

Sacramento Regional County Sanitation District

Interceptor Sequencing Study

**Technical Memorandum 5
Unit Costs for Interceptor Pipe**

January 2010

Sacramento Regional County Sanitation District

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**TECHNICAL MEMORANDUM
NO. 5**

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UNIT COSTS FOR INTERCEPTOR PIPE

1.0 INTRODUCTION

The Sacramento Regional County Sanitation District (SRCSD) is carrying out a high-level study to determine alternatives that would provide build-out regional sewer service for future developments. This technical memorandum (TM) addresses the unit pipe and pump station capital costs of this planning effort. Practical interceptor and pump station alternatives are being chosen through a screening process. This TM will recommend unit costs for interceptor pipes and pump stations that can be used provide rough estimates of their capital costs. Developing these unit costs will be undertaken by using unit costs from bids collected from previous SRCSD projects and adjusting them to current-day dollars. Because of the high-level nature of the ISS, allowances for details such as pipe depth are very limited. Two unit prices will be recommended for each interceptor pipe size, one for open-cut construction (less than 35-feet in depth) and one for trenchless construction (greater than 35-feet in depth).

This TM does not include costs for environmental mitigation, right-of-way purchase, operation and maintenance, public impacts and risk.

2.0 INTERCEPTOR PIPE

SRCSD has completed many capital investment projects with large diameter sewer pipe and these have been collected according to their specific pipe sizes and the unit prices from their project bid tabs. These unit costs are escalated to 2009 dollars and compared to each other. They are also compared to a unit cost list prepared by the Interceptor Engineering (IE) group in 2009 and then a logical best-fit unit cost is assigned to each interceptor pipe size for both open-cut and trenchless construction methods.

3.0 PAST PROJECT COSTS

The following SRCSD interceptor sewer pipe projects were researched in this exercise:

Table 5.1 SRCSD Sewer Pipe Capital Projects

Arden Parallel Force Main	Natomas Force Main
Bradshaw 5B	Sacramento Force Main
Bradshaw 6A	Southport Gravity Sewer
Bradshaw 6B	UNWI 5&6
Bradshaw 7A	UNWI 7
Bradshaw 7B	UNWI 8
Bradshaw 8	West Sacramento Force Main
Folsom East 1B	Yolo Force Main
Laguna Interceptor Extension	

4.0 INTERCEPTOR PIPE UNIT COST ANALYSIS

The collective unit costs of the projects in Table 5.1 have been escalated to 2009 dollars using a 3% escalation rate and are shown as an average in Table 5.2 and 5.3 below. Next to these average unit costs are shown unit costs from a 2009 cost list compiled by IE. For a full spreadsheet of past project unit costs, please see attached *Appendix A and B*.

Table 5.2 Interceptor Pipe Unit Cost Analysis (Installed Open-Cut < 35 Feet Deep)

Pipe Type	Pipe Diameter (inches)	Past Project Unit Prices (In 2009 Dollars)				Avg. Past Project Unit Price (2009)	Current IE Baseline Costs Table (2009)	Best Fit Unit Costs (2009)
RCP	27					\$420	\$420	
RCP	30					\$470	\$470	
RCP	33					\$470	\$525	
RCP	36	\$567			\$567	\$600	\$580	
RCP	42					\$650	\$650	
RCP	48	\$836	\$568	\$832	\$745	\$700	\$720	
RCP	54	\$799	\$966		\$883	\$1,200	\$900	
RCP	60	\$777			\$777	\$1,250	\$960	
RCP	66	\$707			\$707	\$1,300	\$1,020	
RCP	72	\$1,188	\$984		\$1,086	\$1,400	\$1,080	
RCP	78					\$1,500	\$1,140	
RCP	84	\$1,063	\$974	\$939	\$992		\$1,200	
RCP	90	\$1,280	\$1,113		\$1,196		\$1,260	
RCP	108	\$1,344	\$1,101	\$1,180	\$3,014*	\$1,660	\$1,440	
RCP	120	\$1,380			\$1,380		\$1,560	
FM	15					\$220	\$220	
FM	18					\$250	\$250	
FM	21					\$320	\$320	
FM	24					\$355	\$355	
FM	27					\$390	\$390	
FM	32	\$657			\$657		\$500	
FM	36	\$325			\$325	\$525	\$550	
FM	60	\$667			\$667		\$650	
FM	Duel 66	\$1,136	\$1,045		\$1,090		\$1,100	

*Anomaly – not included in analysis.

