SECTION 4 – HYDRAULIC MODEL FLOW ASSIGNMENT

Section 3 described the flow monitoring data collected for this SMP. The flow monitoring data included temporary meters installed for this SMP, historical data available in the service area and temporary flow meters installed for the preparation of member agency master plans. Flow assignment encompassed two general purposes for this SMP: to establish current flow allocations for the purpose of calibration to confirm accuracy; and to estimation how the allocation will change as flow increases in the Service Area. This section describes how existing flow was assigned to the Interceptor Model for the purpose of calibration. Section 6 describes the Interceptor Model loading manholes flow allocation under future growth scenarios. The Interceptor Model load points are depicted on Figure ES-1.

Three input loading regimes were compiled for each load manhole to the Interceptor Model:

1. Average Daily Flow.
2. The diurnal hourly flow pattern for the average daily flow.
3. Infiltration and Inflow contributions during storm events.

4.1 BASELINE AVERAGE FLOW

Current average day flow at time of model construction (2008) was selected for baseline flow assignment for the purpose of Model calibration. Average daily sewage flow in the Service Area has shown a historical pattern of being slightly higher on weekends due to Las Vegas travel. Both average flow and the daily peak are higher on weekends.

Flow loading assignments for capacity analyses will use the weekend flow patterns for assessment of Interceptor capacity. The RWWRF flow meter indicated an average weekend daily peaking factor of 1.43 compared to 1.29 for the weekdays, a 9.8% increase from the weekday pattern, and an overall average daily flow increase on the weekends of 3.6%.

The 2008 weekend average flow was 12.71 mgd. The distribution of this flow to the loading manholes in the Interceptor Model was derived from the flow data research and metering described in Section 3. Table 4-1 shows the resultant average daily flow allocations assigned to the Interceptor Model for calibration purposes.

Table 4-1
Summary of VVWRA Calibration Model Loading Inputs

Loading Point	Load Manhole No.	ADWF Loading, mgd
HESPERIA		
Hercules Street @ I Ave	H-MH045	0.32
Lemon Street @ I Ave	H-MH055	1.06
Bear Valley Rd	H-MH070	0.36
APPLE VALLEY		
South Apple Valley		
Manhole 70 (upstream end)	A-MH070	0.27
Manhole 63	A-MH063	0.46
Manhole 45	A-MH045	0.28
Manhole 24	A-MH024	0.18
Manhole 11	A-MH011	0.40
Manhole 9	A-MH009	0.16
Manhole 4	A-MH004	0.13
North Apple Valley		
Manhole 99 (upstream end)	NA-MH099	0.001
Manhole 42	NA-MH042	0.000
VICTORVILLE		
VSD-1	VV-MH414	0.54
VSD-2	SVL-MH115	2.13
VSD-3	VV-MH227	3.07
VSD-4	VV-RS049	1.31
VSD-5	VV-MH407	0.05
VSD-6	VV-MH422	0.84
SCLA-1	VVMH-115	0.19
SCLA-2	VV-MH217	0.01
Spring Valley Lake	SVL-MH125	0.90
Oro Grande	VV-MH0612	0.06
TOTAL FLOW (2008 MODEL)		**12.71**

4.2 HESPERIA FLOW ALLOCATION AND DIURNAL PATTERNS

Three loading points were input to the Model for the City of Hesperia (See Figure ES-1): at Hercules Street; at Lemon Street; and at Bear Valley Road. The diurnal patterns for the load points were based on the average weekend daily system loading patterns from the March 2007 Hesperia Master Plan flow monitoring that was conducted in 2006. The Hesperia Master Plan flow monitoring targeted the three major connections to the VVWRA system. From 2000 to the present Hesperia has represented from 11% to 15% of the average flow in the VVWRA Service Area. The most current flow monitoring data showed a contribution of 14.4%. For the purpose of Model calibration, the Hesperia contribution was estimated at 13.7% or 1.71 mgd based on the average weekend flows recorded during flow monitoring conducted for this SMP in Hesperia in January 2008. Table 4-2 summarizes the average flow loading assumptions at the three load points.

Table 4-2
Hesperia Model Loading Assumptions

Loading Point	Load Manhole No.	ADWF Loading, mgd
Hercules Street @ I Ave	H-MH045	0.32
Lemon Street @ I Ave	H-MH055	1.06
Bear Valley Rd	H-MH070	0.36

The periodic flow monitoring conducted by VVWRA place a meter at the most downstream portion of the Hesperia Interceptor. The Hesperia 2007 Sewer Master Plan conducted flow monitoring to better establish flow conditions within the City. From that monitoring effort, dry weather diurnal patterns were established. The assumed diurnal patterns are shown in Table 4-3.

