Section 4 – Existing and Planned Recharge Facilities

This section provides an inventory of existing and planned recharge facilities in the Chino Basin that can subsequently be compared to the basin's recharge needs, discussed in Section 5. Existing and planned recharge facilities include spreading basins, ASR wells, and MS4 facilities. In-lieu recharge capabilities exist when the capacity to treat and serve imported water exceeds the imported water demands of the parties that have pumping rights in the basin. These recharge facilities and in-lieu capabilities are described below.

4.1 Existing Spreading Basins

Pursuant to the OBMP, the Peace Agreement, and other agreements, the IEUA, Watermaster, the CBWCD, and the SBCFCD completed the 2001 RMP and constructed spreading basin improvements from 2004 through 2014. These improvements were referred to as the Chino Basin Facilities Improvement Program (CBFIP). Seventeen existing flood retention facilities were modified, and two new spreading facilities were constructed. The waters recharged at these facilities include stormwater, recycled water, imported water, and dry-weather runoff. Figure 1-4 shows the location of these facilities. The recharge of dry-weather runoff is intermittent and can occur at most of the spreading basins.

4.1.1 Spreading Basin Descriptions and Recharge Capacities

Table 4-1 lists the spreading basins with the following information: historical average stormwater recharge, average operational availability for supplemental water recharge, recharge capacity limitations, and theoretical maximum supplemental water recharge capacity. From an operational perspective, there are two types of recharge basins within the Chino Basin: conservation and multipurpose basins. Conservation basins do not have a primary flood control function, and they are operated to recharge storm and supplemental water. Multipurpose basins are operated primarily for flood control and secondarily for recharging storm and supplemental water.

Table 4-1 shows the average annual storm and supplemental water recharge capacities of the spreading basins, based on 2018 conditions. Stormwater recharge varies by year, based on hydrologic conditions, and averaged about 10,150 afy from FY 2004/05 through FY 2016/17. Supplemental water recharge occurs during non-storm periods, and the projected supplemental water recharge capacity averages about 70,200 afy. Appendix B documents the information and computations used to estimate these recharge capacities. Table 4-3 shows the projected increase in stormwater recharge capacity and change in supplemental water recharge capacity after the planned 2013 RMPU projects come online in 2020.

4.1.2 Historical Recharge Activity

Since the installation of SCADA in 2004, data have been tracked for the recharge of all types of water at each spreading basin. Watermaster maintains a database of the monthly recharge volumes by water type and recharge location. Figure 1-5 shows the annual recharge of recycled water, stormwater, and dry-weather runoff since the initiation of the recharge program in FY 2004/05. Table 4-2 is a tabulation of the annual recharge by water type and recharge location for FY 2003/04 through FY 2016/17. Through FY 2016/17, the recharge improvements

constructed by Watermaster and the IEUA have enabled them to recharge about 360,000 af of storm and supplemental water into the Chino Basin.

Recycled water has become a significant portion of annual recharge, increasing from about 200 af in FY 2004/05 to about 13,900 af in FY 2016/17 and averaging about 12,400 afy over the five-year period ending in June 2017. The sum of stormwater, recycled water, and dry-weather runoff recharged in the Chino Basin from FY 2004/05 to the present is about 227,000 af.

Historically, imported water recharge has occurred in the Chino Basin for two reasons: replenishment of overproduction and storage and recovery projects. Watermaster meets its replenishment obligations by purchasing and recharging imported water from Metropolitan or by purchasing unproduced production rights or stored water from parties.

The magnitude of imported water recharge fluctuates significantly due to its availability and recharge needs. During the period of FY 2004/05 through 2006/07, imported water recharge was well above average because Metropolitan was putting water into storage for the DYYP. And in FY 2011/12, about 23,500 af of imported water was recharged in the Chino Basin due to the availability of surplus imported water supplies and incentives provided by Metropolitan to purchase imported water.

4.2 Existing ASR Facilities

ASR wells function as injection and recovery wells: imported water treated to drinking water standards is injected into an aquifer and recovered later when needed. The MVWD owns and operates the only active ASR wells in the Chino Basin, and it can recharge up to 5,480 afy at its wells (4, 30, 32, and 33) and subsequently recover a volume of groundwater equal to the injected water within the same year. Figure 4-1 shows the location of the MVWD's ASR wells, and Table 4-4 lists the wells and their respective injection and extraction capacities. The MVWD typically uses these wells for injection in the seven-month period of October through April and for recovery in the five-month period of May through September. Since these wells were installed in 2006, the MVWD has recharged about 1,075 af: 186 af in FY 2010/11 and 889 af in FY 2011/12. The MVWD anticipates recharging about 2,500 af in FY 2017/18.

4.3 In-Lieu Recharge Capability

In-lieu recharge can occur when a Chino Basin party with pumping rights in the Chino Basin elects to use supplemental water directly in lieu of pumping some or all its rights in the Chino Basin. Normally, this type of in-lieu recharge is classified as carryover water and if unused in the subsequent year is reclassified as excess carryover water in the case of the appropriative pool or water in the local storage account for the overlying non-agricultural pool. In certain cases, in-lieu recharge water is classified as supplemental water recharge (e.g., recharge for the Metropolitan Cyclic Storage Program and DYYP).

4.3.1 Facilities Used to Effectuate In-Lieu Recharge

The facilities used to effectuate in-lieu recharge include surface water treatment plants and conveyance facilities that convey imported water to Chino Basin parties. The IEUA is a wholesaler of imported water from Metropolitan to some of the Chino Basin parties. Three

agencies purchase untreated imported water from the IEUA: the Water Facilities Authority (WFA), CVWD, and FWC.

- The WFA treats imported water purchased from the IEUA at the Agua de Lejos treatment plant (WFA plant) and delivers it to the cities of Chino, Chino Hills, Ontario, and Upland, and to the MVWD. Each of these WFA member agencies has a contracted share of the plant's total capacity of 81 million gallons per day (mgd) (90,700 afy).
- The CVWD treats imported water purchased from the IEUA at the Royer-Nesbit and Lloyd W. Michael treatment plants. These plants have capacities of 11 mgd (12,300 afy) and 60 mgd (67,200 afy), respectively.
- The FWC treats imported water purchased from IEUA and the San Bernardino Valley Municipal Water District at the Sandhill treatment plant. The Sandhill plant has a total capacity of 29 mgd (32,500 afy).

