																
W-47-S									900							
W-48-S							550									
W-49-S							1750									
W-50-S							2250									
W-51-S			2400													
W-52-S	1500															
W-53-S		500														
W-54-S	1200															
W-55-S	1900															
W-56-S	650															
W-57-S					2200											
W-58-S					2050											
W-59-S			3700													
W-60-S			4150													
W-61-S											1400					
W-62-S											2800					
W-63-S	1100															
W-64-S											1750					
W-65-S	500										750					
W-66-S																
W-67-S		1200														
W-68-S										2500						
W-69-S			2000													
W-70-S		600														
W-71-S											4150					
W-72-S									450							
W-73-S	3600															
W-74-S							1900									
W-75-S			2200													
W-76-S			4800													
W-77-S																
W-78-S							1900									
W-79-S							400									
W-80-S							1000									
W-81-S	1200						650									
W-82-S					750											

Cost Summary
Alternative 3E-1
Huntley - Stemple Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-83-S			750													
W-84-S			750													
W-85-S																
W-86-S																
W-87-S																
W-88-S																
W-89-A/S																
W-90-A/S																
W-91-A/S																
W-92-A/S																
W-93-A/S																
W-94-A/S																
W-95-A/S																
W-131-A/S																
W-132-A/S																
W-133-A/S																
W-138-A/S																
W-139-A/S																
W-142-A/S																
W-145-A/S																
W-146-A/S																
W-147-A/S																
W-149-A																
W-150-A																
W-151-A																
W-200-A/S																
W-204-A/S																
W-207-A/S																
W-208-A/S																
W-209-A/S																
Totals																
Length (ft)	30,100	16,400	27,250	0	12,100	0	11,700	0	5,100	9,650	6,700	28,300	16,150	61,400	0	0
Cost (\$1000)	608	415	793	0	517	0	653	0	394	920	1,055	4,650	2,829	11,544	0	0
Total Cost (\$1000)	24,378															

Cost Summary
Alternative 3F-1
Two Rock with ASR to Stemple Creek

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-1-A/S														4300		
W-2-A/S														1100		
W-3-A/S														2800		
W-4-A/S																1300
W-5-S		2100														2700
W-6-A/S																2500
W-7-A/S																
W-8-S	700															
W-9-S	2200															900
W-10-A/S											1800					
W-11-A/S											1900					
W-12-A/S																
W-13-S	900										1800					
W-14-A/S											1600					
W-15-A/S																
W-16-S		2800									4100					
W-17-A/S										1400						
W-18-A/S																
W-19-S	1200									1800						
W-20-A/S																
W-21-S		3600														
W-22-A/S									650							
W-23-A/S									1500							
W-24-S	2500															
W-25-A/S									1300							
W-26-A/S									1150							
W-27-S			1300													
W-28-A/S							700									
W-29A-S		550														
W-30-A/S	1800															
W-31-S	450															
W-33-S					700									1000		
W-34-S																
W-35-S	4100													750		
W-36-S														4250		
W-37-S																
W-38-S										3000						
W-39-S									3750							
W-40-S					3300											
W-41-S			1700													
W-42-S	1000															

Cost Summary
Alternative 3F-1
Two Rock with ASR to Stemple Creek

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-43-S		1800														
W-44-S	1300															
W-45-S	2800											1200				
W-46-S									900							
W-47-S							550									
W-48-S							1750									
W-49-S							2250									
W-50-S																
W-51-S			2400													
W-52-S	1500															
W-53-S		500														
W-54-S	1200															
W-55-S	1800															
W-56-S	650															
W-57-S					2200											
W-58-S					2050											
W-59-S			3700													
W-60-S			4150								1400					
W-61-S											2800					
W-62-S																
W-63-S	1100										1750					
W-64-S																
W-65-S	500										750					
W-66-S																
W-67-S		1200								2500						
W-68-S																
W-69-S			2000													
W-70-S		600														
W-71-S																
W-72-S									450							
W-73-S	3600															
W-74-S							1900									
W-75-S			2200													
W-76-S			4800													
W-77-S							1900									
W-78-S							400									
W-79-S							1000									
W-80-S							650									
W-81-S	1200															
W-82-S					750											

