590164

November 05, 2007

Mr. Matthew H. Litchfield, P.E.
Director, Water Utility
City of San Bernardino Municipal Water Department (SBMWD)
Corporate Yard
195 North "D" Street
San Bernardino, CA 92401

SUBJECT: University Hills Conceptual Water Facilities Study

Dear Mr. Litchfield:

On behalf of our client, Inland Communities Corporation, PBS&J is pleased to submit three (3) copies of the Conceptual Water Facilities Study (Study) for the proposed University Hills Development (Development). This Study outlines design criteria, locations and preliminary sizes of the major water facilities for the Development for SBMWD's review and approval.

BACKGROUND

Inland Communities Corporation is planning a residential community located north of California State University (CSU), in the City of San Bernardino, California. The Development is accessible from freeway I-215 and is generally bounded by San Bernardino National Forest to the north, CSU / Northpark Boulevard to the south, "G" Street to the east and Devil Canyon to the west. See Figure 1 for the location map. It encompasses an area of approximately 404 acres. The proposed water facilities for the Development are shown on Figure 2, Water Facilities Plan. The Development will include up to 980 dwelling units, 5.3 acres under Park / Recreational area, 5.0 acre under Linear Park, 73.6 acres under Roads/ Slopes and 235 acres under Natural Open Space. The general slope of the Development is in the southerly direction.

Proposed water facilities for the Development will be within three pressure zones: 1720, 1880 and 2040. Although, there will not be any development in the 1720 Zone, SBMWD requires storage and pumping facilities for this Zone to provide orderly water distribution system for the Development within 1880 and 2040 zones. Existing water facilities in the1580 Zone will be utilized to supply water to the Development. SBMWD has indicated that the existing 1580 Zone has sufficient capacity to meet the Development demands. Additional storage and pumping facilities are proposed to serve the Development.

The Development is located at the extreme north end of the City and there is no scope of further expansion. Therefore the facilities recommended in this Study are ultimate and there will not be any need of expansion.

PROJECT WATER DEMAND

Water demand calculations for the Development are presented in Appendix A. The demand calculation is done for the planning areas within the Development.

Per SBMWD direction, Table 2 of Section 2, Draft Water Master Plan prepared by CDM was used for unit flow factors (attached in Appendix A). Generally, unit flow factors for lansuse type under "College and Above" segment were used. In cases, where landuse type / density did not match proposed planning areas densities, "Sycamore Zone and Below" category was used. The fire flow for the Development is assumed at 1,500 gpm for four (4) hours duration. A peaking factor of 1.7 for the maximum day demand and 3.4 for the peak hour demand were used.

Water demands for the Development within each pressure zone are summarized in the Table – 1.

Table - 1
Water Demands

	1720 Zone	1880 Zone	2040 Zone	Total
	(gpm)	(gpm)	(gpm)	(gpm)
Average Day Demand	0	368	33	401
Maximum Day Demand	0	626	55	681
Peak Hour Demand	0	1,252	11	1,363
Fire Flow Requirement	1,500	1,500	1,500	n/a
Max. Day and Fire Flow	1,500	2,126	1,555	n/a

HYDRAULICS

SBMWD requires the use of individual pressure regulators for the lots where the maximum pressure exceeds 80 psi. Some of the lots in the proposed development would require individual pressure regulators. The ranges of pad elevation for static pressures within 40 to 80 psi for tanks full condition are as follows:

- 1720 Zone – Maximum 1,628 feet, Minimum 1,536 feet.
- 1880 Zone – Maximum 1,788 feet, Minimum 1,696 feet.
- 2040 Zone – Maximum 1,948 feet, Minimum 1,856 feet.

All planning areas except PA-15 (see Figure 2 and Appendix A) will be served by water facilities provided to serve 1880 zone; PA-15 will be served by facilities required for 2040 zone.

Hydraulic Modeling Software H2Onet version 6.0 by MW Soft was used for creation and evaluation of the hydraulic model for the Development.

A composite hydraulic model was developed for static conditions. It does not include extended period simulation. The pumps were closed to obtain outputs for a non pressurized system. Only, the demands of the Development were used to obtain flow results for the network elements. The hydraulic model was run for four scenarios as described below:

Scenario 1, Average Day Demand with Tanks One Half Full –The hydraulic model was run for average day demand conditions with tanks half full. The model run results for the pipelines and junctions can be seen in Appendix B.

Scenario 2, Maximum Day Demand with Tanks One Half Full –The hydraulic model was run for the maximum day demands and tanks half full. The model run results are tabulated in Appendix B.

Scenario 3, Peak Hour Demand with Tanks One Half Full –The hydraulic model was run for the peak hour demands and tanks half full. The model run results are tabulated in Appendix B.

Scenario 4, Maximum Day Demand with Fire in all zones – Demand nodes in each pressure zones were selected to input fire demand of 1,500 gpm and model run results for maximum day demands and fire in all pressure zones with tanks half full are summarized in Table -2. The model run results are shown in Appendix B.

The results of the hydraulic model runs of all of four scenarios are summarized in Table – 2.

Table – 2
Summary of Hydraulic Model Runs

Scenario			
	Zone	Minimum Pressure at Node	Maximum Velocity in Pipe
		(node/psi)	(pipe/fps)
1 (Average day Demand with tanks half full)	1720	-	-
	1880	51.0	0.6
	2040	64.1	0.1
2 (Maximum day Demand with tanks half full)	1720	-	-
	1880	50.8	1.0
	2040	64.1	0.2
3 (Peak Hour Demand with tanks half full)	1720	-	-
	1880	50.0	2.0
	2040	64.1	0.3
4 (Maximum day Demand and fire in all zones with tanks half full)	1720	56.6	2.4
	1880	48.1	3.4
	2040	60.5	4.4

STORAGE FACILITIES

The storage requirement for the Development has been sized for the following criteria:

- Operational Storage – 25% of the Maximum Day Demand
- Emergency Storage – 100% of the Maximum Day Demand
- Fire Storage - 1,500 gpm for 4-hours

The storage facilities required for the Development are summarized in Table - 3.

Table - 3
Storage Facilities

Items	1720 Zone (University Hills Only)*	1720 (With SBMWD Participation)*	1880 Zone	2040 Zone
Maximum Day Demand (gpm)	0	0	624	55
Operational Storage (gallons)	0	0	225,300	19,960
Emergency Storage (gallons)	0	0	901,180	79,850
Fire Storage (gallons)	0	0	360,000	360,000
Total Storage Required (gallons)	0	0	1,486,480	459,810
Total Storage Required (MG)	0	0	1.49	0.46
Tank Size Recommended(MG)	**0**	**1.0**	**1.50**	**0.50**
Tank Dimensions **Height (feet)** **Diameter (feet)**		 **24** **85**	 **24** **105**	 **24** **60**

***** Note that land planning for the development is on going. No lots will lie within the 1720 Zone however this will be confirmed during detailed design of the project.

One above grade welded steel reservoir will be constructed for each zone. The tentative locations of these reservoirs are shown in Figure 2. The precise location of the reservoirs will be determined at a later stage and SBMWD will be consulted on these locations. A 12 feet wide paved access road would be provided for each reservoir site.

The following is the summary of the major components for the proposed reservoirs:

- Each reservoir would have a common inlet/outlet pipe with flexible connections, isolation valves and an altitude valve to prevent overflow.

- To improve mixing in the tank, each inlet/outlet pipeline would have two check valves, forcing water to travel a greater distance from inlet to outlet in a circular motion.

- The reservoirs would have separate overflow pipes and drain pipes that would discharge to a concrete gutter.

- The gutter would convey storm flows, reservoir overflows and drainage along the access road to the downstream development storm drain.

- Maintenance access to the interiors of the reservoirs would be provided through roof hatches with interior ladders and access manways located on the sides of the reservoirs.

PUMPING FACILITIES

The pumping facilities have been sized for the Cumulative Maximum Day Demand plus fire flow requirement (1,500 gpm). The Cumulative Demand equals in zone demands plus demands in upper zones. The pumping facilities are summarized in the Table – 4.

Table – 4
Pumping Facilities

Items			
	1720 Zone	1880 Zone	2040 Zone
Pump	1580-1720	1720-1880	1880-2040
Maximum Day Demand (gpm)	0	626	55
Cumulative Maximum Day Demand (gpm)	681	681	55
Fire Flow Requirement (gpm)	1,500	1,500	1,500
Pumping Capacity Required (gpm)	2,181	2,181	1,555
Pumping Capacity Recommended (gpm)	2,250	2,250	1,600
Estimated Pumping Head (ft)[1]	180	200	200
Horsepower Requirement (70% Efficiency)	150	160	120
Recommended Pumps	**2-75 Hp Duty**	**2-90 Hp Duty + 1-90 Hp (Standby)**	**2-60 Hp Duty + 1-60 Hp (Standby)**

Notes:

1. Pumping head is the sum of difference in zone elevations, height of tank and approximate (5%) head loss in transmission lines and minor losses.
2. Zone 1720 pumps to be installed at College East Booster Station Site.

The following is the summary of the major components for the proposed booster pump stations:

- The configuration of the pump station would include duty pumps plus one standby pump (largest pump not in service).

- The suction pipes would be supplied with gate valves for isolation and discharge pipes would be equipped with Cla-Val pump control valves or approved equals.

- The pump station would have an above grade flow meter.

- There would be a Cla-Val surge relief valve (or approved equal) located at the discharge header for surge protection, and two butterfly valves for isolation; one each at suction and discharge side.

- The pump station would be an above grade concrete masonry building.

- The pump stations will be equipped with a standby trailer mounted portable generator. This generator will be transported to the pump station where required during power failure.

- The pump station would be divided into separate rooms: main pump room, electrical room to house the motor control center (MCC), and be equipped for hookup to portable generator via Posi-Lok connectors and transfer switch.

The pumps will be vertical turbine type by an approved manufacturer.

Please see Figure 2 for location of a Pumping Facilities.

PIPELINE FACILITIES

The proposed Development is located at the outmost city limit so, there is remote chance of use of the proposed water facilities by other future developments. The pipelines within the Development should be considered distribution lines for all practical purposes. The pipelines that connect pump stations to the reservoirs will be minimum 12-inch in diameter. Also, all looping lines will be 12-inch in diameter. All other distribution pipelines would be 8-inch in diameter. The results of model run for pipelines can be seen in Appendix B.