Pomona receives imported water through the TVMWD. The TVMWD serves Pomona primarily through the Weymouth treatment plant, which has a capacity of 520 mgd (582,000 afy). Pomona's capacity to receive imported water from TVMWD is about 6,800 afy.

4.3.2 Historical In-Lieu Recharge Activity

IEUA and reported in the 2013 RMPU that the total in-lieu recharge for the period of FY 1977/78 through FY 2011/12 was about 350,000 af. Since FY 2011/12, an additional 80,000 af of in-lieu recharge has occurred, bringing the total in-lieu recharge over the Judgment period to about 430,000 af.

4.3.3 In-Lieu Capacity

The projected in-lieu recharge capacity for each agency with access to imported water was estimated based on planning data compiled for the Storage Framework. Each party's in-lieu recharge capacity was limited by the lessor of the following:

- Capacity of treatment plant(s) to treat and serve imported water or party's capacity to receive imported water, less the party's projected imported water demand
- Party's Chino Basin pumping rights
- Party's Chino Basin pumping

The appropriator parties capable of in-lieu recharge include the Cities of Chino, Chino Hills, Ontario, Pomona and Upland, and CVWD, FWC and MVWD. Each party's capacity was calculated monthly for planning years 2020, 2025, 2030, 2035 and 2040. Appendix C contains tables, showing how the in-lieu recharge estimates were made. These planning estimates were submitted to each party for comment. Table 4-5a shows the estimated annual in-lieu capacities for each of the parties. The total in-lieu recharge capacity in the Chino Basin, based on the planning data provided by the parties, ranges from 40,900 afy in 2020 to about 45,700 afy in 2030, declining to 41,900 afy in 2040.

Subsequent conversations with the WFA[5] have indicated that the WFA plant's current capacity is less than its rated capacity of 81 mgd (90,700 afy) due to solids handling limitations. According to WFA, the current capacity of the WFA plant is about 40 mgd in the summer months and about 20 mgd in the winter months. Table 4-5b shows the in-lieu recharge estimates with these capacity limitations. With the WFA limitations, the total in-lieu recharge capacity in the Chino Basin ranges from 17,700 afy in 2020 to about 20,700 afy in 2030, declining to 19,200 afy in 2040.

4.4 Existing MS4 Facilities

The Court's Order on April 25, 2014 approved Section 5 of the 2013 RMPU and ordered Watermaster to compile MS4 project-related information from appropriative pool parties within the Chino Basin in order to compute net new stormwater recharge. Net new stormwater recharge (net new recharge) is defined in the 2013 RMPU as follows:

> "The net new recharge from the implementation of the 2010 MS4 permit is equal to the stormwater recharge caused by the implementation of stormwater management projects pursuant to the MS4 permit minus the decrease in recharge at existing stormwater management facilities minus the incidental deep infiltration of precipitation that would have occurred in the pre-project condition." [6]

This net new stormwater recharge calculation must be completed concurrent with the next recalculation of Safe Yield, which is expected to be completed in 2020. Section 5 of the 2013 RMPU contains three alternatives to compute net new recharge, including the Alternative 3 Hybrid Alternative, recommended by the RMPU Steering Committee and subsequently approved by Watermaster and the Court. The recommended alternative is described in Section 5 as follows:

> "Watermaster staff would annually acquire and store electronic versions of MS4 project-related reports and maintenance verification databases. When scoping a future safe yield re-determination, Watermaster would use its judgment and discretion to determine if there has been a significant potential increase in MS4 project-related recharge. If judged significant, the Watermaster would explicitly incorporate significant MS4 projects into the modeling and other technical activities required to re-determine safe yield. The calibration process for the groundwater model used in the safe yield re-determination would be used to refine the MS4 recharge estimates. Net new recharge would be estimated by rerunning the calibration without the new MS4 facilities and comparing both simulations." [7]

[5] Email from Terry Catlin, April 10, 2018.

[6] Section 5.1, 2013 Amendment to the 2010 Recharge Master Plan, October 2013: http://www.cbwm.org/docs/engdocs/2013%20Amendment%20to%20the%202010%20RMPU/2013%20Amendment%20to%20the%202010%20RMPU%20%E2%80%93%20Sections%201%20through%208.pdf

[7] Section 5.3.3, 2013 Amendment to the 2010 Recharge Master Plan, October 2013:

On July 31, 2014, Watermaster started its first annual MS4 data request and sent a letter to each appropriative pool party requesting MS4-related information. The annual data request includes:

- Water Quality Management Plan (WQMP) reports
- Design reports
- As-built drawings[8]
- Maintenance verification

Watermaster has continued to request MS4 data each fiscal year since July 31, 2014. The data requests are sent out in July or August, and the data are due in October of each fiscal year.

MS4 projects with WQMP reports submitted to the Watermaster are compiled in a database. WEI reviews the WQMP reports for projects constructed after FY 2010/11[9] and extracts the following information:

- Location of the MS4 project
- Project's overall drainage area
- Project's total drainage area that flows into constructed infiltration feature(s)[10]
- Design capture volume (DCV)[11] of the constructed infiltration feature(s)

At the end of FY 2016/17, Watermaster analyzed the data compiled in the database. Table 4-6 summarizes the information received by Watermaster up to FY 2016/17, and Figure 4-2 shows the locations of the MS4 projects. Table 4-6 shows that at the end of FY 2016/17, Watermaster had received almost 200 WQMP reports for projects constructed during the period of FY 2010/11 to FY 2015/16, of which 163 were within the Chino Basin.

http://www.cbwm.org/docs/engdocs/2013%20Amendment%20to%20the%202010%20RMPU/2013%20Amendment%20to%20the%202010%20RMPU%20%E2%80%93%20Sections%201%20through%208.pdf

[8] At the March 19, 2015 RMPU Steering Committee meeting, the Appropriator Parties informed Watermaster that they may not be able to provide as-built drawings. As-built drawings are important to Watermaster because they include what was constructed and the construction completion date. In the absence of as-built drawings, Watermaster requires certification that the facilities were constructed as represented in the WQMP and design reports. Watermaster staff has developed a form that can be used by Appropriator Parties if they cannot furnish as-built drawings for an MS4 or other local storm water management project constructed during and after FY 2011. Finally, Watermaster also requires records of maintenance performed on each constructed MS4 project or other local storm water management projects from the Appropriator Parties.