Cost Summary
Alternative 3F-1
Two Rock with ASR to Stemple Creek

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-83-S			750													
W-84-S			750													
W-85-S							1300									
W-86-S					2400											
W-87-S		2000														
W-88-S		1800											2500			
W-89-A/S													1900			
W-90-A/S													2750			
W-91-A/S													1700			
W-92-A/S													1050			
W-93-A/S													1000			
W-94-A/S													3100			
W-95-A/S													2650			
W-131-A/S													6000			
W-132-A/S													1800			
W-133-A/S													1300			
W-138-A/S													5100			
W-139-A/S													10500			
W-142-A/S													6250			
W-145-A/S													800			
W-146-A/S													2600			
W-147-A/S																
W-149-A					700											
W-150-A			700													
W-151-A	200															
W-200-A/S														3300		
W-204-A/S														5300		
W-205-A/S														3300		
W-206-A/S														800		
W-207-A/S														1900		
W-210-A/S														20		
Totals																
Length (ft)	30,600	16,950	24,450	0	12,100	0	12,400	0	9,700	12,850	17,900	1,200	51,000	28,820	0	7,400
Cost (\$1000)	618	429	712	0	517	0	693	0	750	1,225	2,819	197	8,934	5,418	0	1,858
Total Cost (\$1000)	24,168															

Cost Summary
Alternative 3A-2
Two Rock Reservoir to Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-1-A/S											4300					
W-2-A/S											1100					
W-3-A/S											3000					
W-89-A/S											2500					
W-90-S											1900					
W-91-A/S											2750					
W-92-A/S											1700					
W-93-S											1050					
W-94-A/S										1000						
W-95-A/S										3100						
W-96-A	1650											3000				
W-97-A/S						1300										
W-98-A						1350										
W-99-A						700										
W-100-A				650												
W-101-A																
W-102-A		750														
W-103-A			1900													
W-104-A		1800														
W-105-A/S												2650				
W-106-A/S												2950				
W-108-A/S											850					
W-109-A/S											850					
W-110-A/S	2450															
W-111-A/S	2850															
W-113-A/S											2650					
W-114-A/S											2600					
W-115-A			1150													
W-116-A		1750														
W-117-A	1800															
W-118-A/S										1100						
W-120-A										2200						
W-121-A										4200						
W-122-A			3600													
W-123-A		1800														
W-124-A								2300		2300						
W-125-A																
W-126-A			2300													
W-127-A		1450														
W-128-A			3900													
W-129-A		6300														
W-130-A	2500															
W-131-A												2650				
W-132-A												6000				
W-133-A												1800				
W-134-A			1800													
W-135-A		1800														

Cost Summary
Alternative 3A-2
Two Rock Reservoir to Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-138-A		2500														
W-137-A		1450										1300				
W-138-A/S												5100				
W-139-A/S																
W-140-A		5000														
W-141-A	1200											10500				
W-142-A/S		1000														
W-143-A																
W-144-A	1050													6250		
W-145-A/S														800		
W-146-A/S														2600		
W-147-A/S																
W-148-A/S				1200										3700		
W-200-A/S														5300		
W-204-A/S														3300		
W-205-A/S														800		
W-206-A/S														1900		
W-207-A/S																
Totals																
Length (ft)	13,500	25,600	14,650	1,850	0	3,350	2,300	2,300	0	11,600	25,250	35,950	0	24,850	0	0
Cost (\$1000)	273	648	426	72	0	156	128	157	0	1,106	3,976	5,907	0	4,634	0	0
Total Cost (\$1000)	17,484															