A preliminary discussion with San Bernardino County Flood Control District has been initiated to use their right of way adjacent to Sycamore 1 tank (1580 Zone) for installation of pipelines feeding the proposed water tanks.

PRELIMINARY OPINION OF CONSTRUCTION COST AND PHASING

It is assumed that the facilities within zones 1720 and 1880 would be constructed in first phase. It will require construction of 1720 Zone and 1880 Zone reservoirs and pumping facilities. Phase 2 facilities would require construction of 2040 Zone reservoir and pumps. Phase 2 facilities are contingent on phase 1. It is assumed that proposed facilities in phase 1 would precede facilities in phase 2. The approximate cost of the proposed backbone water facilities for phase 1 is $ 8.4 million and $ 2.1 million for phase 2. The total cost for the development is approximately $ 10.5 million. SBMWD will share 100% of cost of 1720 Zone water tank (1.0 MG) and difference of cost of upsizing of pipelines from 12-inch to 16-inch.

The cost sharing between University Hills Specific Plan and SBMWD is as follows:

University Hills Specific Plan - $8.3 Million
SBMWD - $2.2 Million

The details of Preliminary Cost Estimate and sharing of cost can be seen in Appendix C. The estimated dollar amount will vary with fluctuation of materials and labor cost so, cost sharing will be per percentage amount as shown.

CONCLUSION

We appreciate SBMWD's review and consideration of this Conceptual Water Facilities Study. This Study and the District's review comments will serve as the basis of Design Memorandum that will precede the final design of water facilities for University Hills Development. If there are any concerns or questions during the course of review, please do not hesitate to call me at (951) 358-1433.

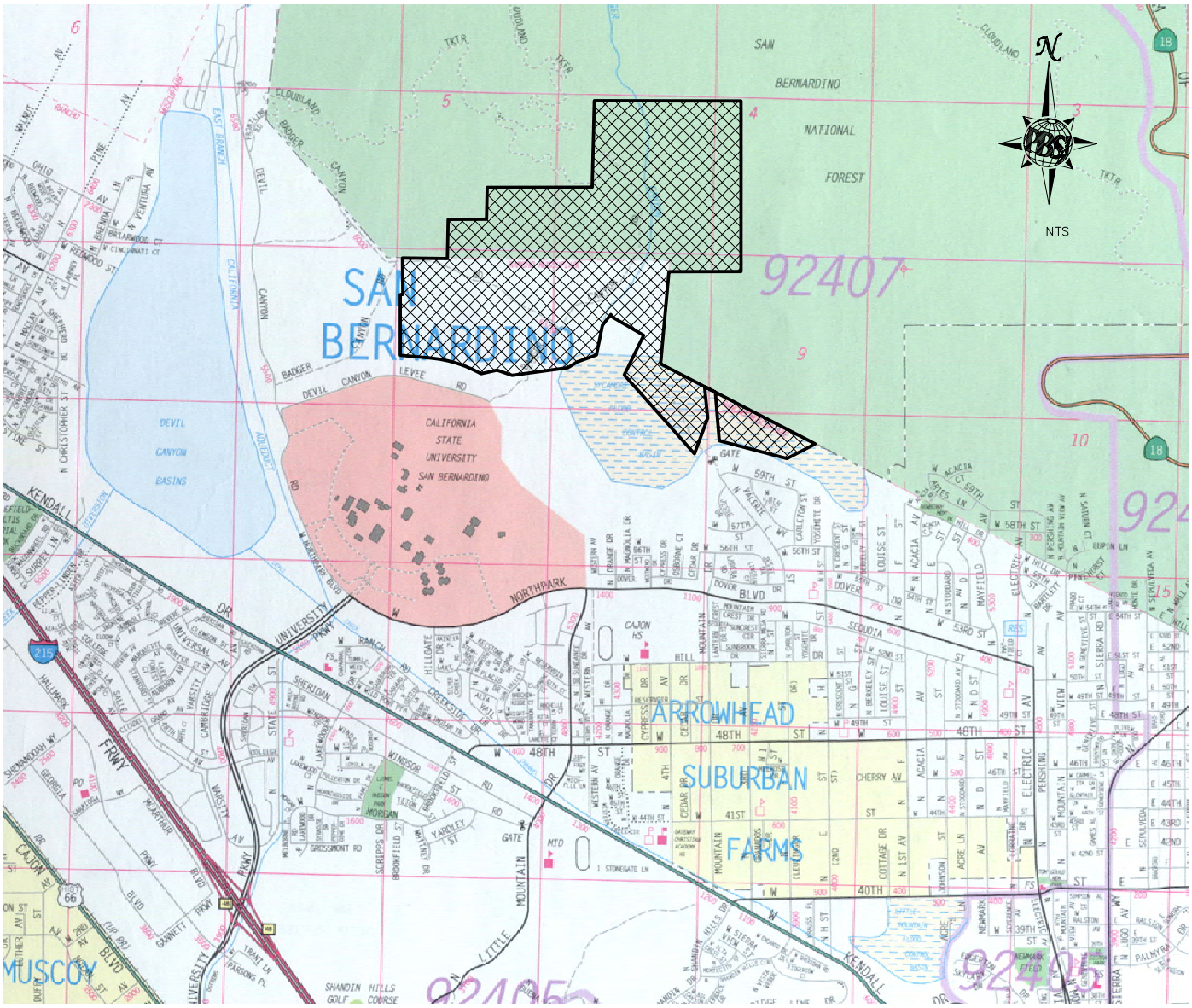
Sincerely,

Tom Molina, P.E.
Program Manager

Attachments

Figure 1	Location Map
Figure 2	Water Facilities Plan
Appendix A	Flow Calculations
Appendix B	Hydraulic Modeling
Appendix C	Preliminary Cost Estimate

CC: Mohamad Younes, Inland Communities Corp.



LEGEND

PROJECT BOUNDARY

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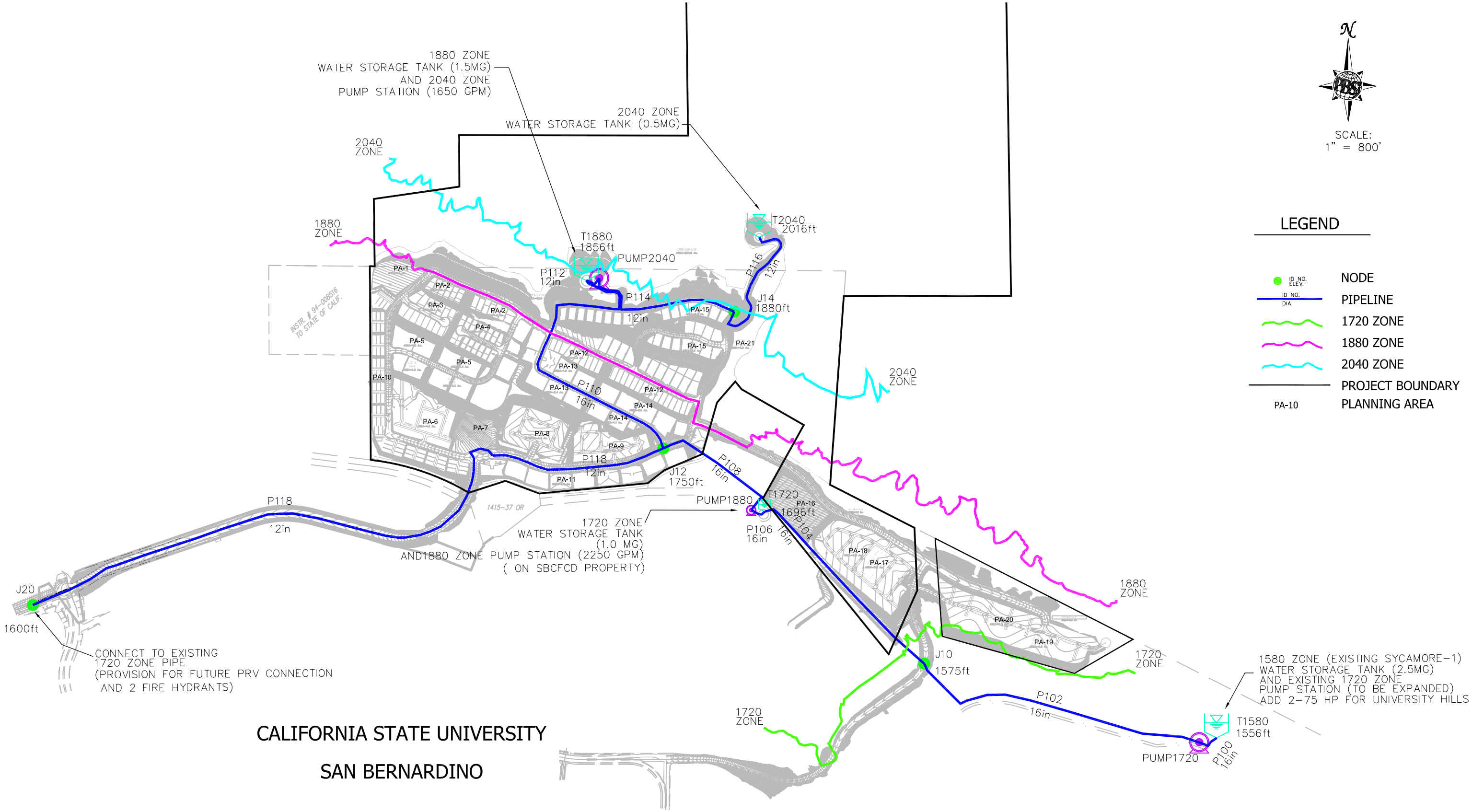
SAN BERNARDINO MUNICIPAL WATER DEPARTMENT UNIVERSITY HILLS	FIGURE 1
LOCATION MAP	