[9] The WQMP approval date was used when the construction date was not available.

[10] Infiltration features are specifically designed to capture and infiltrate storm water runoff to comply with MS4 permits. Infiltration features could include offsite and onsite infiltration basins, infiltration trenches, infiltration pits, underground infiltration, drywells, gravel bedding infiltration, and bioretention with no underdrain.

[11] For San Bernardino and Riverside Counties, design capture volume (DCV) is the volume of storm water runoff resulting from the 85th percentile, 24-hr storm event that the designed infiltration feature is constructed to capture. For LA County, DCV is (1) the 0.75-inch, 24-hour storm event, or (2) the 85th percentile, 24-hour storm event, whichever is greater.

4.4.1 Historical MS4 Recharge Activity

Once the projects within the basin were identified, the projects were separated into two categories: projects compliant with MS4 through infiltration features and projects compliant with MS4 through non-infiltration features. A total of 114 of the 163 projects within the Chino Basin were identified as complying with MS4 through infiltration features. These projects have an aggregate drainage area of 1,733 acres.

4.4.2 MS4 Recharge Capacities

To prepare a reconnaissance-level estimate of the potential net new recharge of these 114 projects under idealized conditions,[12] WEI assumed that these projects would create net new recharge at the same expected rate developed during the 2013 RMPU for Chino Fire Station No. 1. Based on this analysis, it was determined that the total reconnaissance-level estimate of net new storm water recharge is 381 afy. Note that because precipitation is greater north of the Chino Fire Station No.1[13] and the majority of MS4 projects submitted to Watermaster are north of the Fire Station, this estimate is conservatively low. Watermaster will review these projects and estimate their potential net new recharge in the future safe yield recalculation.

4.4.3 Deficiencies in MS4 Facilities Documentation and Reporting

To determine the completeness of Watermaster's MS4 projects database, it was compared to the WQMP Inventories from the *NPDES Phase I MS4 Permit Annual Report FY 2014* prepared by San Bernardino and Riverside Counties.[14] This comparison indicated that Watermaster had received a subset of MS4 projects from each of the appropriative pool parties. And, few appropriative pool parties submitted the documentation required by Section 5 of the 2013 RMPU. 58 percent (95 out of 163 MS4 projects within the Chino Basin) of the submitted MS4 projects have confirmed WQMP approval dates, 22 percent (36 out of 163 MS4 projects within the Chino Basin) have documentation on the project construction dates, and 10 percent (17 out of 163 MS4 projects within the Chino Basin) have documentation on the maintenance performed.

The results of the analysis summarized in Table 4-6 were presented at the Recharge Investigations and Projects Committee (RIPCom) meeting on September 21, 2017. The main conclusions and recommendations presented at, and resulting from, this meeting were:

- The appropriative pool parties have not provided a comprehensive dataset of the projects within their service area.

[12] Idealized conditions mean that the infiltration feature performs as it was designed and that maintenance is performed to ensure that the infiltration feature performs as originally designed.

[13] Section 5.3.1, 2013 Amendment to the 2010 Recharge Master Plan, October 2013.

[14] Watermaster can only use the WQMP Inventory from the *NPDES Phase I MS4 Permit FY 2014 Annual Report* to estimate the number of MS4 projects in San Bernardino and Riverside Counties. Watermaster cannot use the Inventory to determine the new net storm water recharge because the inventory does not contain the information required to estimate storm water recharge.

- Watermaster does not have all of the data required to compute net new recharge.[15]
- There is potential for at least 380 afy of net new recharge if the projects are maintained to perform as originally designed.
- After the 2018 RMPU is published, Watermaster will review the time and effort in the implementation of the MS4 program and reassess the value it provides.

Watermaster continues to collect and analyze MS4 data in order to determine if there has been a significant potential increase in MS4-project related recharge. If judged significant, Watermaster would explicitly incorporate significant MS4 projects into the modeling and other technical activities required to re-calculate safe yield; the calibration process for the groundwater model used in the safe yield re-calculation would be used to refine the MS4 recharge estimates. Net new recharge would be estimated by rerunning the calibration without the new MS4 facilities and comparing both simulations. Watermaster will continue to update Figure 4-2 and Table 4-6 to document the available information on MS4 compliance measures. RIPCom will review this information annually.

4.5 Planned Recharge Facilities Currently Being Implemented

The 2013 RMPU contained recommendations to improve 10 recharge facilities and an implementation plan for their planning, design, and construction. Since completion of the 2013 RMPU, the IEUA and Watermaster have entered into agreements to plan, design, and construct five of the recommended facility improvements. Table 1-1 lists the 2013 RMPU projects that could be constructed, their expected annual stormwater recharge, and their supplemental water recharge benefits. With completion of the 2013 RMPU projects, stormwater recharge is projected to increase by 4,800 afy, and recycled water recharge capacity is projected to increase by 7,100 afy.

Table 4-3 shows the projected recharge capacity for various sources of water after the construction of the 2013 RMPU projects expected to occur in 2020. The projected average stormwater recharge capacity is 15,800 afy, the total imported water capacity is 49,900 afy, and the total recycled water capacity is 20,300 afy.

4.6 Summary of Existing and Planned Recharge Capacity

Table 4-7 summarizes the existing recharge capacity, the recharge capacity expected when the planned 2013 RMPU projects are online in 2020 and the expected recharge capacity based on 2020 conditions if the WFA treatment plant capacity is restored to its original design capacity. The supplemental water recharge capacity is about 93,400 afy in 2018 and will not change after the planned 2013 RMPU projects are online. If the total capacity of the WFA plant is restored, the total supplemental water recharge capacity increases to about 116,600 afy.

