HOLLISTER URBAN AREA WATER AND WASTEWATER MASTER PLAN

APPENDIX G – TREATED WATER STORAGE CALCULATIONS

Introduction

This memorandum discusses the methodology used to calculate the required additional storage for the Hollister/Sunnyslope water distribution system. The calculations have been prepared to assist in the development of the costs for the Hollister Urban Area Water and Wastewater Master Plan.

Planning Assumptions

The following assumptions have been used in this analysis:

- ◈ Base Storage Requirements:
  - ▲ Fire Flow: 840,000 gallons (3,500 gpm for 4 hours)
  - ▲ Operational: 33% of MDD
  - ▲ Emergency Reserve: 50% of MDD
- ◈ The total required storage is the sum of Fire Flow, Operational, and Emergency Reserve.
- ◈ Projected demands are as developed by HDR, based on lower conservation level.
- ◈ Percentage of total demand by pressure zone is based on demands in the hydraulic model:
  - ▲ Low zone: 52%
  - ▲ Middle zone: 35%
  - ▲ High zone: 12%
- ◈ Existing Storage in High Zone:
  - ▲ Ridgemark #1:   1.0 mgal
  - ▲ Ridgemark #2:   0.5 mgal
  - ▲ Total: 1.5 mgal
- ◈ Usable Storage in High Zone:
  - ▲ Ridgemark #1:   1.0 mgal
  - ▲ Ridgemark #2:   0.4 mgal
  - ▲ Total: 1.4 mgal

◈ Existing Storage in Middle Zone:
- ▲ Fairview Road: 2.0 mgal

◈ Usable Storage in Middle Zone
- ▲ Fairview Road: 2.0 mgal

◈ Existing Storage in Low Zone
- ▲ Park Hill #1: 2.2 mgal
- ▲ Park Hill #2: 4.5 mgal
- ▲ Sally Flat: <u>0.5 mgal</u>
- ▲ Total: 7.2 mgal

◈ Usable Storage in Low Zone
- ▲ Park Hill #1: 0.1 mgal
- ▲ Park Hill #2: 4.0 mgal
- ▲ Sally Flat: <u>0.5 mgal</u>
- ▲ Total: 4.6 mgal

◈ Storage in an upper zone can be used to meet storage requirements in a lower zone, i.e. storage in the High zone is also available for the Middle and Low zones.

Methodology

Specific calculations are performed as detailed in Table 1 with line numbers on the left side of the table for use in this description. The following steps are taken in the analysis:

◈ Define the storage criteria used to develop storage volumes (lines 1 through 5)

◈ Include system-wide Average Annual and Maximum Day demands as calculated previously (lines 8 through 10)

◈ Determine the Fire Flow, Operational, and Emergency Reserve Storage Requirements based on the Maximum Day demands. From this, total storage requirements are also calculated (lines 14 through 17).

◈ Include existing storage facilities as well as the total storage (lines 20 through 28).

◈ Include usable storage at those facilities as well. See Additional Considerations for calculation of usable storage. Additional storage requirements are also calculated by subtracting the total usable storage from the total storage requirements (lines 31 through 40)

◈ Determine demand by pressure zone (assuming percentage of total demand remains constant throughout planning period) (lines 41 through 45).

◈ Determine storage requirements for High zone, High plus Middle zone, and full system using demands calculated above and assumed storage factors (lines 47 through 50). Now have storage requirements for High zone, High plus Middle, and High plus Middle plus Low Zone (Full System). These can now be compared with existing storage.

◈ Determine total storage in each zone (lines 52 through 55).

◆ Identify storage surplus/(deficit) in each zone by subtracting the required storage from the existing storage (lines 57 through 60).

◆ Determine amount of new storage needed to eliminate deficit (lines 62 through 66). Note that new storage in the High zone can offset a deficit in all three zones, new storage in the Middle zone can offset a deficit in either the Middle or Low zones. The process used in determining amount of new storage needed involves adjusting the amount of new storage needed in the Middle and High zones to eliminate all deficits.

◆ Determine the surplus/(deficit) for each zone after the new storage is included (lines 68 through 71).

Additional Considerations

Since the Hollister/Sunnyslope distribution system uses gravity storage reservoirs (water is delivered to customers from the reservoirs by gravity, not by pumping), not all the storage in the reservoirs is considered "usable." Water in a reservoir that is at a hydraulic grade lower than approximately 43 feet (20 psi) above the highest customer should not be considered as usable and should be removed from the calculations. This volume of water is typically called "dead storage."

The calculations above remove the dead storage from the full volume of the existing reservoirs in order to come up with the usable storage (lines 31 through 40).

Results

The calculations are demonstrated in Figure 1 on the following page. The total new storage required, based on the planning assumptions previously described, is shown in Table 1.