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UNIVERSITY HILLS		FIGURE 2
WATER FACILITIES PLAN		

Appendix A

Flow Calculations

University Hills Development
Land Use, Area, Dwelling Units and Density

Planning Area	Details of Planning Area			
	Land Use	**DU/AC**	**Area**	**DU**
1880 Zone:				
1	Open Space / Park	0	2.10	0
2	SFD-5000	6	2.20	13
3	SFD-5000	6	2.50	15
4	SFD-5000	6	2.70	16
5	SFD- Green Court	12	7.90	95
6	Townhouse / Flats / Live-Work	17	4.60	80
7	Parkhouse	0	2.20	0
8	Townhouse / Flats / Live-Work	17	4.40	75
9	Townhouse / Flats / Live-Work	20	3.20	64
10	SFD-Green Court	11	5.40	59
11	Townhouse / Rowhouse	17	5.90	98
12	SFD-4000	8	3.10	26
13	SFD-Green Court	13	4.00	50
14	SFD-Green Court	11	4.60	50
16	Faculty Housing Site	15	4.00	60
17	Recreation Facility	0	0.50	0
18	Townhouse / Rowhouse	16	8.60	138
19	Recreation Facility	0	0.50	0
20	Green Court	13	8.30	104
	subtotal:		**76.7**	**943**
Irrigated Slope Area			**35.4**	
2040 Zone:				
15	Estate Lots	3	14.30	37

Planning Area	Details of Planning Area			
	Land Use	**DU/AC**	**Area**	**DU**
	subtotal:		**14.3**	**37**
Irrigated Slope Area			**1.4**	
TOTAL				**980**

San Bernardino Municipal Water Department (SBMWD)
University Hills Development
Water Demand and Sizing of Facilities per Pressure Zone

Pressure Zone	Planning Area	Land Use	DU/AC	Area	Mean Water Demand	Average Day Demand	Max. Day Demand	Peak Hour Demand	Notes
				(ac)	(gpm/ac)	(gpm)	(gpm)	(gpm)	
1720				**0**		**0.00**	**0.00**	**0.00**	1
1880	1	Open Space / Park	0	2.10	2.07	4.35	7.39	14.78	2
	2	SFD-5000	6	2.20	2.68	5.90	10.02	20.05	3
	3	SFD-5000	6	2.50	2.68	6.70	11.39	22.78	3
	4	SFD-5000	6	2.70	2.68	7.24	12.30	24.60	3
	5	SFD- Green Court	12	7.90	4.16	32.86	55.87	111.74	4
	6	Townhouse / Flats / Live-Work	17	4.60	4.16	19.14	32.53	65.06	4
	7	Parkhouse	0	2.20	2.07	4.55	7.74	15.48	2
	8	Townhouse / Flats / Live-Work	17	4.40	4.16	18.30	31.12	62.23	4
	9	Townhouse / Flats / Live-Work	20	3.20	5.72	18.30	31.12	62.23	5
	10	SFD-Green Court	11	5.40	3.61	19.49	33.14	66.28	4A
	11	Townhouse / Rowhouse	17	5.90	4.16	24.54	41.72	83.45	4
	12	SFD-4000	8	3.10	3.61	11.19	19.02	38.05	4A
	13	SFD-Green Court	13	4.00	4.16	16.64	28.29	56.58	4
	14	SFD-Green Court	11	4.60	3.61	16.61	28.23	56.46	4A
	16	Faculty Housing Site	15	4.00	4.16	16.64	28.29	56.58	4
	17	Recreation Facility	0	0.50	2.07	1.04	1.76	3.52	2
	18	Townhouse / Rowhouse	16	8.60	4.16	35.78	60.82	121.64	4
	19	Recreation Facility	0	0.50	2.07	1.04	1.76	3.52	2
	20	Green Court	13	8.30	4.16	34.53	58.70	117.40	4
	Roads / Slopes / Misc.			35.41	2.07	73.30	124.61	249.22	6
	Subtotal 1880 Zone:			**112.11**		**368.13**	**625.82**	**1251.64**	8
2040									
	15	Estate Lots	3	14.30	2.08	29.74	50.56	101.13	7

Pressure Zone	Planning Area	Land Use	DU/AC	Area	Mean Water Demand	Average Day Demand	Max. Day Demand	Peak Hour Demand	Notes
				(ac)	(gpm/ac)	(gpm)	(gpm)	(gpm)	
	Roads / Slopes / Misc.			1.39	2.07	2.88	4.89	9.78	6
	Subtotal 2040 Zone:			**15.69**		**32.62**	**55.45**	**110.91**	8
	TOTAL					**401**	**681**	**1363**	

A. Please refer the proposed Site Plan for University Hills Development (attached) for Planning Area, Density (DU/AC) and area (acre).

B. Refer Section 2, Table 2-2 of Master Plan for Water Demand Factors. 95% UCL of Mean Water Demand is used for calculation.

C. Abbreviations:

DU - Dwelling Units
AC - Acre
gpm - Gallons per minute
SFD - Single Family Dwellings

D. Notes:

1 None of the proposed development is within Pressure Zone 1720.
2 Mean water demand for open space/park has been considered as public facility (2.07 gpm/acre).
3 Refer Table 2-2, College Zone and above residential suburban land use type (3.8-6.75 DU/AC), mean water demand - 2.68 gpm/ac. Planning area with density close to lower value also included.
4 Refer Table 2-2, Sycamore zone and below, res med landuse type (11.5-19 DU/AC) with 10% addition as per SBMWD directive (attached): 4.16 gpm/ac
4A Refer Table 2-2, College Zone and above Res Urban landuse type. The proposed DU/AC in the range (8-11) is near to lower range value (11.5 du/ac) so, a demand factor of 3.61 gpm/ac is used.
5 Refer Table 2-2, Sycamore zone and below, res med high landuse type (19-30 DU/AC), mean water demand- 5.72 gpm/ac..
6 It is assumed that 50% of total area within roads / slopes / misc. category will be irrigated. The total irrigated area within this category is further proportioned in zones 1880 and 2040 per dwelling units within these pressure zones. Demand 2.07 gpm per acre.
7 Refer Table 2-2, College Zone and above residential low land use type (2.05-3.8 DU/AC), mean water demand - 2.08 gpm/ac.
8 Max. Day Demand is 1.70 times Average Day Demand (See section 2, Maximum Day Demand Ratio). and Peak Hour Demand is 3.4 times Average Day Demand.

San Bernardino Municipal Water Department (SBMWD)
University Hills Development
Tank Sizes per Pressure Zone

Items	1720 Zone	1880 Zone	2040 Zone
Maximum Day Demand (gpm)	0	626	55
Emergency Storage (gallons)[1]	-	901,180	79,850
Operational Storage (gallons)[2]	-	225,300	19,960
Fire Storage (gallons)[3]	-	360,000	360,000
Total Storage Required (gallons)	-	1,486,480	459,810
Total Storage Required (MG)	-	1.49	0.46
Tank Size Recommended (MG)[4]	**1.00**	**1.50**	**0.50**

Notes:

1. Emergency Storage equivalent to one full day of Maximum Day Demand
2. Operational Storage equivalent to 25% of one full day of Maximum Day Demand.
3. Fire Storage equivalent to 1,500 gpm for 4-hour duration.
4. Storage Facilities for 1720 Zone as per direction of SBMWD.

San Bernardino Municipal Water Department (SBMWD)
University Hills Development
Pump Sizes per Pressure Zone

Items	1720 Zone	1880 Zone	2040 Zone
Pump	1580-1720	1720-1880	1880-2040
Maximum Day Demand (gpm)	-	626	55
Cumulative Maximum Day Demand (gpm)[1]	681	681	55
Fire Flow Requirement (gpm)	1,500	1,500	1,500
Total Capacity Requirement (gpm)	2,181	2,181	1,555
Total Capacity Recommended (gpm)	2,250	2,250	1,600
Estimated Pumping Head (ft)[2]	180	200	200
Horsepower Requirement (70% Efficiency)	150	160	120
Recommended Units	**2-75 Hp (Duty)**	**2-90 Hp (Duty) + 1-90 Hp (Standby)**	**2-60 Hp (Duty) + 1-60 Hp (Standby)**

Notes:

1. Cumulative demand equals in zone demand plus demands for higher zones.
2. Pumping head is the sum of difference in zone elevations, height of tank and approximate (5%) head losses in transmission lines including minor losses.

San Bernardino Municipal Water Department (SBMWD)
University Hills Development
Tank Sizes per Pressure Zone

Items	1720 Zone	1880 Zone	2040 Zone
Maximum Day Demand (gpm)	0	626	55
Emergency Storage (gallons)[1]	-	901,180	79,850
Operational Storage (gallons)[2]	-	225,300	19,960
Fire Storage (gallons)[3]		360,000	360,000
Total Storage Required (gallons)	-	1,486,480	459,810
Total Storage Required (MG)	-	1.49	0.46
Tank Size Recommended (MG)[4]	**1.00**	**1.50**	**0.50**
Height of Tank (ft)	24.00	24.00	24.00
Diameter of Tank (ft)	84.69	103.73	59.89
Recommended Diameter of Tank (ft)	**85**	**105**	**60**

Notes:

1. Emergency Storage equivalent to one full day of Maximum Day Demand
2. Operational Storage equivalent to 25% of one full day of Maximum Day Demand.
3. Fire Storage equivalent to 1,500 gpm for 4-hour duration.
4. Storage Facilities for 1720 Zone as per direction of SBMWD.

Section 2
Water Demand

2.1 Introduction

Evaluation of current water demand and projections of future demand are necessary to assess the adequacy of existing water supply and distribution facilities. This section presents historical production and consumption data, current water use, and projected water requirements by land use type and by pressure zone. In addition, this section describes seasonal and maximum day peaking factors as well as fire flow requirements.

The term "Water Demand" is often used interchangeably between water production and water consumption; to clarify this concept, water demand in this report is defined as the amount of water sold by the Water Department plus an allowance for unaccounted-for water. This combined amount represents the total amount of water that production facilities produced historically or should produce in the future to serve the water needs of the community.

2.2 Historical Water Production and Consumption

2.2.1 Water Production

Since the previous water master plan was completed in 1991, water production has increased from 39,377 ac-ft per year (35.15 mgd) in 1991 to over 50,000 ac-ft per year in 1999 and 2000 and again in 2004. This represents an increase of 28 percent over this period or approximately 1.8 percent per year. However, it should be noted that the majority of the increase in production occurred during the 1990s as the highest annual production over the last 15 years was recorded in 1999 when close to 52,000 ac-ft were produced. Since the year 2000, water production has fluctuated between 48,000 and 50,000 ac-ft per year as illustrated in Figure 2-1.