[15] Per Section 5 of the 2013 RMPU, the Steering Committee recommended that if the Appropriator Parties do not consistently provide data to Watermaster or if the submitted data are incomplete, Watermaster compute net new recharge using the method described in Alternative 2 in Section 5 of the 2013 RMPU. In this alternative, the net new recharge from determining safe yield would be automatically incorporated into the safe yield, and the direct estimation of net new recharge would not be made.

Table 4-1
Average Stormwater Recharge and Supplemental Water Recharge Capacity Estimates

Recharge Facility	Average Stormwater Recharge FY 2004/05 through FY 2016/17	Average Operational Availability for Supplemental Water Recharge												Recharge Capacity Limitations for Supplemental Water Recharge Facilities						Theoretical Maximum Supplemental Water Recharge Capacity							
		Quarter 3			Quarter 4			Quarter 1			Quarter 2			Spillway, Outlet, Cons. Berm or Inlet Controlled		Freeboard	Maximum Operating Level	Wetted Area at Maximum Operating Level	Assumed Number of Years Between Maintenance[2]	Parameter Values for Estimating Infiltration Rate[3]				Maximum Theoretical One-Month Recharge Total[5]	Maximum Theoretical Three-Month Recharge Total[6]	Maximum Theoretical Annual Recharge Total[7]	Maximum Average Theoretical Annual Recharge Between Maintenance Periods[8]
																				Exponential Decay Function[4]			Long-Term Average Infiltration Rate				
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Elevation	Control Structure[1]					Alpha	Maximum Infiltration Rate	R-Squared Goodness of Fit					
	(afy)													(ft-amsl)		(ft)	(ft-amsl)	(acres)			(ft/day)		(ft/day)	(af)			
Brooks Street Basin	489	0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	889.5	a	1.5	888.0	9.6	3	0.0003	1.8	0.674	-	385	1,031	2,401	1,658
College Heights Basin - East	78	0.74	0.74	0.75	0.83	0.92	1.00	0.90	0.90	0.96	0.91	0.84	0.78	1242.0	a	1	1241.0	6.2	10	-	-	-	3.0	558	1,552	5,816	5,816
College Heights Basin - West		0.74	0.74	0.75	0.83	0.92	1.00	0.90	0.90	0.96	0.91	0.84	0.78	1242.0	a	16	1226.0	3.3	10	-	-	-	2.0	198	551	2,064	2,064
Montclair Basin 1	953	0.74	0.74	0.75	0.83	0.92	1.00	0.75	0.75	0.96	0.91	0.84	0.78	1128.2	b	1	1127.2	7.4	4	0.002	3.8	0.879	-	302	608	994	409
Montclair Basin 2		0.74	0.74	0.75	0.83	0.92	1.00	0.75	0.75	0.96	0.91	0.84	0.78	1097.0	b	0	1097.0	11.6	4	0.0002	4.4	0.622	-	1,188	2,923	5,960	2,940
Montclair Basin 3		0.74	0.74	0.75	0.83	0.92	1.00	0.75	0.75	0.96	0.91	0.84	0.78	1057.0	b	0	1057.0	4.3	4	0.002	3.2	0.625	-	280	572	964	400
Montclair Basin 4		0.74	0.74	0.75	0.83	0.92	1.00	0.75	0.75	0.96	0.91	0.84	0.78	1037.0	b	2	1035.0	5.5	4	0.0005	1.4	0.720	-	270	702	1,609	915
Eighth Street Basin	1,069	0.74	0.74	0.75	0.83	0.92	1.00	0.50	0.50	0.96	0.91	0.84	0.78	1144.5	b	0	1144.5	17.0	2	-	-	-	0.7	357	993	3,426	3,426
Seventh Street Basin		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	1130.0	c	0	1130.0	5.6	3	-	-	-	0.7	118	327	1,170	1,170
Upland Basin	430	0.74	0.74	0.75	0.83	0.92	1.00	0.90	0.90	0.96	0.91	0.84	0.78	1210.0	f	30	1180.0	13.2	10	0.00022	1.3	0.986	-	283	801	2,027	891
Subtotal Management Zone 1	3,019																							3,939	10,058	26,429	19,689
Ely	1,120	0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	838.0	b	3	835.0	33.0	3	0.0001	1.2	0.511	-	948	2,578	6,274	4,501
Grove Basin	305	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Etiwanda Debris Basin	212	0.74	0.74	0.75	0.83	0.92	1.00	0.90	0.90	0.96	0.91	0.84	0.78	1605.0	d	0	1605.0	15.5	10	-	-	-	0.6	279	776	2,908	2,908
Hickory Basin East	361	0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	1117.0	d	3	1114.0	4.1	3	-	-	-	0.7	86	239	856	856
Hickory Basin West		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	1115.0	d	1	1114.0	6.8	3	-	-	-	0.7	143	397	1,420	1,420
Lower Day Basin Cell 1	513	0.74	0.74	0.75	0.83	0.92	1.00	0.80	0.80	0.96	0.91	0.84	0.78	1379.8	e	1	1377.0	3.6	5								
Lower Day Basin Cell 2		0.74	0.74	0.75	0.83	0.92	1.00	0.80	0.80	0.96	0.91	0.84	0.78	1379.8	e	1	1372.0	4.9	5	0.0005	1.8	0.909	-	438	1,088	2,244	983
Lower Day Basin Cell 3		0.74	0.74	0.75	0.83	0.92	1.00	0.80	0.80	0.96	0.91	0.84	0.78	1379.8	e	1	1373.0	6.3	5								
San Sevaine No. 1	816	0.74	0.74	0.75	0.83	0.92	1.00	0.80	0.80	0.96	0.91	0.84	0.78	1488.7	d	0	1488.7	9.7	5	0.01	3.4	0.732	-	231	324	418	114
San Sevaine No. 2		0.74	0.74	0.75	0.83	0.92	1.00	0.80	0.80	0.96	0.91	0.84	0.78	1472.5	f	0	1472.5	8.5	5	0.0001	2.8	1.000	-	647	1,774	4,626	2,869
San Sevaine No. 3		0.74	0.74	0.75	0.83	0.92	1.00	0.80	0.80	0.96	0.91	0.84	0.78	1458.0	f	0	1458.0	5.3	5	0.0001	2.8	1.000	-	403	1,132	3,126	2,226
Turner Basin No. 1	1,527	0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	1000.0	b	2	998.0	12.7	3	0.002	2.0	0.698	-	424	785	1,172	577
Turner Basin No. 2		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	990.5	b	1	989.5	3.9	3	0.0045	1.8	0.505	-	139	276	453	227
Turner Basin No. 3		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	980.5	a	2	978.5	2.8	3	-	-	-	0.5	42	117	418	418
Turner Basin No. 4A		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	980.5	a	2	978.5	6.6	3	-	-	-		99	274	981	981
Turner Basin No. 4B		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	980.5	a	2	978.5	1.1	3	-	-	-	0.5	17	46	164	164
Turner Basin No. 4C		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	980.5	a	2	978.5	1.3	3	-	-	-		19	53	191	191
Victoria Basin	309	0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	1323.9	b	1	1322.9	19.1	3	-	-	-	0.4	229	637	2,279	2,279
Subtotal Management Zone 2	5,163																							4,144	10,497	27,528	20,713
Banana Basin	258	0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	1143.0	b	0	1143.0	7.5	3	-	-	-	0.8	180	501	1,790	1,790
Declez Basin Cell 1		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	833.2	d	0	833.2	6.9	3	-	-	-	0.6	124	345	1,235	1,235
Declez Basin Cell 2	582	0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	831.0	d	1	830.0	4.6	3	-	-	-	0.6	83	230	823	823
Declez Basin Cell 3		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	831.0	d	1	830.0	4.3	3	-	-	-		77	215	770	770
IEUA RP3 Basin Cell 1	1,129	0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	961.0	d	3	958.0	10.4	3	-	-	-	1.5	468	1,301	4,653	4,653
IEUA RP3 Basin Cell 3		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	950.0	d	0	950.0	7.3	3	-	-	-	1.5	329	913	3,266	3,266
IEUA RP3 Basin Cell 4		0.74	0.74	0.75	0.83	0.92	1.00	0.67	0.67	0.96	0.91	0.84	0.78	945.0	d	1	944.0	8.2	3	-	-	-	1.5	369	1,026	3,669	3,669
Subtotal Management Zone 3	1,969																							1,630	4,532	16,204	16,204
Totals	10,151																							9,713	25,088	70,162	56,606