Table 1. Cumulative Storage Requirements

Pressure Zone	2005	2013	2018	2023	Buildout
High	2	2	3	3	3
Middle	4	4	6	8	20
Low	0	0	0	0	0
Total New Storage	**6**	**6**	**9**	**11**	**23**

Figure 1. Treated Water Storage Calculations

STORAGE ASSUMPTIONS

1	**Storage Requirements**	
2	Fire Flow	840,000 gallons
3	Operational	33 % of MDD
4	Emergency Reserve	50 % of MDD
5	Basis of Storage Estimates	Aggregate storage requirements; not by pressure zone

	Historic Demands	2005	2013	2018	2023	Buildout
7						
8	Avg. Annual Demands (mgd)	7.1	7.5	9.2	10.6	18.0
9	Maximum Day Demands (mgd)	14.2	15.0	18.4	21.1	36.0
10	Avg. of Jan, Feb, March, and Dec Demands (mgd)	4.7	5.0	6.1	7.0	11.9

STORAGE REQUIREMENTS

		Storage Requirements				
14	Operational Storage (mgal)	4.7	4.9	6.1	7.0	11.9
15	Emergency Reserve Storage (mgal)	7.1	7.5	9.2	10.6	18.0
16	Fire Flow Storage (mgal)	0.84	0.84	0.84	0.84	0.84
17	**Total Storage Requirements (mgal)**	**12.6**	**13.3**	**16.1**	**18.4**	**30.7**

		Existing Storage Facilities				
21	Fairview Road (SSCWD)	1.0	1.0	1.0	1.0	1.0
22	Ridgemark #1 (SSCWD)	1.0	1.0	1.0	1.0	1.0
23	Ridgemark #2 (SSCWD)	0.5	0.5	0.5	0.5	0.5
24	Fairview Road (City)	1.0	1.0	1.0	1.0	1.0
25	Park Hill #1 (City)	2.2	2.2	2.2	2.2	2.2
26	Park Hill #2 (City)	4.5	4.5	4.5	4.5	4.5
27	Sally Flat (City)	0.5	0.5	0.5	0.5	0.5
28	**Total**	**10.7**	**10.7**	**10.7**	**10.7**	**10.7**

		Usable Storage Facilities				
32	Fairview Road (SSCWD)	1.0	1.0	1.0	1.0	1.0
33	Ridgemark #1 (SSCWD)	1.0	1.0	1.0	1.0	1.0
34	Ridgemark #2 (SSCWD)	0.4	0.4	0.4	0.4	0.4
35	Fairview Road (City)	1.0	1.0	1.0	1.0	1.0
36	Park Hill #1 (City)	0.1	0.1	0.1	0.1	0.1
37	Park Hill #2 (City)	4.0	4.0	4.0	4.0	4.0
38	Sally Flat (City)	0.5	0.5	0.5	0.5	0.5
39	**Total**	**8.0**	**8.0**	**8.0**	**8.0**	**8.0**
40	Additional Storage Requirements	4.6	5.3	8.1	10.4	22.7

		Demands by Pressure Zone				
42	Low: 52%	7.4	7.8	9.6	11.0	18.7
43	Middle: 35%	5.0	5.2	6.4	7.4	12.6
44	High: 12%	1.7	1.8	2.2	2.5	4.3
45	High plus Middle	6.7	7.0	8.6	9.9	16.9

		Storage Requirements By Zone (cumulative)				
48	High	2.3	2.3	2.7	2.9	4.4
49	High Plus Middle	6.4	6.7	8.0	9.1	14.9
50	Full System	12.6	13.3	16.1	18.4	30.7

		Existing Storage by Zone				
53	High	1.4	1.4	1.4	1.4	1.4
54	High Plus Middle	3.4	3.4	3.4	3.4	3.4
55	Full System	8.0	8.0	8.0	8.0	8.0

		Surplus/(Deficit) Storage by Zone (cumulative)				
58	High	(0.9)	(0.9)	(1.3)	(1.5)	(3.0)
59	High Plus Middle	(3.0)	(3.3)	(4.6)	(5.7)	(11.5)
60	Full System	(4.6)	(5.3)	(8.1)	(10.4)	(22.7)

		New Storage by Zone to Eliminate Deficit (cumulative)				
63	High	2	2	3	3	3
64	Middle	4	4	6	8	20
65	Low	0	0	0	0	0
66	**Total New Storage**	**6**	**6**	**9**	**11**	**23**

		Surplus/(Deficit) After New Storage				
69	High	1.1	1.1	1.7	1.5	(0.0)
70	High Plus Middle	3.0	2.7	4.4	5.3	11.5
71	Full System	1.4	0.7	0.9	0.6	0.3