2.2.2 Water Consumption

SBMWD's billing system segregates accounts in three main groupings; fire service, landscape service, and water service. Each of these main groups is further subdivided into various categories. Of these groups, fire service represented less than one tenth of one percent of the annual consumption during the 2000-05 period. Landscape service, which includes separate services for common landscaped areas, assessment districts, and golf courses, represented approximately 13 percent of total consumption for the period. The Water Service category, which is generally subdivided into various residential groups, non-residential, municipal, and other smaller categories, represented the remaining 87 percent of total consumption.

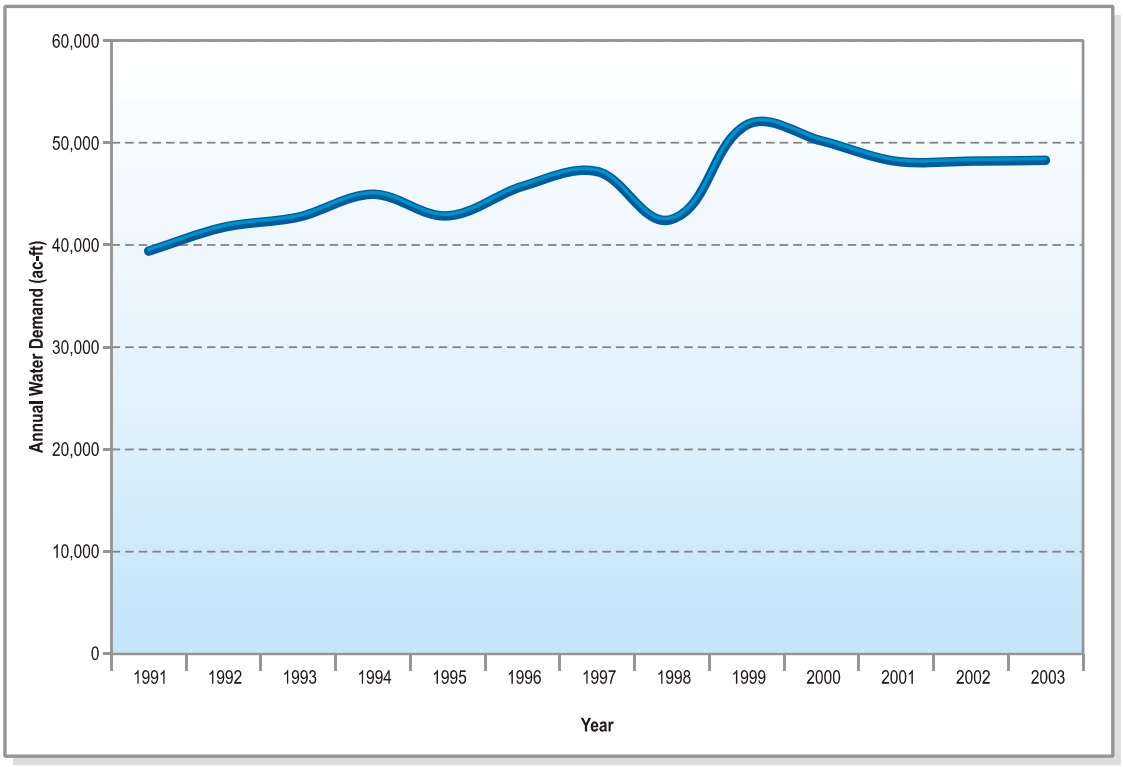

Figure 2-1
Historical Production from 91 to 2005

Documented water consumption (i.e. billing) for residential purposes represented approximately two thirds of total consumption in the service area during the 2003-05 period, as illustrated in Figure 2-2. Non-Residential and Municipal, including Landscape, represented approximately 13 to 15 percent each with the remaining 5 to 7 percent falling under the Other Category. Other includes wholesale deliveries to neighboring agencies, construction water from metered hydrants, the county hospital, and accounted use by the Fire Department.

2.2.3 Unaccounted-for Water

Unaccounted-for water is the difference between the amount of water produced and the amount of water billed to customers. An expected fraction for a system like the SBMWD's system is approximately 10 percent of total production.

Within the water system, the following are expected sources of unaccounted-for water:

- Hydrant Testing and Flushing. Hydrant testing is performed by both the Water Department and the Fire Department. The Fire Department performs a comprehensive testing program to monitor the level of fire protection available throughout the service area.

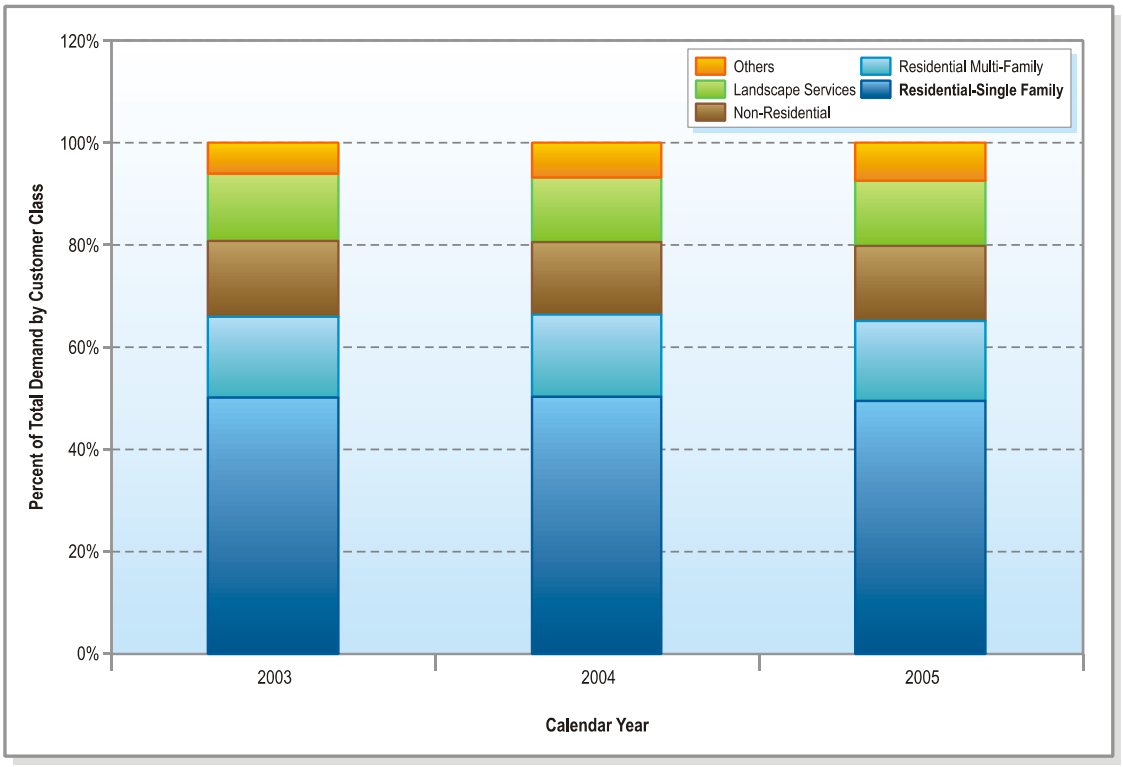

Figure 2-2
Water Consumption

- Fire Hydrant Operations by Fire Department. This represents the use of water for emergencies.
- Customer Meter. Customer meters represent one of the main sources of unaccounted-for water as they tend to under represent actual consumption. While the Water Department has a replacement program to replace some of the malfunctioning meetings, a systematic program to replace meters is not currently being implemented.

Another source for inaccuracies between production and water sales is flow meters at production facilities. Flow meters have been installed in all production facilities to record daily production. While the Department has a meter testing program to maintain accurate production records, individual meters are often off by as much as 10 percent in either direction as documented in pump test reports conducted by Southern California Edison for the Water Department.

A comparison of water production vs. consumption records for the 2003-05 periods indicates an average rate of unaccounted-for water of seven percent of production or approximately 3,000 ac-ft per year. Unaccounted-for water ranged from a low of 6.1 percent of production in 2005 to a high of 8.8 percent the year before. Figure 2-3 compares annual water production and consumption for the 2003-05 periods and illustrates the annual rate of unaccounted-for water.