Table 5.3 Interceptor Pipe Unit Cost Analysis (Installed Trenchless > 35 Feet Deep)

Pipe Type	Pipe Diameter (inches)	Past Project Unit Prices (In 2009 Dollars)			Avg. Past Project Unit Price (2009)	Current IE Baseline Costs Table (2009)	Best Fit Unit Costs (2009)
RCP	27						\$700
RCP	30						\$800
RCP	33						\$900
RCP	36					\$1,050	\$1,000
RCP	42						\$1,100
RCP	48	\$1,507	\$806	\$1,731	\$1,348	\$1,200	\$1,300
RCP	54					\$2,100	\$1,525
RCP	60					\$2,150	\$1,750
RCP	66	\$1,791			\$1,791		\$1,975
RCP	72	\$1,915	\$2,460		\$2,187		\$2,200
RCP	78						\$2,250
RCP	84	\$2,319			\$2,319		\$2,300
RCP	90						\$2,400
RCP	108	\$1,229	\$20,867*	\$3,478	\$8,525		\$2,500
RCP	120						\$2,600

*Anomaly – Not included in analysis.

The last column (named “Best Fit Unit Costs”) is produced by comparing the unit costs in the previous columns and making a judgment on a cost that makes sense. There are different reasons for why past unit costs are so different than the IE costs (varying depths, short tunnel reaches, different sub-surface conditions etc) and these can sometimes be taken into account. With those numbers considered more reliable for one pipe size, others were then filled in using a reasonably spaced scale. As indicated by the tables, two data entries were ignored as being anomalies.

5.0 PUMP STATIONS

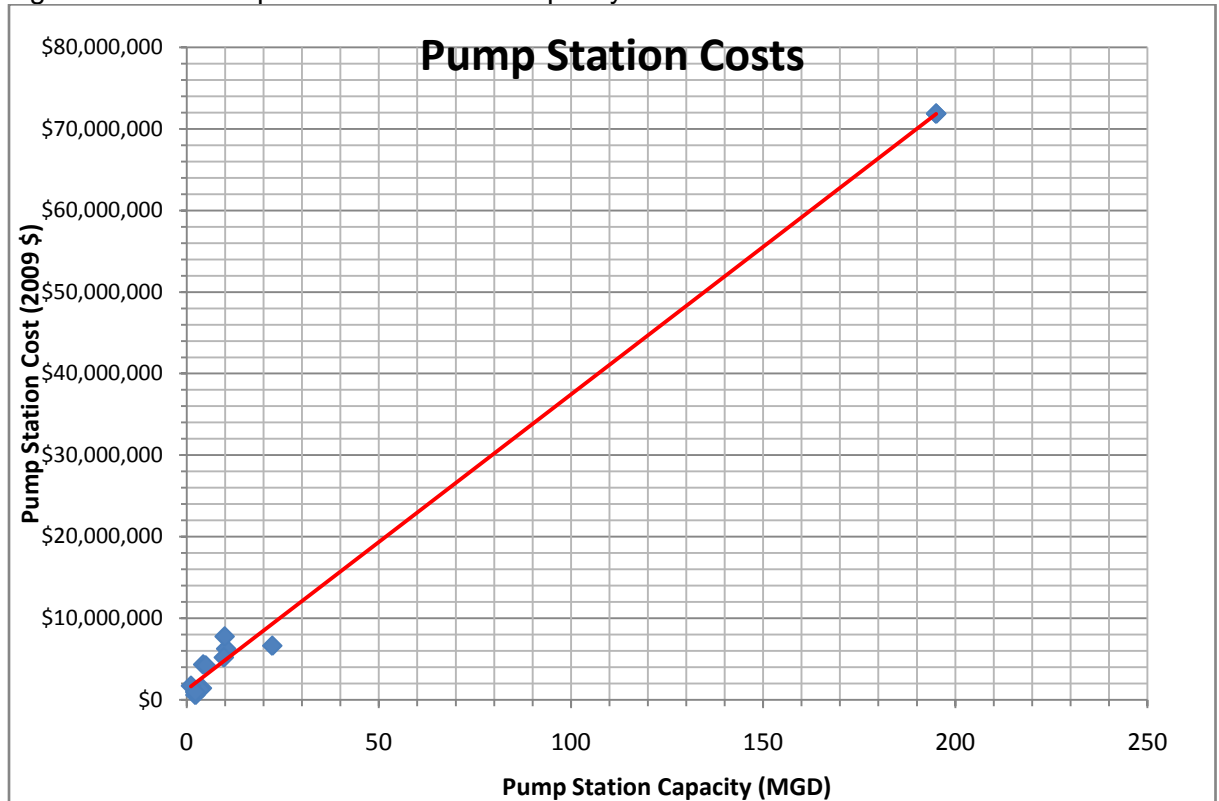
Similarly, SRCSD have constructed a number of pump stations and Table 5.4 below lists these projects as well as their bid dates, capacities and costs.