1 - Limiting control structure types include: a = inlet, b = spillway, c = flood control restriction, d = conservation berm, e = outlet, and f = other restriction.

2 - The term maintenance as used in the table means maintenance activities that restore infiltration rates (removal of clogging layers followed by ripping or functionally equivalent activities).

3 - Infiltration rates were based either on an exponential decay function if data were available to develop such a function and their R^2 values were greater than 0.5 **or** the average long-term infiltration rate; both based on IEUA data and reported infiltration rates.

4 - Details on the calculation of the exponential decay function are in Appendix B.

5 - Assumes recharge facility has been cleaned over the period of July to August and is filled to operating level on September 1st.

6 - Maximum Theoretical Three-Month Recharge Total is the total recharge from the three-month period directly after a cleaning.

7 - Maximum Theoretical Annual Recharge Total is the total recharge from the 10-month period directly after a cleaning.

8 - Average annual recharge over the span between maintenance. When recharge facilities are not being cleaned, operational availability is 1.0 for July and August. Average cleaning frequency of each recharge facility was provided by IEUA.

Table 4-2
Summary of Annual Wet-Water Recharge Records in the Chino Basin
(af)

Basin Name	FY 2003/2004				FY 2004/2005				FY 2005/2006				FY 2006/2007				FY 2007/2008				FY 2008/2009				FY 2009/2010			
	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total
MVWD ASR Well	NM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
College Heights Basins	NM	0	0	0	0	0	0	0	108	5,326	0	5,434	1	3,125	0	3,126	172	0	0	172	0	0	0	0	65	382	0	447
Upland Basin	NM	0	0	0	989	0	0	989	214	5,985	0	6,199	195	7,068	0	7,263	312	0	0	312	274	0	0	274	532	0	0	532
Montclair Basins	NM	3,558	0	3,558	3350	7,887	0	11,237	1,296	5,579	0	6,875	355	10,681	0	11,036	859	0	0	859	611	0	0	611	937	4,592	0	5,529
Brooks Street Basin	NM	0	0	0	1776	0	0	1,776	524	2,032	0	2,556	205	1,604	0	1,809	475	0	0	475	434	0	1,605	2,039	666	0	1,695	2,361
7th and 8th Street Basins	NM	0	0	0	620	0	0	620	1,271	0	0	1,271	640	0	0	640	959	0	1,054	2,013	1,139	0	352	1,491	1,744	6	1,067	2,817
Ely Basins	NM	0	49	49	2010	0	158	2,168	1,531	0	188	1,719	631	0	466	1,097	1,603	0	562	2,165	927	0	364	1,291	1,164	0	246	1,410
Grove Basin	NM	0	0	0	0	0	0	0	133	0	0	133	166	0	0	166	326	0	0	326	405	0	0	405	351	0	0	351
Turner Basins	NM	0	0	0	1428	310.2	0	1,738	2,575	346	0	2,921	406	313	1,237	1,956	1,542	0	0	1,542	1,200	0	171	1,371	2,220	0	397	2,617
Lower Day Basin	NM	0	0	0	2798	107	0	2,905	624	2,810	0	3,434	78	2,266	0	2,344	303	0	0	303	168	0	0	168	540	3	0	543
Etiwanda Debris Basins	NM	2,812	0	2,812	0	2137	0	2,137	20	2,488	0	2,508	0	1,160	0	1,160	10	0	0	10	28	0	0	28	775	7	0	782
Victoria Basin	NM	0	0	0	0	0	0	0	330	0	0	330	260	0	0	260	427	0	0	427	250	0	0	250	494	2	0	496
San Sevaine	NM	1,211	0	1,211	2830	1620.7	0	4,451	2,072	9,172	0	11,244	244	5,749	0	5,993	749	0	0	749	225	0	0	225	993	0	0	993
Hickory Basin	NM	0	0	0	298	197	0	495	438	636	586	1,660	536	212	647	1,395	949	0	567	1,516	199	0	46	245	700	7	856	1,563
Banana Basin	NM	0	0	0	425	0	0	425	300	193	529	1,022	226	783	643	1,653	278	0	157	435	383	0	40	423	416	0	898	1,314
RP-3 Basins	NM	0	0	0	1105	0	0	1,105	767	0	0	767	802	0	0	802	511	0	0	511	613	0	106	719	1,902	1	2,051	3,954
Declez Basin	NM	0	0	0	19	0	0	19	737	0	0	737	0	0	0	0	730	0	0	730	656	0	0	656	774	0	0	774
Totals:	NM	7,582	49	7,631	17,648	12,258	158	30,065	12,940	34,567	1,303	48,810	4,745	32,960	2,993	40,698	10,205	0	2,340	12,545	7,512	0	2,684	10,196	14,273	5,000	7,210	26,483