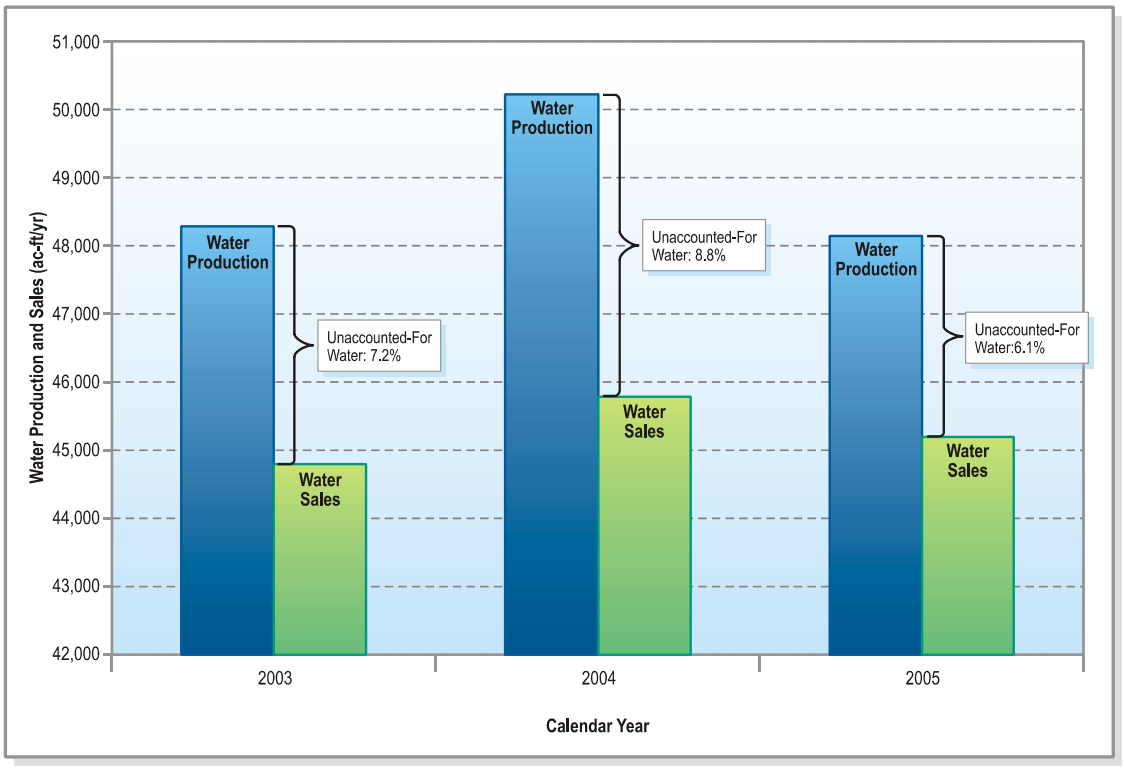

Figure 2-3
Unaccounted-for water

2.2.4 Seasonal Fluctuations in Demand

Maximum Month Demand Ratio. Historical monthly production records since 1991 were used to develop average monthly production curves as illustrated in Figure 2-4. To develop the production curve, monthly production for individual years was compared against the average monthly production for that year to determine the monthly production ratio. Maximum month production occurred in most years during the month of August and ranged between 132 and 163 percent of average month production; it averaged 144 percent over the 15 year period. Minimum production occurred in the month of February and ranged from 53 to 76 percent of the average monthly production. It should be noted that the upper and lower values for each month shown in Figure 2-4 indicate the maximum and minimum monthly ratios for that given month over the 1991-2005 period.

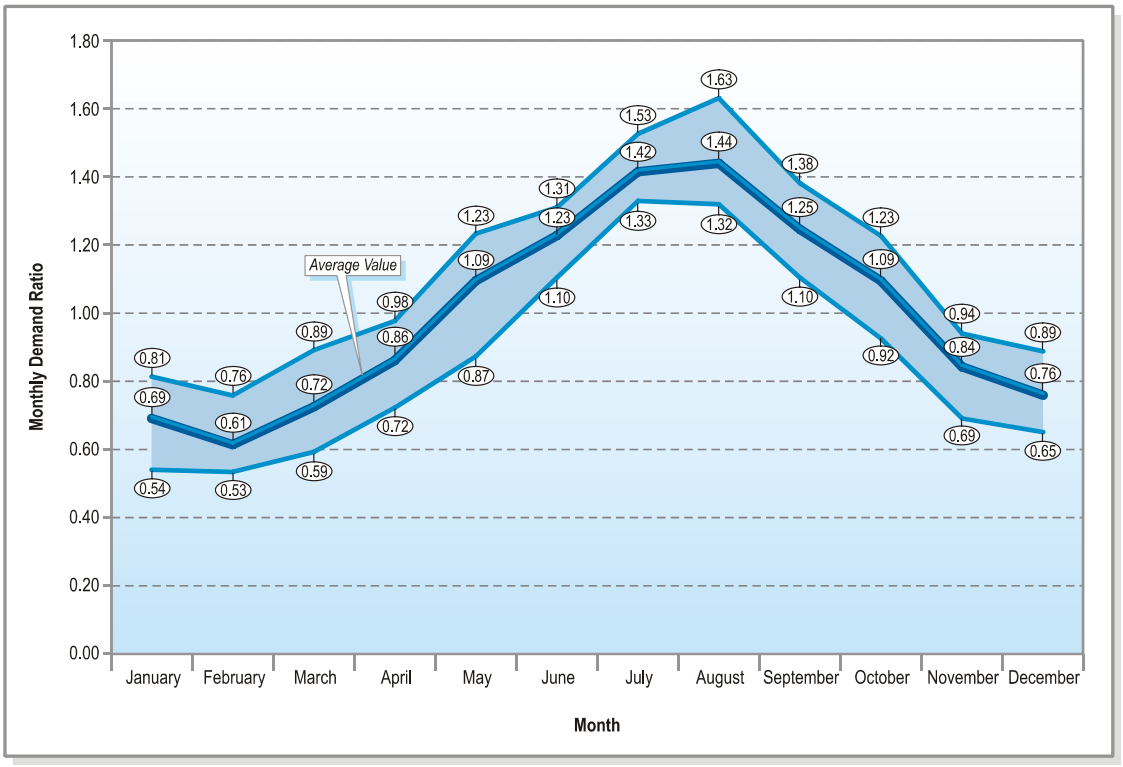

Figure 2-4
Seasonal Fluctuations in Water Production

Maximum Day Demand Ratio. Maximum day demand (MDD) ratio was estimated from daily production records for the 2000-05 periods. Maximum day to average day production ratio ranged from 1.63 to 1.78 and averaged 1.70. This value represents 1.18 times the maximum month ratio of 1.44 established earlier. The maximum day to maximum month ratio was increased to 1.20 times as daily production records do not account for changes in storage and to add a small degree of contingency. The 1.20 ratio to maximum month is also consistent with the value used in the 1991 Master Plan. The resulting maximum day to average day ratio was calculated at 1.73 times; this value is slightly lower than the maximum ratio of 1.78 times calculated for the 2000-05 period.

Maximum Day Production. A review of daily production records over the last six years indicates a maximum daily production of approximately 70 mgd. This production rate was exceeded less than five times per year prior to 2006 as illustrated in Figure 2-5; however, during the current year, as of July 31, was exceeded 34 times with daily production averaging well over 70 mgd for the entire month of July. This was partly due to extremely high temperatures in July and deliveries of approximately 8 mgd to SBVMWD.

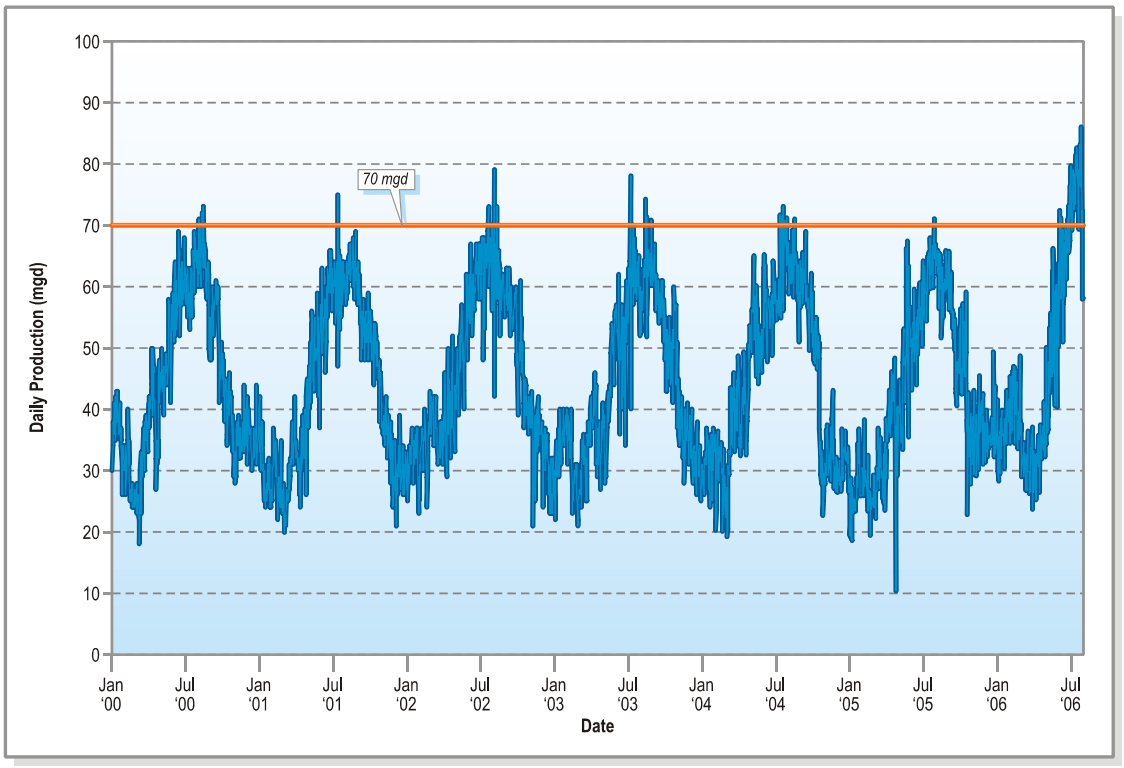

Figure 2-5
Daily Production 2000-06

2.3 Basis for Water Demand Projections

The basis for projecting water demands were the 2002 billing consumption, adjusted for unaccounted-for water, and unit flow rates for individual land use types derived from it.

2.3.1 2002 Billing Information

The 2002 billing information for individual accounts was associated with their designated land use using GIS to segregate demands by land use type. To accomplish this, water accounts were initially matched to a parcel in the GIS database using a common assessor's parcel number (APN). To increase the matching percentage, aerial photography was used to identify developed parcels not listed in the billing database; these parcels were identified as potentially being served by the Water Department. In addition, accounts were evaluated individually and matched to the parcel layer by adding or updating their APN. Some accounts could not be matched to the parcel layer after further review. The unmatched accounts correspond to approximately five percent of the system wide consumption.

Table 2-1 presents the actual water consumption by land use type based on billing records. Actual consumption was increased by seven percent to account for unaccounted-for water. This table also shows the number of accounts by land use type and their respective acreage. Water demand is presented for both average day and maximum day; maximum day values were obtained by multiplying average day demands by a 1.73 factor as discussed in Section 2.2.4. The average day demand was estimated at 27,259 gpm, which corresponds to an annual demand of 43,970 ac-ft per year. This demand excludes deliveries to other local agencies.