Table 5.4 SRCSD Pump Station Costs

Facility	Bid Date	Capacity (MGD)	Original Cost	Today's Cost (2009)
Iron Point Pump Station	2000	10.3	\$4,800,000	\$6,262,911
Northborough LS	2001	4	\$1,129,000	\$1,430,183
Parkway Green LS	2002	2.3	\$483,960	\$595,210
Anatolia LS	2004	3.6	\$1,111,037	\$1,287,996
Fruitridge Center Pump Station	2004	9.7	\$4,483,880	\$5,198,046
Power Inn Pump Station	2004	22.3	\$5,719,423	\$6,630,379
New Natomas Pump Station	2004	195	\$61,983,500	\$71,855,865
South River Pump Station	2004	195	\$61,983,500	\$71,855,865
Natomas Central LS	2006	1.15	\$1,576,000	\$1,722,138
Metro Air Park LS	2006	4.33	\$3,965,000	\$4,332,663
Laguna Ridge N LS	2006	5	\$3,848,500	\$4,205,360
SunCreek 1 (Proposed OPC)	2010	2.26	\$1,000,000	\$970,874
SunCreek 2 (Proposed OPC)	2010	9.91	\$8,000,000	\$7,766,990

By graphing the capacities against the 2009 costs we get the following:

Figure 5.1 Pump Station Costs vs. Capacity



The red line in *Figure 5.1* is a trend line for this data. Although there is obviously an absence of data between the capacities of approximately 22 MGD and 195 MGD it is

determined that, for the purposes of the high-level nature of the ISS, this trend line is sufficient to estimate the costs of various sized pump stations.

6.0 RECOMMENDATIONS

Based upon the information obtained from this exercise, the following recommendations are made:

Table 5.5 Recommended Interceptor Pipe Unit Costs

Pipe Type	Pipe Diameter (inches)	Unit Cost for Open-Cut (\$/ft <35 feet deep)	Unit Cost for Trenchless (\$/ft >35 feet deep)
RCP	27	\$420	\$700
RCP	30	\$470	\$800
RCP	33	\$525	\$900
RCP	36	\$580	\$1,000
RCP	42	\$650	\$1,100
RCP	48	\$720	\$1,300
RCP	54	\$900	\$1,525
RCP	60	\$960	\$1,750
RCP	66	\$1,020	\$1,975
RCP	72	\$1,080	\$2,200
RCP	78	\$1,140	\$2,250
RCP	84	\$1,200	\$2,300
RCP	90	\$1,260	\$2,400
RCP	108	\$1,440	\$2,500
RCP	120	\$1,560	\$2,600
FM	15	\$220	-
FM	18	\$250	-
FM	21	\$320	-
FM	24	\$355	-
FM	27	\$390	-
FM	32	\$500	-
FM	36	\$550	-
FM	60	\$650	-

Table 5.6 Pump Station Capital Costs from Figure 5.1

PS Capacity (MGD)	Cost (\$million in 2009)	PS Capacity (MGD)	Cost (\$million in 2009)
10	\$5.0	110	\$41.0
20	\$8.0	120	\$44.5
30	\$12.0	130	\$48.0
40	\$16.0	140	\$52.0
50	\$19.0	150	\$55.5
60	\$23.0	160	\$59.0
70	\$26.0	170	\$62.5
80	\$30.0	180	\$66.0
90	\$34.0	190	\$70.0
100	\$37.0	200	\$73.5

6.1 Recommended Multipliers

From previous SRCSD projects (especially the LNWI projects) the following table shows the additional engineering capital costs that should be added to a cost estimate in order to reach the total approximate capital cost for a project.