Cost Summary
Alternative 3B-2
Bloomfield - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.83	251.05
Pipe Code	Length (Ft)															
W-90-A/S		1900														
W-91-A/S			2750													
W-92-A/S			1700													
W-93-S			1050													
W-94-A/S				1000												
W-95-A/S						3100										
W-96-A	1650											3000				
W-97-A/S																
W-98-A						1300										
W-99-A						1350										
W-100-A						700										
W-101-A				650												
W-102-A		750														
W-103-A			1800													
W-104-A		1800									2650					
W-105-A/S											2950					
W-106-A/S												4800				
W-107-A/S											850					
W-108-A/S											850					
W-109-A/S																
W-110-A/S	2450															
W-111-A/S	2850										2650					
W-113-A/S											2600					
W-114-A/S																
W-115-A			1150													
W-116-A		1750														
W-117-A	1800															
W-118-A/S										1100						
W-120-A										2200						
W-121-A										4200						
W-122-A			3600													
W-123-A		1800														
W-124-A							2300	2300								
W-125-A																
W-126-A			2300													
W-127-A		1450														
W-128-A				3900												
W-129-A		6300														
W-130-A	2500															
W-131-A									6000	2650						
W-132-A																

Cost Summary
Alternative 3B-2
Bloomfield - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-133-A			1800						1800							
W-134-A																
W-135-A		1800														
W-136-A		2500														
W-137-A		1450					1300									
W-138-A/S							5100									
W-139-A/S																
W-140-A		5000														
W-141-A	1200															
W-142-A/S					10500											
W-143-A		1000														
W-144-A	1050															
W-145-A/S			6250													
W-146-A/S		800														
W-148-A/S				1200												
W-200-A/S														3700		
W-201-A/S														17,000		
W-202-A/S														12,500		
W-203-A/S														9000		
Totals																
Length (ft)	13,500	28,300	22,500	6,750	10,500	6,450	8,700	2,300	7,800	10,150	12,550	3,000	4,800	42,200	0	0
Cost (\$1000)	273	716	655	262	449	301	486	157	603	967	1,976	493	841	7,934	0	0
Total Cost (\$1000)	16,112															

Cost Summary
Alternative 3C-2
Carroll Road - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	184.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-90-A/S		1900														
W-91-A/S			2750													
W-92-A/S			1700													
W-93-S			1050													
W-94-A/S				1000												
W-95-A/S						3100										
W-96-A	1650													3000		
W-97-A/S																
W-98-A						1300										
W-99-A						1350										
W-100-A						700										
W-101-A				650												
W-102-A		750														
W-103-A			1900													
W-104-A		1800												2650		
W-105-A/S														2950		
W-106-A/S														850		
W-108-A/S														850		
W-109-A/S														2450		
W-110-A/S														2850		
W-111-A/S														2050		
W-112-A/S											2650					
W-113-A/S											2600					
W-114-A/S																
W-115-A			1150													
W-116-A		1750														
W-117-A	1800															
W-118-A/S										1100						
W-120-A										2200						
W-121-A										4200						
W-122-A			3800													
W-123-A		1800														
W-124-A								2300								
W-125-A									2300							
W-126-A			2300													
W-127-A		1450														
W-128-A				3900												
W-129-A		6300														
W-130-A	2500														2650	
W-131-A														8000		
W-132-A																

Cost Summary
Alternative 3C-2
Carroll Road - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.83	251.05
Pipe Code	Length (Ft)															
W-133-A			1800											1800		
W-134-A																
W-135-A		1800														
W-136-A		2500														
W-137-A		1450												1300		
W-138-A/S														5100		
W-139-A/S																
W-140-A		5000														
W-141-A	1200													10500		
W-142-A/S																
W-143-A		1000														
W-144-A	1050													6250		
W-145-A/S														800		
W-146-A/S														2600		
W-147-A/S																
W-148-A				1200										3300		
W-200-A/S														5300		
W-204-A/S														1900		
W-207-A/S																
Totals																
Length (ft)	8,200	27,500	18,250	8,750	0	6,450	2,300	2,300	0	7,500	5,250	0	0	65,150	0	0
Cost (\$1000)	168	698	473	262	0	301	128	157	0	715	827	0	0	12,249	0	0
Total Cost (\$1000)	16,973															