Table 2-1
2002 Water Demand

2002 Water Demand by Land Use Type					
Land Use Type	*Acreage*	*APNs*	*Water Demand (gpm)*		*MDD (MG)*
			ADD	MDD	
Commercial	92	109	83	144	0.21
Commercial General	964	2,040	1,609	2,784	4.01
Commercial Heavy	209	354	281	486	0.70
Commercial Neighborhood	8	35	24	42	0.06
Commercial Office	357	577	922	1,596	2.30
Commercial Regional	548	555	1,366	2,364	3.40
Industrial Extractive	--	--	--	--	--
Industrial Heavy	414	122	345	597	0.86
Industrial Light	852	1,189	1,203	2,082	3.00
Office Industrial Park	117	115	112	193	0.28
Public	214	17	51	88	0.13
Public Facilities	669	115	1,629	2,819	4.06
Public Flood Control Areas	52	17	26	45	0.06
Public Parks	178	46	360	622	0.90
Residential 35	--	--	--	--	--
Residential Estate	127	83	272	471	0.68
Residential High	56	173	274	473	0.68
Residential Low	454	647	656	1,135	1.63
Residential Medium	575	2,027	2,101	3,634	5.23
Residential Medium High	154	366	573	992	1.43
Residential Medium High 20	2	8	2	3	0.00
Residential Suburban	5,370	26,775	13,359	23,110	33.28
Residential Urban	952	3,320	1,968	3,404	4.90
Unknown	70	18	43	75	0.11
Total	**12,433**	**38,708**	**27,259**	**47,159**	**67.91**

2.3.2 Unit Flow Factors

Unit flow factors were developed for various land use designations from the 2002 billing records. After matching the billing database to individual parcels, their land use and parcel size were used to estimate water consumption per acre for the different designations. A total of 32,551 billing records, representing over 95 percent of active

accounts in 2002 were used in the statistical analysis to develop unit flow factors. Unit flow factors for residential parcels in the Verdemont Area (College Zone and higher) were separated from other residential areas as water consumption in Verdemont is anticipated to be higher on a per unit basis. The results of the statistical analysis are presented in Table 2-2.

Table 2-2
Unit Flow Factors

Unit Flow Factors by Land Use Designation							
Land Use Type	*Total Accounts*	*No of Accts Used to Calculate Demand*	*Data Distribution*	*Average Water Demand 50% UCL (gpm/ac)*	*80% UCL of Mean Water Demand (gpm/ac)*	*95% UCL of Mean Water Demand (gpm/ac)*	*Method for UCL Calculation*
All Parcels:							
Industrial	1,105	1,094	Neither Normal nor Lognormal	1.34	1.38	1.42	Nonparametric - Standard Bootstrap
Public	128	121	Neither Normal nor Lognormal	1.73	1.92	2.07	Nonparametric - Standard Bootstrap
Commercial	2,629	2,622	Neither Normal nor Lognormal	1.87	1.91	1.95	Nonparametric - Standard Bootstrap
College Zone and Above:							
Res Urban (6.75-11.5 du/ac)	47	47	Normal	3.35	3.48	3.61	Student's t
Res Suburban (3.8-6.75 du/ac)	3,405	3,395	Neither Normal nor Lognormal	2.65	2.66	2.68	Nonparametric - Standard Bootstrap
Res Low (2.05 - 3.8 du/ac)	342	336	Neither Normal nor Lognormal	1.99	2.04	2.08	Nonparametric - Standard Bootstrap
Res Estate (<2.05 du/ac)	1191	14	Normal	0.84	0.88	0.93	Student's t
Sycamore Zone and Below:							
Res Med High (19-30 du/ac)	12	12	Normal	4.65	5.17	5.72	Student's t
Res Med (11.5-19 du/ac)	231	228	Neither Normal nor Lognormal	3.58	3.68	3.78	Nonparametric - Standard Bootstrap
Res Urban (6.75-11.5 du/ac)	4,293	4,279	Neither Normal nor Lognormal	2.56	2.57	2.59	Nonparametric - Standard Bootstrap
Res Suburban (3.8-6.75 du/ac)	18,114	18,100	Neither Normal nor Lognormal	2.32	2.33	2.34	Nonparametric - Standard Bootstrap
Res Low (2.05 - 3.8 du/ac)	1,829	1,815	Neither Normal nor Lognormal	1.96	1.98	2.00	Nonparametric - Standard Bootstrap
Res Estate (<2.05 du/ac)	400	388	Normal	1.11	1.15	1.19	Nonparametric - Standard Bootstrap

The water consumption records for each account within each category were divided by the area of the parcel associated with each account so that water demand could be expressed on a per unit area. Statistical analyses were performed using ProUCL (EPA 2001), a software program developed by EPA to allow for graphical exploration of data, evaluation of data distribution, and calculation of upper confidence limits for the arithmetic mean of any given data set. The data set for each of the categories above was visually examined by plotting a Quantile-Quantile plot (Q-Q plot) in ProUCL. The plot was examined to identify high-demand users (outliers) for a given category. Outliers were removed from the larger data set for the category under consideration for purposes of central tendency calculations.

The distribution of each data set was evaluated through the Shapiro-Wilk W-test for smaller data sets and with the Lillefor's test for larger data sets, due to sample size restrictions associated with the W-test. The arithmetic mean and the 80 and 95 percent upper confidence limits (UCLs) of the mean were determined for each data set (Table 2-2). The UCL is the upper limit of the confidence interval about the mean value. For example, from Table 2-2, the average (50% UCL) water demand for industrial parcels is 1.34 gpm/acre while the 95 percent UCL is 1.42 gpm/acre. This means that there is a 95 percent probability that the mean of a subset of the industrial land use dataset would have an average demand of 1.42 gpm/acre or less while there is only a 50 percent chance that the mean for the same subset would be 1.34 gpm/acre or lower.

For data sets exhibiting a normal distribution, Student's t-statistic was used as the basis for UCL calculations. For data sets exhibiting neither a normal nor lognormal distribution the standard bootstrap method (nonparametric) was used to calculate UCLs due to the fact that this method requires no assumption of an underlying distribution for a given data set. Bootstrap estimation is a computer intensive re-sampling method for estimating distributions and confidence limits of statistics for which the theoretical sampling distribution is not known. To estimate 95 percent confidence limits for the mean of *n* samples, one would repeatedly (2,000 simulations) select a subset of *i* records with replacement from the original data and calculate the mean of each of these bootstrap samples. The 97.5th and 2.5th percentiles of the distribution of means are estimates of the 95 percent confidence limits. The Pro UCL software generates the standard bootstrap UCL as a standard component of model output for any given data set.

2.4 Ultimate Water Demand

Ultimate water demand at build out was estimated by adding the potential demand from undeveloped parcels to current demands from developed parcels served by the Water Department. Potential demand was estimated by applying a unit flow factor to undeveloped parcels based on their land use and densities of development.

2.4.2 Projected Water Demands

Ultimate water demands were developed by applying the unit flow factors to undeveloped parcels based on their designated land use type and adding the resulting demands to actual consumption from parcels served by the Water Department. Allowances were made for unaccounted for water. Table 2-3 presents a summary of projected demands by land use type similar to Table 2-1. This table indicates that average day demand could increase to an estimated 49,083 gpm or approximately 79,169 ac-ft per year. This value represents an 80 percent increase over current annual demand of 43,970 ac-ft per year.

Table 2-3
Projected Water Demands

Projected Water Demand by Land Use Type					
Land Use Type	*2002 ADD (gpm)*	*Incremental Demand*			*Ultimate ADD Demand (gpm)*
		Parcels	Acreage	ADD (gpm)	
Commercial	83	87	50	99	182
Commercial General	1,609	684	415	810	2,419
Commercial Heavy	281	182	94	183	464
Commercial Neighborhood	24	18	4	8	33
Commercial Office	922	118	64	209	1,131
Commercial Regional	1,366	327	336	656	2,022
Industrial Extractive	- -	66	1,592	2,260	2,260
Industrial Heavy	345	196	760	2,158	2,503
Industrial Light	1,203	1,093	1,155	3,039	4,243
Office Industrial Park	112	114	96	187	299
Public	51	30	284	587	638
Public Facilities	1,629	290	618	1,280	2,909
Public Flood Control Areas	26	366	3,253	- -	26
Public Parks	360	78	181	374	734
Residential 35	- -	15	83	223	223
Residential Estate	272	150	1237	1,183	1,455
Residential High	274	76	4	23	296
Residential Low	656	486	2,296	4,926	5,582
Residential Medium	2,101	855	143	393	2,493
Residential Medium High	573	90	43	164	737
Residential Medium High 20	2	1	0	1	2
Residential Suburban	13,359	1,721	962	2,329	15,687
Residential Urban	1,968	416	364	733	2,701
Unknown	43	444	265	- -	43
Total	**27,259**	**7,903**	**14,299**	**21,822**	**49,083**

The projected annual demand of 79,169 ac-ft per year is approximately 10 percent higher than the estimated 72,000 ac-ft per year ultimate demand estimated in the 1991 water master plan. The incremental difference is due to the following reasons:

- Use of a more refined statistical analysis of unit flow factors for the different land use types.
- Use of the 95 percent UCL about the mean to establish unit flow factors. This resulted in slightly higher factors when compared to mean values used previously.
- Incorporation of projected demands from the Inland Valley Development Agency service area.

2.5 Water Demand by Pressure Zone

Current and projected water demands were also segregated by pressure zone as indicated in Table 2-4. Pressure zones were grouped into various areas based on their geographical location. As anticipated, the Verdemont area in the northwest portion of the service area would experience the highest growth as water demands could increase by as much as 250 percent over current demands. Significant increase in demand is also anticipated in the Mountain Area as the service area includes a significant amount of undeveloped lands above the existing reservoir. Substantial increase in water demand is also anticipated in the Lower Zone as average water demand are anticipated to increase from approximately 11,500 gpm to 19,400 gpm representing close to a 70 percent increase. Part of the increase in the Lower Zone is related to the incorporation of the Inland Valley Development Agency service area in the former Norton Air Force base.