Table 4-3
Hesperia Dry Weather Diurnal Flow Patterns at Interceptor Load Points

Hour[1]	Dry Weather Factor at Hercules[2], Q/Qavg	Dry Weather Factor at Lemon[2], Q/Qavg	Dry Weather Factor at Bear Valley[2], Q/Qavg
0	0.74	0.90	0.84
1	0.63	0.70	0.71
2	0.54	0.56	0.62
3	0.52	0.45	0.52
4	0.51	0.40	0.50
5	0.52	0.39	0.46
6	0.64	0.39	0.48
7	0.92	0.46	0.60
8	1.05	0.79	0.79
9	1.24	1.13	0.96
10	1.37	1.41	1.28
11	1.29	1.55	1.50
12	1.25	1.49	1.47
13	1.25	1.39	1.42
14	1.12	1.15	1.23
15	0.90	0.92	1.02
16	0.84	0.87	0.96
17	0.86	0.86	0.96
18	0.89	0.87	0.91
19	0.95	0.90	0.86
20	0.98	0.95	0.91
21	0.96	1.01	0.91
22	0.86	1.03	0.83
23	0.75	0.90	0.78

1 Hour zero is midnight.

2 Avg. Hourly Flow/Daily Average Flow.

4.3 SPRING VALLEY LAKE/CSA 64 FLOW ALLOCATION AND DIURNAL PATTERNS

The periodic flow monitoring conducted by VVWRA includes a meter placed at the most downstream portion of the CSA 64 service area. Historical data from 2000-2008 shows this load point to comprise from 3.6% to 8.4% of the overall Service Area average dry weather flow. The flow for model calibration is estimated at 7.0%, or 0.90 mgd based on the average weekend flows recorded during flow monitoring conducted for this SMP in at SVL Manhole #22 in March 2008.

The periodic flow monitoring conducted by VVWRA established the diurnal pattern for this flow. The diurnal pattern assumption for Model dry weather input is shown in Table 4-4.

Table 4-4
Spring Valley Lake Diurnal Flow Pattern

Hour	Dry Weather Flow Factor, Q/Qavg
0	0.83
1	0.59
2	0.38
3	0.39
4	0.34
5	0.28
6	0.43
7	0.52
8	0.93
9	1.36
10	1.47
11	1.57
12	1.49
13	1.38
14	1.30
15	1.24
16	1.23
17	1.21
18	1.20
19	1.22
20	1.25
21	1.23
22	1.15
23	1.00

1 Hour zero is midnight.

2 Avg. Hourly Flow/Daily Average Flow.

4.4 APPLE VALLEY FLOW ALLOCATION AND DIURNAL PATTERNS

Apple Valley has two primary trunks that connect to the VVWRA Interceptor: The South Apple Valley (SAV) Interceptor; and the North Apple Valley (NAV) Interceptor. As with Hesperia, the periodic monitoring conducted by VVWRA places a meter at the most downstream portion of the Apple Valley primary trunk sewers. From 2000 to 2008, the South Apple Valley Interceptor has accounted for 11.8% to 19.6% of the Service Area flow. The North Apple Valley Trunk has only one connection and accounts for 0.001% of the Service Area Flow. For purposes of calibration, the South Apple Valley contribution was determined to be 14.8%, and the North Apple Valley contribution was set at 0.001%. This yields a flow from the South Apple Valley Trunk of 1.88 mgd, and 0.01 mgd from the North Apple Valley Trunk for the 2008 calibration year.

No current master plan is available to proportion the South Apple Valley flow over the load points in the Interceptor Model. Therefore the flow monitoring conducted as part of this SMP was used to estimate the proportionment. Seven locations were established for loading the South Apple Valley Interceptor based on a review of existing lateral connections to the system. Table 4-5 summarizes the loading assumptions derived from the flow monitoring.

Table 4-5
South Apple Valley Flow Loading

SAV Load Manhole ID	ADWF Loading, mgd
A-MH004	0.13
A-MH009	0.16
A-MH011	0.40
A-MH024	0.18
A-MH045	0.28
A-MH063	0.46
A-MH070END	0.27
Totals	1.88

The flow monitoring conducted under this SMP was also used for establishing the estimate of diurnal patterns for the eight load points. Table 4-6 shows the diurnal estimates for each load point.