Basin Name	FY 2010/2011				FY 2011/2012				FY 2012/2013				FY 2013/2014				FY 2014/2015				FY 2015/2016				FY 2016/2017			
	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total	SW	IW	RW	Total
MVWD ASR Well	0	186	0	186	0	889	0	889	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
College Heights Basins	593	559	0	1,152	4	578	0	582	0	0	0	0	4	0	0	4	0	0	0	0	0	0	0	0	70	0	0	0
Upland Basin	1,308	899	0	2,207	222	2,118	0	2,340	119	0	0	119	95	0	0	95	325	0	0	325	425	0	0	425	583	2,179	0	2,762
Montclair Basins	1,762	3,672	0	5,434	703	11,893	0	12,596	204	0	0	204	416	0	0	416	411	0	0	411	441	0	0	441	1,046	2,575	0	3,621
Brooks Street Basin	628	0	1,373	2,001	363	561	836	1,760	115	0	1,505	1,620	112	0	1,308	1,420	198	0	1,011	1,209	182	0	1,215	1,397	674	6,150	0	6,824
7th and 8th Street Basins	1,583	543	1,871	3,997	1,047	572	641	2,260	751	0	2,261	3,012	441	5	1,423	1,869	1,751	0	48	1,799	921	0	1,470	2,391	1,034	188	385	1,607
Ely Basins	1,415	83	757	2,255	1,096	885	393	2,374	568	0	1,378	1,946	548	0	3,298	3,846	183	0	1,751	1,934	1,506	0	1,012	2,518	1,378	18	2,291	3,687
Grove Basin	431	0	0	431	400	0	0	400	177	0	0	177	258	0	0	258	481	0	0	481	471	0	0	471	363	0	1,491	1,854
Turner Basins	2,308	0	53	2,361	1,879	199	1,034	3,112	1,120	0	176	1,296	596	0	1,565	2,161	1,289	0	948	2,237	1,616	0	1,958	3,574	1,667	290	1,236	3,193
Lower Day Basin	703	894	0	1,597	158	1,439	0	1,597	106	0	0	106	114	28	0	142	341	0	0	341	281	0	0	281	449	292	0	741
Etiwanda Debris Basins	1,213	147	0	1,360	100	567	0	667	33	0	0	33	45	0	0	45	27	0	0	27	83	0	0	83	426	281	0	707
Victoria Basin	461	69	773	1,303	221	281	665	1,167	94	0	842	936	192	0	1,379	1,571	306	0	931	1,237	343	0	635	978	642	128	1,621	2,391
San Sevaine	1,049	1,707	396	3,152	436	1,228	513	2,177	147	0	575	722	162	0	274	436	330	0	1	331	585	0	0	585	785	540	0	1,325
Hickory Basin	371	10	776	1,157	258	515	783	1,556	199	0	874	1,073	171	13	1,920	2,104	243	0	2,034	2,277	184	0	575	759	142	0	136	278
Banana Basin	149	0	267	416	247	0	1,915	2,162	114	0	670	784	87	24	1,071	1,182	197	0	1,148	1,345	365	0	2,106	2,471	166	0	500	666
RP-3 Basins	2,201	882	1,799	4,882	1,339	1,724	1,789	4,852	1,021	0	2,198	3,219	717	350	1,355	2,422	1,030	0	2,968	3,998	1,226	0	3,282	4,508	1,437	386	5,770	7,593
Declez Basin	877	0	0	877	798	0	65	863	530	0	0	530	341	374	0	715	895	0	0	895	607	0	969	1,576	607	99	514	1,220
Totals:	17,052	9,650	8,065	34,767	9,271	23,449	8,634	41,354	5,298	0	10,479	15,777	4,299	795	13,593	18,687	8,007	0	10,840	18,847	9,236	0	13,222	22,458	11,469	13,127	13,944	38,470

NM - Not measured SW - Surface Water IW - Imported Water RW - Recycled Water FY - Fiscal Year

Table 4-3
Historical and Projected Storm and Wet-Water Supplemental Water Recharge Capacity in the Chino Basin
(afy)

Water Type	Pre-OBMP Recharge Capacity in 2000	Capacity after 2001 RMP Recharge Projects Were Completed in 2004	Capacity after 2013 RMPU Recharge Projects Are Completed
Storm[1]	~2,000	11,000	15,800
Recycled	500	13,200	20,300
Imported	28,500	57,000	49,900
Total	31,000	81,200	86,000

1 - Stormwater recharge capacity is defined as the average expected or historical stormwater recharge.