Table 2-4
2002 and Projected Water Demand by Pressure Zone

Current and Projected Water Demand by Pressure Zone						
Pressure Zone	*2002 Demand (gpm)*		*Ultimate Demand*			
	ADD	MDD	ADD (gpm)	Increment over 2002	MDD (gpm)	MDD (MG)
Northwest Area:						
Devore and Higher	361	625	3,922	986%	6,785	9.77
Cajon	772	1,336	3,613	368%	6,251	9.00
College and Devil Canyon	2,960	5,121	6,501	120%	11,247	16.20
	4,093	7,082	14,036	243%	24,282	34.97
Sycamore Area:						
Ridgeline	48	83	55	15%	95	0.14
Sycamore	1,309	2,265	2,152	64%	3,723	5.36
	1,357	2,348	2,207	63%	3,818	5.50
Mountain Area:						
Mountain and Higher	1,235	2,137	2,742	122%	4,744	6.83
Del Rosa Area:						
Ridgeview and Higher	64	111	253	296%	438	0.63
Daley Canyon	463	282	278	70%	481	0.69
Del Rosa	746	1,281	886	19%	1,534	2.21
	974	1,684	1,418	46%	2,453	3.53
Upper Area:						
Upper and Shandin Hills	6,242	10,799	7,099	14%	12,281	17.69
Intermediate Area:						
Intermediate	1,886	3,263	2,183	16%	3,776	5.44
Lower Area:						
Elevated	446	772	489	10%	846	1.22
Terrace	1,666	2,882	2,530	52%	4,377	6.30
Lower and IVDA	9,359	16,191	16,380	75%	28,337	40.81
	11,471	19,845	19,399	69%	33,560	48.33
Total	**27,259**	**47,158**	**49,083**	**80%**	**34,914**	**122.30**

Appendix B

Hydraulic Modeling

Junction Report- University Hills, Average Day Demand, Tanks Half Full

	ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1	J20	0.1	1,600.0	1,867.7	116.0
2	J14	32.6	1,880.0	2,028.0	64.1
3	J10	0.0	1,575.0	1,708.0	57.6
4	J12	368.1	1,750.0	1,867.7	51.0

Pipe Report- University Hills, Average Day Demand, Tanks Half Full

		ID	From Node	To Node	Diameter (in)	Length (ft)	Roughness	Flow (gpm)	Velocity (ft/s)	HL/1000 (ft/kft)
1		P100	T1580	PUMP1720	16.0	175.8	130.0	0.0	0.0	0.0
2		P102	PUMP1720	J10	16.0	2,509.2	130.0	0.0	0.000000	0.0
3		P104	J10	T1720	16.0	1,873.1	130.0	0.0	0.000000	0.0
4		P106	T1720	PUMP1880	16.0	130.2	130.0	0.0	0.000000	0.0
5		P108	PUMP1880	J12	16.0	1,128.8	130.0	0.0	0.000000	0.0
6		P110	J12	T1880	16.0	2,773.3	130.0	-368.2	0.6	0.1
7		P112	T1880	PUMP2040	12.0	145.6	120.0	0.0	0.00000	0.0
8		P114	PUMP2040	J14	12.0	1,375.7	120.0	0.0	0.00000	0.0
9		P116	J14	T2040	12.0	1,261.4	120.0	-32.6	0.1	0.00
10		P118	J12	J20	12.0	5,877.3	120.0	0.1	0.000	0.0

Tank Report- University Hills, Tank Report, Tanks Half Full

	ID	Flow (gpm)	Elevation (ft)	Head (ft)	% Full (%)	Level (ft)
1	T1580	0.0	1,556.0	1,568.0	50.0	12.0
2	T1720	0.0	1,696.0	1,708.0	50.0	12.0
3	T1880	-368.2	1,856.0	1,868.0	50.0	12.0
4	T2040	-32.6	2,016.0	2,028.0	50.0	12.0

Junction Report- University Hills, Max. Day Demand, Tanks Half Full

	ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1	J20	0.2	1,600.0	1,867.3	115.8
2	J14	55.5	1,880.0	2,028.0	64.1
3	J10	0.0	1,575.0	1,708.0	57.6
4	J12	625.8	1,750.0	1,867.3	50.8

Pipe Report- University Hills, Max. Day Demand, Tanks Half Full

		ID	From Node	To Node	Diameter (in)	Length (ft)	Roughness	Flow (gpm)	Velocity (ft/s)	HL/1000 (ft/kft)
1		P100	T1580	PUMP1720	16.0	175.8	130.0	0.0	0.0	0.0
2		P102	PUMP1720	J10	16.0	2,509.2	130.0	0.0	0.000000	0.0
3		P104	J10	T1720	16.0	1,873.1	130.0	0.0	0.000000	0.0
4		P106	T1720	PUMP1880	16.0	130.2	130.0	0.0	0.000000	0.0
5		P108	PUMP1880	J12	16.0	1,128.8	130.0	0.0	0.000000	0.0
6		P110	J12	T1880	16.0	2,773.3	130.0	-626.0	1.0	0.3
7		P112	T1880	PUMP2040	12.0	145.6	120.0	0.0	0.00000	0.0
8		P114	PUMP2040	J14	12.0	1,375.7	120.0	0.0	0.00000	0.0
9		P116	J14	T2040	12.0	1,261.4	120.0	-55.5	0.2	0.0
10		P118	J12	J20	12.0	5,877.3	120.0	0.2	0.000	0.0

Tank Report- University Hills, Max. Day Demand, Tanks Half Full

		ID	Flow (gpm)	Elevation (ft)	Head (ft)	% Full (%)	Level (ft)
1		T1580	0.0	1,556.0	1,568.0	50.0	12.0
2		T1720	0.0	1,696.0	1,708.0	50.0	12.0
3		T1880	-626.0	1,856.0	1,868.0	50.0	12.0
4		T2040	-55.5	2,016.0	2,028.0	50.0	12.0

Junction Report- University Hills, Peak Hour Demand, Tanks Half Full

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1		J20	0.3	1,600.0	1,865.4	115.0
2		J14	110.9	1,880.0	2,027.9	64.1
3		J10	0.0	1,575.0	1,708.0	57.6
4		J12	1,251.6	1,750.0	1,865.4	50.0

Pipe Report- University Hills, Peak Hour Demand, Tanks Half Full

		ID	From Node	To Node	Diameter (in)	Length (ft)	Roughness	Flow (gpm)	Velocity (ft/s)	HL/1000 (ft/kft)
1		P100	T1580	PUMP1720	16.0	175.8	130.0	0.0	0.0	0.0
2		P102	PUMP1720	J10	16.0	2,509.2	130.0	0.0	0.000000	0.0
3		P104	J10	T1720	16.0	1,873.1	130.0	0.0	0.000000	0.0
4		P106	T1720	PUMP1880	16.0	130.2	130.0	0.0	0.000000	0.0
5		P108	PUMP1880	J12	16.0	1,128.8	130.0	0.0	0.000000	0.0
6		P110	J12	T1880	16.0	2,773.3	130.0	-1,252.0	2.0	0.9
7		P112	T1880	PUMP2040	12.0	145.6	120.0	0.0	0.00000	0.0
8		P114	PUMP2040	J14	12.0	1,375.7	120.0	0.0	0.00000	0.0
9		P116	J14	T2040	12.0	1,261.4	120.0	-110.9	0.3	0.1
10		P118	J12	J20	12.0	5,877.3	120.0	0.3	0.000	0.0

Tank Report- University Hills, Peak Hour Demand, Tanks Half Full

		ID	Flow (gpm)	Elevation (ft)	Head (ft)	% Full (%)	Level (ft)
1		T1580	0.0	1,556.0	1,568.0	50.0	12.0
2		T1720	0.0	1,696.0	1,708.0	50.0	12.0
3		T1880	-1,252.0	1,856.0	1,868.0	50.0	12.0
4		T2040	-110.9	2,016.0	2,028.0	50.0	12.0

Junction Report- University Hills, Max. Day and Fire Demand, Tanks Half Full

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1		J20	0.2	1,600.0	1,861.0	113.1
2		J14	1,555.0	1,880.0	2,019.6	60.5
3		J10	1,500.3	1,575.0	1,705.5	56.6
4		J12	2,126.4	1,750.0	1,861.0	48.1

Pipe Report- University Hills, Max. Day and Fire Demand, Tanks Half Full

		ID	From Node	To Node	Diameter (in)	Length (ft)	Roughness	Flow (gpm)	Velocity (ft/s)	HL/1000 (ft/kft)
1		P100	T1580	PUMP1720	16.0	175.8	130.0	0.0	0.0	0.0
2		P102	PUMP1720	J10	16.0	2,509.2	130.0	0.0	0.000000	0.0
3		P104	J10	T1720	16.0	1,873.1	130.0	-1,500.3	2.4	1.3
4		P106	T1720	PUMP1880	16.0	130.2	130.0	0.0	0.000000	0.0
5		P108	PUMP1880	J12	16.0	1,128.8	130.0	0.0	0.000000	0.0
6		P110	J12	T1880	16.0	2,773.3	130.0	-2,126.5	3.4	2.5
7		P112	T1880	PUMP2040	12.0	145.6	120.0	0.0	0.00000	0.0
8		P114	PUMP2040	J14	12.0	1,375.7	120.0	0.0	0.00000	0.0
9		P116	J14	T2040	12.0	1,261.4	120.0	-1,555.0	4.4	6.7
10		P118	J12	J20	12.0	5,877.3	120.0	0.2	0.000	0.0

Tank Report- University Hills, Max. Day and Fire Demand, Tanks Half Full

		ID	Flow (gpm)	Elevation (ft)	Head (ft)	% Full (%)	Level (ft)
1		T1580	0.0	1,556.0	1,568.0	50.0	12.0
2		T1720	-1,500.3	1,696.0	1,708.0	50.0	12.0
3		T1880	-2,126.5	1,856.0	1,868.0	50.0	12.0
4		T2040	-1,555.0	2,016.0	2,028.0	50.0	12.0

Appendix C

Preliminary Cost Estimate

COST ESTIMATE
SAN BERNARDINO MUNICIPAL WATER DEPARTMENT (SBMWD)
University Hills Development
Preliminary Opinion of Probable Cost

For- SBMWD

Date: 10/15/2007
Calcs: *BR*
Chk'd: *TM*

No.	Item	Quantity	Unit	Unit Price	Amount	Cost Sharing: University Hills Specific Plan % of Cost	University Hills Specific Plan Amount	SBMWD % of Cost	SBMWD Amount	Notes
1	**Phase 1 Facilities**									
1A	Transmission Facilities									
1A.1	Zone 1720, 16-inch DIP Water Transmission Main in non-paved area incl. appurtenances	4,580	L.F.	$120	$550,000					
	Construction Contingencies (15%)				$83,000					
	Engineering, Environmental and Construction Management (30%)				$190,000					
	Subtotal:				**$823,000**	**75%**	**617,300**	**25%**	**205,800**	1
1A.2	Zone 1880, 16-inch DIP Water Transmission Main in non-paved area incl. appurtenances	4,030	L.F.	$120	$484,000					
	Construction Contingencies (15%)				$73,000					
	Engineering, Environmental and Construction Management (30%)				$167,000					
	Subtotal:				**$724,000**	**75%**	**543,000**	**25%**	**181,000**	2
1A.3	Zone 1720, 12-inch DIP Water Transmission Main in non-paved area incl. appurtenances	5,880	L.F.	$90	$529,000					
	Construction Contingencies (15%)				$79,000					
	Engineering, Environmental and Construction Management (30%)				$182,000					
	Subtotal:				**$790,000**	**100%**	**790,000**	**0%**	**0**	3