Table 5.7 Recommended Capital Cost Additions

Construction Add-Ons	Percentage of Probable Construction Sub-Total
Mobilization/Demobilization	10.0%
Contingencies	30.0%
Engineering Costs	Percentage of Total Probable Construction Cost
Engineering/Admin/Legal/Environmental/RoW	43.0%

SRCSD PAST PROJECTS OPEN-CUT UNIT COSTS

Appendix A - SRCSD Past Projects Unit Prices - Open-Cut

Project	Arden Parallel FM	Bradshaw 5B	Bradshaw 6A	Bradshaw 6B	Bradshaw 7A	Bradshaw 7B	Bradshaw 8	Folsom East 1B	Laguna Interceptor Extension	Natomas FM	North & South Sac River Cross	Sacramento FM	Southport Gravity Sewer	UNWI 5&6	UNWI 7	UNWI 8	West Sacramento FM	Yolo FM	
Contract #	3709	3115	3564	3641	3764	3765	3749	3701	3695	3792	3793	3799	3795	3639	3646	3609	3794	3797	
Year Bid	2004	1999	2004	2004	2004	2004	2004	2002	2004	2004	2004	2004	2004	2004	2003	2003	2004	2004	
Avg. Depth (ft)	15	30	25-30	30-35	30-35	25-30	35-40	30	20-30	Under River		<16	35	25-30	15-20		15-20	20-25	
Escalation Rate	3.0%	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	
Pipe Type	Pipe Size (in)	Pipe Depth (ft)	2009 Dollars																
Gravity RCP	36	26-30															\$475	\$567	
Gravity RCP	36	31-35																	
Gravity RCP	48	16-20													\$700	\$836			
Gravity RCP	48	21-25																	
Gravity RCP	48	26-30												\$490	\$568		\$697	\$832	
Gravity RCP	54	26-30						\$650	\$799								\$809	\$966	
Gravity RCP	60	21-25							\$670	\$777									
Gravity RCP	66	26-30												\$610	\$707				
Gravity RCP	72	26-30					\$1,025	\$1,188	\$800	\$984									
Gravity RCP	78	41-45																	
Gravity RCP	84	26-30							\$810	\$939									
Gravity RCP	84	30-35				\$917	\$1,063	\$840	\$974										
Gravity RCP	90	30				\$1,104	\$1,280	\$960	\$1,113										
Gravity RCP	108	30	\$1,000	\$1,344	\$950	\$1,101				\$2,600	\$3,014								
Gravity RCP	108	30-35				\$1,018	\$1,180												
Gravity RCP	120	30-35											\$1,190	\$1,380					
FM	32	<16													\$550	\$657			
FM	36	<16															\$280	\$325	
FM	60	<16	\$724	\$839						\$593	\$687						\$575	\$667	
FM	66	<16										\$980	\$1,136					\$901	\$1,045

SRCSD PAST PROJECTS TRENCHLESS UNIT COSTS

Appendix B - SRCSD Past Projects Unit Prices - TRENCHLESS

Project	Arden Parallel FM	Bradshaw 5B	Bradshaw 6A	Bradshaw 6B	Bradshaw 7A	Bradshaw 7B	Bradshaw 8	Folsom East 1B	Laguna Interceptor Extension	Natomas FM	North & South Sac River Cross	Sacramento FM	Southport Gravity Sewer	UNWI 5&6	UNWI 7	UNWI 8	West Sacramento FM	Yolo FM
Contract #	3709	3115	3564	3641	3764	3765	3749	3701	3695	3792	3793	3799	3795	3639	3646	3609	3794	3797
Year Bid	2004	1999	2004	2004	2004	2004	2004	2002	2004	2004	2004	2004	2004	2004	2003	2003	2004	2004
Avg. Depth (ft)	15	30	25-30	30-35	30-35	25-30	35-40	30	20-30	Under River			30	35	25-30	15-20	15-20	20-25
Escalation Rate	3.0%	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009
Pipe Type	Pipe Size (in)	Pipe Depth (ft)	2009 Dollar s															
Gravity RCP	48	16-20													\$675	\$806		
Gravity RCP	48	21-25																
Gravity RCP	48	26-30												\$1,300	\$1,507		\$1,450	\$1,731
Gravity RCP	66	26-30													\$1,500	\$1,791		
Gravity RCP	72	26-30						\$2,000	\$2,460									
Gravity RCP	72	31-35																
Gravity RCP	72	36-40						\$1,652	\$1,915									
Gravity RCP	84	26-30								\$2,000	\$2,319							
Gravity RCP	108	30		\$1,060	\$1,229	\$18,000	\$20,867			\$3,000	\$3,478							
FM	15	<16																
FM	18	<16																
FM	21	<16																
FM	24	<16																
FM	27	<16																
FM	32	<16													\$1,450	\$1,731	\$1,585	\$1,893
FM	36	<16																
FM	60	<16																
FM	60	80	\$2,131	\$2,470														
FM	66	20-30										\$1,800	\$2,087					