Cost Summary
Alternative 3D-2
Valley Ford - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-90-A/S		1900														
W-91-A/S			2750													
W-92-A/S			1700													
W-93-S			1050													
W-94-A/S				1000												
W-95-A/S						3100										
W-96-A	1650													3000		
W-97-A/S																
W-98-A						1300										
W-99-A						1350										
W-100-A						700										
W-101-A				650												
W-102-A		750														
W-103-A			1900													
W-104-A		1600														
W-105-A/S														2650		
W-106-A/S														2650		
W-108-A/S														850		
W-109-A/S														850		
W-110-A/S	2450															
W-111-A/S	2850															
W-113-A/S														2650		
W-114-A/S														2600		
W-115-A																
W-116-A																
W-117-A	1800	1750	1150													
W-118-A/S																
W-119-A																
W-120-A											2200					
W-121-A											4200					
W-122-A			3600													
W-123-A		1800														
W-124-A																
W-125-A							2300	2300								
W-126-A			2300													
W-127-A		1450														
W-128-A				3900												
W-129-A		6300														
W-130-A	2500															
W-131-A														2650		
W-132-A														6000		

Cost Summary
Alternative 3D-2
Valley Ford - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	48.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-133-A				1800										1800		
W-134-A																
W-135-A		1800														
W-136-A		2500														
W-137-A		1450														
W-138-A/S														1300		
W-139-A/S														5100		
W-140-A																
W-141-A	1200	5000														
W-142-A/S														10500		
W-143-A		1000														
W-144-A	1050													6250		
W-145-A/S														800		
W-146-A/S														2600		
W-147-A/S																
W-148-A				1200										3700		
W-200-A/S														5800		
W-204-A/S														1900		
W-207-A/S																
Totals																
Length (ft)	13,500	27,500	14,450	8,550	0	6,450	2,300	2,300	0	0	6,400	0	0	68,150	0	0
Cost (\$1000)	273	698	421	332	0	301	128	157	0	0	1,008	0	0	12,813	0	0
Total Cost (\$1000)	16,128															

Cost Summary
Alternative 3E-2
Huntley Reservoir - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-4-A/S											1300					
W-6-A/S											2700					
W-7-A/S											2500					
W-10-A/S											1100					
W-11-A/S											1800					
W-12-A/S											1900					
W-14-A/S											1800					
W-15-A/S											1600					
W-17-A/S											4100					
W-18-A/S											1400					
W-20-A/S											1800					
W-22-A/S											650					
W-23-A/S											1500					
W-25-A/S											1300					
W-26-A/S											1150					
W-28-A/S											700					
W-29-A/S											550					
W-30-A/S											1600					
W-32-A/S											4500					
W-39-A/S											2500					
W-50-A/S											1900					
W-91-A/S											2750					
W-92-A/S											1700					
W-93-A/S											1050					
W-94-A/S										1000						
W-94-A/S										3100						
W-98-A/S	1650											3000				
W-97-A/S																
W-99-A						1300										
W-99-A						1350										
W-100-A						700										
W-101-A				650												
W-102-A		750														
W-103-A			1900													
W-104-A		1800														
W-105-A/S												2950				
W-106-A/S												2950				
W-108-A/S											850					
W-109-A/S											850					
W-110-A/S	2450															
W-111-A/S	2850															