No.	Item	Quantity	Unit	Unit Price	Amount	Cost Sharing				Notes
						University Hills Specific Plan		SBMWD		
						% of Cost	Amount	% of Cost	Amount	
				Subtotal Phase 1 Pipelines	**$2,337,000**		**$1,950,300**		**$386,800**	
1B	Pumping Facilities									
1B.1	Zone 1720 Pump Station (150 HP @ $1,500 per HP) - Pumps Only	1	EA	$225,000	$225,000					
		Subtotal:			$225,000					
		Construction Contingencies (15%)			$34,000					
		Engineering, Environmental and Construction Management (30%)			$78,000					
				Subtotal:	**$337,000**	**100%**	**337,000**	**0%**	**0**	4
1B.2	Zone 1880 Pump Station (270 HP @ $3,000 per HP)	1	EA	$810,000	$810,000					
		Subtotal:			$810,000					
		Construction Contingencies (15%)			$122,000					
		Engineering, Environmental and Construction Management (30%)			$280,000					
				Subtotal:	**$1,212,000**	**100%**	**1,212,000**	**0%**	**0**	5
				Subtotal Phase 1 Pumping Facilities	**$1,549,000**		**$1,549,000**		**$0**	
1C	Storage Facilities									
1C.1	Zone 1720 Reservoir - (1.0 MG)	1	EA	$1,200,000	$1,200,000					
		Construction Contingencies (15%)			$180,000					
		Engineering, Environmental and Construction Management (30%)			$414,000					
				Subtotal:	**$1,794,000**	**0%**	**0**	**100%**	**1,794,000**	6
1C.2	Zone 1880 Reservoir - (1.5 MG)	1	EA	$1,800,000	$1,800,000					

No.	Item	Quantity	Unit	Unit Price	Amount	Cost Sharing				Notes
						University Hills Specific Plan		SBMWD		
						% of Cost	Amount	% of Cost	Amount	
	Construction Contingencies (15%)				$270,000					
	Engineering, Environmental and Construction Management (30%)				$621,000					
	Subtotal:				**$2,691,000**	**100%**	**2,691,000**	**0%**	**0**	7
	Subtotal Phase 1 Storage Facilities				**$4,485,000**		**$2,691,000**		**$1,794,000**	
	Total for Phase 1 Water Facilities				**$8,371,000**		**$6,190,000**		**$2,181,000**	
2	**Phase 2 Facilities**									
2A	Transmission Facilities									
2A.1	Zone 2040, 12-inch DIP Water Transmission Main in non-paved area incl. appurtenances	2,780	L.F.	$90	$250,000					
	Construction Contingencies (15%)				$38,000					
	Engineering, Environmental and Construction Management (30%)				$86,000					
	Subtotal:				**$374,000**	**100%**	**374,000**	**0%**	**0**	8
	Subtotal Phase 2 Pipelines				**$374,000**		**$374,000**		**$0**	
2B	Pumping Facilities									
2B.1	Zone 2040 Pump Station (180 HP @ $3,000 per HP)	1	EA	$540,000	$540,000					
	Subtotal:				$540,000					
	Construction Contingencies (15%)				$81,000					
	Engineering, Environmental and Construction Management (30%)				$186,000					
	Subtotal:				**$807,000**	**100%**	**807,000**	**0%**	**0**	9
	Subtotal Phase 2 Pumping Facilities				**$807,000**		**$807,000**		**$0**	

No.	Item	Quantity	Unit	Unit Price	Amount	Cost Sharing				Notes
						University Hills Specific Plan		SBMWD		
						% of Cost	Amount	% of Cost	Amount	
2C	Storage Facilities									
2C.1	Zone 2040 Reservoir - (0.5 MG)	1	EA	$600,000	$600,000					
	Construction Contingencies (15%)				$90,000					
	Engineering, Environmental and Construction Management (30%)				$207,000					
	Subtotal:				**$897,000**	**100%**	**897,000**	**0%**	**0**	10
	Subtotal Phase 2 Storage Facilities				**$897,000**		**$897,000**		**$0**	
	Total for Phase 2 Water Facilities				**$2,078,000**		**$2,078,000**		**$0**	
	Cost Summary									
	Phase 1 Water Facilities				**$8,371,000**		**$6,190,000**		**$2,181,000**	
	Phase 2 Water Facilities				**$2,078,000**		**$2,078,000**		**$0**	
	TOTAL PROJECT COST				**$10,449,000**		**$8,268,000**		**$2,181,000**	

Explanation of Notes:

Note 1 and 2- The difference of cost of upsizing a 12-inch to 16-inch pipeline to be shared by SBMWD and Univ. Hills Specific Plan (25% of cost in percentage by SBMWD and 75% by Univ. Hills Specific Plan)
Notes 3,4,5,7,8,9 and 10 - 100% of cost to be shared by Univ. Hills Specific Plan.
Note 6- 100% of the cost of installation of zone 1720 tank to be shared by SBMWD.

PBS&J	COMPUTATION SHEET	University Hills Water facilities
		Page _____ of _____
		Made By BR
		Date 10/15/2007
Subject:	University Hills Development	Checked By TM
	ITEM NO. Pipe Install 12-inch DIP Non-Paved	Date
	UNIT LF	

PURPOSE:

To estimate cost of pipeline construction per linear foot for 12-inch DIP in non-paved street.

SOURCE:

RS Means Heavy Construction Cost Data 2005
PBS&J Data
Manufacturer

ASSUMPTIONS:

12-inch DIP would be installed in non-paved area.

	Length (FT)	Width (FT)	Area (SF)	Area (SY)	Cost / SY	Total Cost	Cost / FT	
AC Demo	0	12	0	0	$6.55	$0.00	$0.00	Means / 2005
	Length (FT)	**Width (FT)**	**Depth (FT)**	**Tons**	**Cost / Ton**	**Total Cost**	**Cost / FT**	
Dispose of AC	0	12	0.33	0	$70.00	$0.00	$0.00	
	Length (FT)	**Width (FT)**	**Depth (FT)**	**V (CY)**	**Cost / CY**	**Total Cost**	**Cost / FT**	
Trench Excavation	100	3	6.5	72	$7.20	$520.00	$5.20	Means / 2005
	Length (FT)	**Cost / FT**				**Total Cost**	**Cost / FT**	
Shoring	100	$7.00				$700.00	$7.00	
	Length (FT)	**Width (FT)**	**Depth (FT)**	**V (CY)**	**Cost / CY**	**Total Cost**	**Cost / FT**	
Install Bedding	100	3	0.33	4	$26.00	$95.33	$0.95	get-a-quote
	Length (FT)				**Cost / FT**	**Total Cost**	**Cost / FT**	
Install 12" Pipe	100				$43.86	$4,386.00	$43.86	Means / 2005
	Length (FT)			**V (CY)**	**Cost / CY**	**Total Cost**	**Cost / FT**	
Backfill	100			72.22222	$3.20	$231.11	$2.31	Means / 2005
	Length (FT)	**Width (FT)**	**Area (SY)**		**Cost / SY**	**Total Cost**	**Cost / FT**	

Pavement Replacement	0	12	0	$24.00	$0.00	$0.00

	Total Cost	Cost / FT
SUM:	$5,932.44	$59.32
Add 40% for appurtenances		$23.73
Subtotal		$83.05
Price Escalation (6.43%)		5.3155
Total		88.37

PBS&J	COMPUTATION SHEET	University Hills Water facilities
		Page ____ of ____
		Made By BR
		Date 10/15/2007
Subject:	University Hills Development	Checked By TM
	ITEM NO. Pipe Install 16-inch DIP Non-Paved	Date
	UNIT LF	

PURPOSE:

To estimate cost of pipeline construction per linear foot for 16-inch DIP in non-paved street.

SOURCE:

RS Means Heavy Construction Cost Data 2005
PBS&J Data
Manufacturer

ASSUMPTIONS:

16-inch DIP would be installed in non-paved area.

	Length (FT)	Width (FT)	Area (SF)	Area (SY)	Cost / SY	Total Cost	Cost / FT	
AC Demo	0	12	0	0	$6.55	$0.00	$0.00	Means / 2005

	Length (FT)	Width (FT)	Depth (FT)	Tons	Cost / Ton	Total Cost	Cost / FT
Dispose of AC	0	12	0.33	0	$70.00	$0.00	$0.00

	Length (FT)	Width (FT)	Depth (FT)	V (CY)	Cost / CY	Total Cost	Cost / FT	
Trench Excavation	100	3	6.5	72	$7.20	$520.00	$5.20	Means / 2005

	Length (FT)	Cost / FT	Total Cost	Cost / FT
Shoring	100	$7.00	$700.00	$7.00

	Length (FT)	Width (FT)	Depth (FT)	V (CY)	Cost / CY	Total Cost	Cost / FT	
Install Bedding	100	3	0.33	4	$26.00	$95.33	$0.95	get-a-quote

	Length (FT)	Cost / FT	Total Cost	Cost / FT	
Install 16" Pipe	100	$62.10	$6,210.00	$62.10	Means / 2005

	Length (FT)	V (CY)	Cost / CY	Total Cost	Cost / FT	
Backfill	100	72.22222	$5.58	$403.00	$4.03	Means / 2005

	Length (FT)	Width (FT)	Area (SY)	Cost / SY	Total Cost	Cost / FT

Pavement Replacement	0	12	0	$24.00	$0.00	$0.00

	Total Cost	Cost / FT
SUM:	$7,928.33	$79.28
Add 40% for appurtenances		$31.71

Subtotal	$111.00
Price Escalation (6.43%)	7.1371
Total	118.13