Table 4-6
South Apple Valley Dry Weather Diurnal Flow Patterns at Interceptor Load Points

Hour[1]	A-MH004, Q/Qavg	A-MH009, Q/Qavg[2]	A-MH011, Q/Qavg[2]	A-MH024, Q/Qavg[2]	A-MH045 Q/Qavg[2]	A-MH063, Q/Qavg	A-MH070, Q/Qavg
0	0.86	0.84	0.84	0.84	0.84	0.84	0.93
1	0.66	0.71	0.71	0.71	0.71	0.71	0.64
2	0.56	0.59	0.59	0.59	0.59	0.59	0.47
3	0.33	0.49	0.49	0.49	0.49	0.49	0.36
4	0.30	0.42	0.42	0.42	0.42	0.42	0.28
5	0.27	0.39	0.39	0.39	0.39	0.39	0.23
6	0.34	0.48	0.48	0.48	0.48	0.48	0.24
7	0.27	0.55	0.55	0.55	0.55	0.55	0.32
8	0.48	0.73	0.73	0.73	0.73	0.73	0.44
9	1.11	1.03	1.03	1.03	1.03	1.03	0.78
10	1.34	1.25	1.25	1.25	1.25	1.25	1.30
11	1.91	1.40	1.40	1.40	1.40	1.40	1.60
12	1.62	1.31	1.31	1.31	1.31	1.31	1.68
13	1.76	1.31	1.31	1.31	1.31	1.31	1.66
14	1.36	1.14	1.14	1.14	1.14	1.14	1.53
15	1.36	1.11	1.11	1.11	1.11	1.11	1.45
16	1.23	1.00	1.00	1.00	1.00	1.00	1.30
17	1.28	1.05	1.05	1.05	1.05	1.05	1.27
18	1.17	1.07	1.07	1.07	1.07	1.07	1.23
19	1.09	1.07	1.07	1.07	1.07	1.07	1.24
20	1.19	1.15	1.15	1.15	1.15	1.15	1.30
21	1.20	1.14	1.14	1.14	1.14	1.14	1.31
22	1.18	1.02	1.02	1.02	1.02	1.02	1.32
23	1.12	1.04	1.04	1.04	1.04	1.04	1.13

1 Hour zero is midnight.

2 Laterals into manhole exhibited undesirable flow characteristics at connection for direct placement of a meter. Diurnal pattern for MH-63 used as typical diurnal in Model.

The North Apple Valley Interceptor receives flow from the Juvenile Detention Facility, only. Table 4-7 shows the estimate of current diurnal variation from this facility for model calibration.

Table 4-7
North Apple Valley Dry Weather Diurnal Flow Patterns at Interceptor Load Points

Hour[1]	NAV, Q/Qavg[2]
0	0.83
1	0.59
2	0.38
3	0.39
4	0.34
5	0.28
6	0.43
7	0.52
8	0.93
9	1.36
10	1.47
11	1.57
12	1.49
13	1.38
14	1.30
15	1.24
16	1.23
17	1.21
18	1.20
19	1.22
20	1.25
21	1.23
22	1.15
23	1.00

1 Hour zero is midnight.

2 Avg. Hourly Flow/Daily Average Flow.

4.5 VICTORVILLE FLOW ALLOCATION AND DIURNAL PATTERNS

Extensive flow monitoring data is available for flow allocation to the Interceptor Model load points in the City of Victorville. These load points are summarized in Table 4-8.

Table 4-8
City of Victorville Interceptor Model Load Points

Load Point ID	Location Of Discharge to VVWRA Interceptor
VSD-1	Downstream of VSD-6, Upstream of VSD 5, ties in to Victorville Schedule 4 Interceptor at Manhole 4-14
VSD-2	SVL/CSA-64 MH #15, downstream of Hesperia Interceptor Connection
VSD-3	Junction structure at upstream end of Double Barrel Interceptor (Victorville Sch. 1 and 2)
VSD-4	Downstream of VSD-3, ties in at VV Schedule 1 Relief Sewer Manhole RS 1-49
VSD-5	Downstream of VSD #6, ties in at Victorville Schedule 4 Interceptor at Manhole 4-07
VSD-6	Downstream of the Upper Narrows, ties in at Victorville Schedule 4 Interceptor at MH 4-21.
SCLA-1	Downstream of SCLA #2, ties in at Victorville Schedule 1 Manhole 1-15 and Relief Sewer Manhole RS 1-16
SCLA-2	Downstream of VSD #4, ties in at Victorville Schedule 1 Relief Sewer Manhole RS 1-34
Oro Grande (CSA)	Downstream of SCLA #2, ties in at Victorville Schedule 1 Interceptor Manhole 1-13. Pumped flow from Oro Grande Lift Station

Each of these load points has been included in the historical VVWRA flow monitoring. In addition, special monitoring was conducted that included these load points as part of the *2007 VVWRA Interceptor Facilities Plan Amendment.* Table 4-9 shows the range of historical contributions from each of these load points.