Cost Summary
Alternative 3E-2
Huntley Reservoir - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	36.78	42.73	48.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-113-A/S											2650					
W-114-A/S											2600					
W-115-A			1150													
W-116-A		1750														
W-117-A	1800									1100						
W-118-A/S										2200						
W-120-A										4200						
W-121-A																
W-122-A			3600													
W-123-A		1800														
W-124-A							2300	2300								
W-125-A			2300													
W-126-A																
W-127-A		1450														
W-128-A			3900													
W-129-A		6300														
W-130-A	2500														2850	
W-131-A/S															6000	
W-132-A/S															1800	
W-133-A/S																
W-134-A			1800													
W-135-A		1800														
W-136-A		2500														
W-137-A		1450													1300	
W-138-A/S															5100	
W-139-A/S																
W-140-A		5000														
W-141-A	1200														10500	
W-142-A/S																
W-143-A		1000														
W-144-A	1050														6250	
W-145-A/S															800	
W-146-A/S															2800	
W-147-A/S																
W-148-A				1200											3700	
W-200-A/S															5300	
W-204-A/S															1900	
W-207-A/S															2000	
W-208-A/S															1000	
W-209-A/S																
Totals																
Length (ft)	13,500	25,600	14,850	1,850	0	3,350	2,300	2,300	0	11,600	50,800	8,900	0	50,800	0	0
Cost (\$1000)	273	648	426	72	0	156	128	157	0	1,106	8,000	1,462	0	9,570	0	0
Total Cost (\$1000)	21,988															

Cost Summary
Alternative 3F-2
Two Rock with ASR - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-1-A/S								4300								
W-2-A/S								1100								
W-3-A/S								3000								
W-89-A/S								2500								
W-90-S								1900								
W-91-A/S								2750								
W-92-A/S								1700								
W-93-S								1050								
W-94-A/S							1000									
W-95-A/S							3100									
W-96-A	1650															
W-97-A/S												3000				
W-98-A						1300										
W-99-A						1350										
W-100-A						700										
W-101-A				650												
W-102-A		750														
W-103-A			1900													
W-104-A		1800														
W-105-A/S												2650				
W-106-A/S												2950				
W-108-A/S											850					
W-109-A/S											850					
W-110-A/S	2450															
W-111-A/S	2850															
W-113-A/S											2650					
W-114-A/S											2600					
W-115-A			1150													
W-116-A		1750														
W-117-A	1800															
W-118-A/S										1100						
W-120-A										2200						
W-121-A										4200						
W-122-A			3600													
W-123-A		1800														
W-124-A																
W-125-A						2300		2300								
W-126-A			2300													
W-127-A		1450														
W-128-A			3900													
W-129-A		6300														

Cost Summary
Alternative 3F-2
Two Rock with ASR - Americano Creek System

Pipe Diameter (in)	8	10	12	14	15	16	18	20	21	24	30	36	42	48	54	60
Unit Cost (\$/LF)	20.19	25.30	29.11	38.78	42.73	46.68	55.85	68.26	77.28	95.31	157.48	164.32	175.17	188.01	212.63	251.05
Pipe Code	Length (Ft)															
W-130-A	2500											2650				
W-131-A												6000				
W-132-A												1800				
W-133-A			1800													
W-134-A		1800														
W-135-A		2500														
W-136-A		1450														
W-137-A																
W-138-A/S													1300			
W-139-A/S													5100			
W-140-A		5000														
W-141-A	1200															
W-142-A/S		1000											10500			
W-143-A																
W-144-A	1050															
W-145-A																6250
W-146-A																800
W-147-A																2600
W-148-A				1200												
W-200-A/S																3300
W-204-A/S																5300
W-205-A/S														3300		
W-206-A/S														800		
W-207-A/S															1900	
W-210-A/S														20		
Totals																
Length (ft)	13,500	25,800	14,650	1,850	0	3,350	6,400	20,600	0	7,500	6,950	19,050	16,900	4,120	20,150	0
Cost (\$1000)	273	648	426	72	0	156	357	1,406	0	715	1,094	3,130	2,960	775	4,284	0
Total Cost (\$1000)	16,297															