Table 4-9
Victorville Connection Points Historical Percent Contribution of Total Flow to VVWRA (2000-2009)

Load Point ID	Historical Range of Flow Contribution, % of Total VVWRA Flow
VSD-1	4.1% to 9.7%
VSD-2	12.0% to 20.4%
VSD-3	18.0% to 26.0%
VSD-4	0.9% to 11.1%
VSD-5	0.3% to 1.5%
VSD-6	2.7% to 18.3%
SCLA-1	1.9% to 4.8%
SCLA-2	0.00% to 0.03%
Oro Grande (CSA-42)	0.05% to 0.13%

Current contributions were estimated for Model input for the purpose of calibration and comparison to the 2008 Service Area flow of 12.70 mgd. Contributions were based on flow monitoring results conducted in 2007 and 2008. Table 4-10 shows the estimate for model input.

Table 4-10
Victorville Calibrated Model Loading Inputs

Load Point ID	Model Calibration ADWF Loading, mgd	Percent of Total VVWRA Flow
VSD-1	0.54	4.3%
VSD-2	2.13	16.8%
VSD-3	3.07	24.2%
VSD-4	1.31	10.3%
VSD-5	0.05	0.4%
VSD-6	0.84	6.6%
SCLA-1	0.19	1.5%
SCLA-2	0.01	0.1%
Oro Grande (CSA-42)	0.06	0.5%

The extensive flow monitoring data also provided a well established base for estimate of current dry weather diurnal patterns at each load point in the Victorville Interceptor. Table 4-11 summarizes the diurnal assumptions.

Table 4-11
Victorville Dry Weather Diurnal Flow Patterns at Interceptor Load Points

Hour[1]	VSD-1	VSD-2	VSD-3	VSD-4	VSD-5	VSD-6	SCLA-1	SCLA-2	Oro Grande
0	0.82	0.87	0.93	0.74	1.32	0.48	0.66	0.66	0.72
1	0.71	0.71	0.72	0.61	1.36	0.32	0.58	0.76	0.49
2	0.60	0.57	0.55	0.50	1.32	0.27	0.49	0.83	0.24
3	0.54	0.48	0.42	0.37	1.33	0.23	0.45	0.84	0.40
4	0.51	0.44	0.36	0.34	1.29	0.20	0.47	0.94	0.32
5	0.51	0.42	0.33	0.34	1.31	0.21	0.47	0.93	0.20
6	0.57	0.47	0.34	0.36	1.26	0.28	0.47	0.93	0.49
7	0.81	0.63	0.50	0.48	1.20	0.65	0.68	0.84	0.82
8	1.05	0.86	0.79	0.66	0.73	1.08	1.32	1.21	1.21
9	1.23	1.12	1.18	1.08	0.68	1.50	1.19	1.24	1.48
10	1.33	1.32	1.39	1.27	0.68	1.66	1.28	1.31	1.58
11	1.35	1.43	1.54	1.52	0.59	1.71	1.34	1.19	1.55
12	1.33	1.46	1.51	1.57	0.53	1.66	1.34	1.34	1.35
13	1.31	1.16	1.40	1.49	0.56	1.57	1.23	1.26	1.25
14	1.26	1.11	1.31	1.43	0.52	1.49	1.17	1.63	1.24
15	1.22	1.03	1.24	1.41	0.54	1.35	1.27	1.15	1.25
16	1.17	1.01	1.17	1.39	0.55	1.31	1.40	0.77	1.22
17	1.14	1.19	1.15	1.33	0.56	1.29	1.15	0.67	1.18
18	1.18	1.15	1.14	1.26	1.14	1.26	1.23	0.91	1.15
19	1.14	1.15	1.15	1.23	1.23	1.23	1.09	1.10	1.19
20	1.12	1.19	1.17	1.22	1.24	1.19	1.09	1.00	1.21
21	1.14	1.19	1.25	1.22	1.39	1.20	1.27	1.04	1.23
22	1.06	1.20	1.31	1.20	1.38	1.05	1.28	0.76	1.16
23	0.92	1.07	1.16	0.99	1.30	0.78	1.09	0.70	1.04

1 Hour zero is midnight.