Table 4-4
MVWD ASR Injection and Extraction Capacity[1]

ASR Well	Injection Capacity[2]		Extraction Capacity[2]	
	(gpm)	(afm)	(gpm)	(afm)
MVWD-4	400	53	400	53
MVWD-30	1,000	133	2,000	265
MVWD-32	1,000	133	2,000	265
MVWD-33	1,000	133	2,000	265
Total	3,400	451	6,400	849

1. All of the existing ASR wells are owned by the Monte Vista Water District with the exception being MVWD-33, which is co-owned by the City of Chino.

2. The injection and extraction capacities assume the wells are operating 24 hours a day for 30 days.

Table 4-5a
Estimated In-Lieu Recharge Capacities for Major Appropriative Pool Parties, 2020 through 2040
(afy)

Appropriative Pool Party	Maximum In-Lieu Recharge Capacity				
	2020	2025	2030	2035	2040
Chino	1,449	1,191	946	818	750
Chino Hills	2,570	3,600	3,600	3,600	3,600
CVWD	11,383	13,687	13,859	13,938	13,938
MVWD	4,420	4,413	4,471	4,379	4,259
Ontario	12,006	12,829	13,348	13,017	11,490
Pomona	6,321	6,787	6,800	6,587	5,307
Upland	2,800	2,798	2,641	2,545	2,545
Total	40,949	45,305	45,665	44,884	41,889

Table 4-5b
Estimated In-Lieu Recharge Capacities for Major Appropriative Pool Parties with WFA Plant Limitations, 2020 through 2040
(afy)

Appropriative Pool Party	Maximum In-Lieu Recharge Capacity				
	2020	2025	2030	2035	2040
Chino	0	0	0	0	0
Chino Hills	0	0	0	0	0
CVWD	11,383	13,687	13,859	13,938	13,938
MVWD	0	0	0	0	0
Ontario	0	0	0	0	0
Pomona	6,321	6,787	6,800	6,587	5,307
Upland	0	0	0	0	0
Total	17,704	20,474	20,659	20,525	19,245

Table 4-6
Summary of Compliance with Section 5 of the 2013 Amendment to the 2010 RMPU
for Projects Constructed during FY 2010/11 to FY 2015/16

Appropriative Pool Party	All MS4 Projects		MS4 Projects that Utilize Infiltration Features for MS4 Compliance [5]				Confirmed Approval Date	Confirmed Construction Date	Confirmed Maintenance
	Number of Projects	Total Drainage Area (acres)	Number of Projects	Total Drainage Area (acres)	Design Capture Volume[6] (af)	Reconnaissance Estimate of Stormwater Recharge under Idealized Conditions (afy)			
All MS4 Projects Submitted to Watermaster									
Chino, City of	18	890	5	445	24	98	11	3	0
Chino Hills, City of [1]	0	0	0	0	0	0	0	0	0
Ontario, City of	38	396	36	376	32	83	24	13	16
Pomona, City of [2]	28	144	16	100	5	22	4	0	0
Upland, City of	6	23	5	23	1	5	1	5	0
CVWD [2]	0	0	0	0	0	0	0	0	0
FWC	60	584	46	501	45	110	48	0	0
JCSD	18	879	10	472	14	104	1	3	0
MMWC	1	3	0	0	0	0	0	1	1
MVWD	12	59	7	27	2	6	12	11	0
Riverside County [3,4]	0	0	0	0	0	0	0	0	0
San Bernardino County	6	10	2	7	1	2	0	0	0
SAWCo [1]	0	0	0	0	0	0	0	0	0
Total	187	2,988	127	1,951	124	428	101	36	17
Submitted MS4 Projects within the Chino Basin									
Chino, City of	18	890	5	445	24	98	11	3	0
Chino Hills, City of [1]	0	0	0	0	0	0	0	0	0
Ontario, City of	38	396	36	376	32	83	24	13	16
Pomona, City of [2]	11	61	10	55	3	13	2	0	0
Upland, City of	6	23	5	23	1	5	1	5	0
CVWD [2]	0	0	0	0	0	0	0	0	0
FWC	53	394	39	328	28	72	44	0	0
JCSD	18	879	10	472	14	104	1	3	0
MMWC	1	3	0	0	0	0	0	1	1
MVWD [3]	12	59	7	27	2	6	12	11	0
Riverside County [4,5]	0	0	0	0	0	0	0	0	0
San Bernardino County	6	9	2	7	1	2	0	0	0
SAWCo [1]	0	0	0	0	0	0	0	0	0
Total	163	2,714	114	1,733	105	381	95	36	17

Notes:

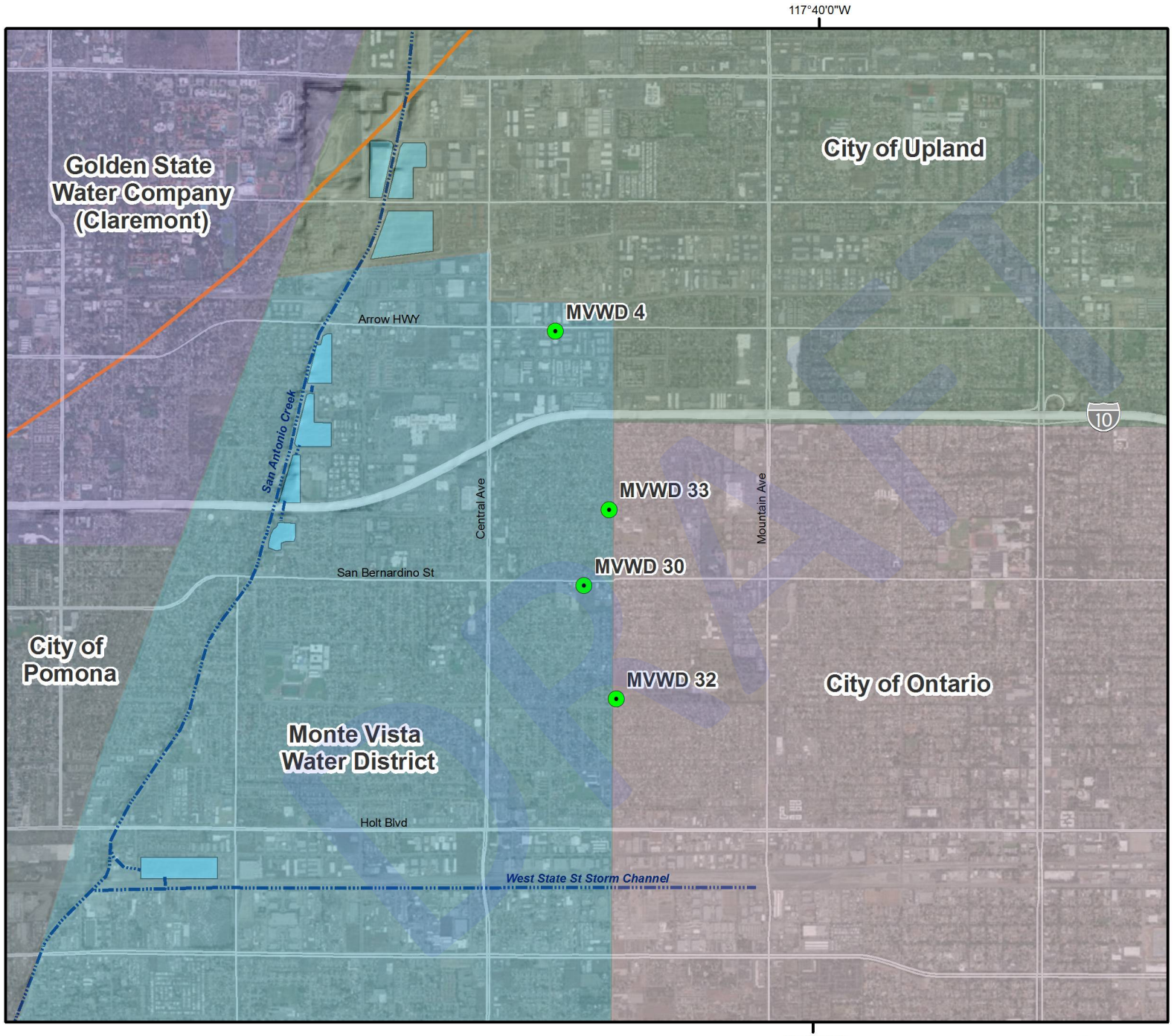
CVWD: Cucamonga Valley Water District
FWC: Fontana Water Company
JCSD: Jurupa Company Services District
MMWC: Marygold Mutual Water Company
MVWD: Monte Vista Water District
SAWCo: San Antonio Water Company

1. Not required to comply with the court order because their service area is mostly located outside of the Chino Basin boundary.
2. The CVWD informed Watermaster that they are in communication with the City of Rancho Cucamonga, and their data collection is in process.
3. Riverside County provided a GIS database, showing Riverside County's drainage facilities within the Chino Basin, which include all drainage facilities, not just MS4 facilities. The county informed Watermaster that they do not have specific data on MS4 projects and that Watermaster should request MS4 data from the cities within the county.
4. Riverside and San Bernardino Counties prepare annual reports that include a database of all MS4 projects within their jurisdiction. A comparison of these databases to the data submitted to Watermaster indicates that Watermaster has received only a subset of MS4 projects in each Appropriator Party service area. Watermaster cannot use these county databases directly because they do not contain the information required to estimate stormwater recharge.
5. Infiltration features could include offsite or onsite infiltration basins, infiltration trenches, infiltration pits, underground infiltration, drywells, gravel bedding infiltration, and bioretention with no underdrain.
6. For San Bernardino and Riverside Counties, design capture volume (DCV) is the volume of storm water runoff resulting from the 85th percentile, 24-hr storm event that the designed infiltration feature is constructed to capture. For LA County, DCV is either the 0.75-inch, 24-hour storm event, or the 85th percentile, 24-hour storm event, whichever is greater.
7. Estimated based on the assumption that all projects are similar to the Chino Fire Station No. 1 and Training Center MS4 project evaluated in Section 5 of the 2013 Amendment to the 2010 RMPU. Note that because precipitation is expected to increase north of Chino Fire Station No.1 and the majority of MS4 projects submitted to Watermaster are north of the Fire Station, this estimate is conservatively low. Idealized conditions mean that the infiltration feature performs as it was designed and that maintenance is performed to ensure that the infiltration feature performs as originally designed.

Table 4-7
Estimated Recharge Capacities in the Chino Basin
(afy)

Water Type	Recharge Type	2018 Conditions	2018 Conditions Plus Current Recommended 2013 RMPU Projects	2018 Conditions Plus Current Recommended 2013 RMPU Projects and Restoration of WFA Capacity
Stormwater	Average Stormwater Recharge in Spreading Basins	10,150	14,950	14,950
	Average Expected Recharge of MS4 Projects	380	380	380
	Subtotal	10,530	15,330	15,330
Supplemental Water	Spreading Capacity for Supplemental Water	70,200	70,200	70,200
	ASR Injection Capacity	5,480	5,480	5,480
	In-Lieu Recharge Capacity[1]	17,700	17,700	40,900
	Subtotal	93,380	93,380	116,580
	Total	103,910	108,710	131,910

[1] In-lieu recharge capacity is based on 2020 estimates. See Tables 4-5a and 4-5b.

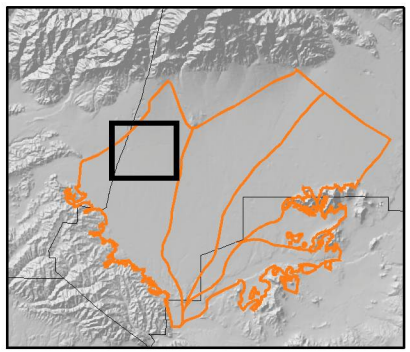


MVWD ASR Well

Streams & Flood Control Channels

Flood Control & Conservation Basins

OBMP Management Zones



Prepared by:

WEI Wildermuth Environmental, Inc.

Author: SO

Date: 4/23/2018

Name: Figure_4-1_MVWD_ASR

0 1,250 2,500 Feet

0 460 920 Meters

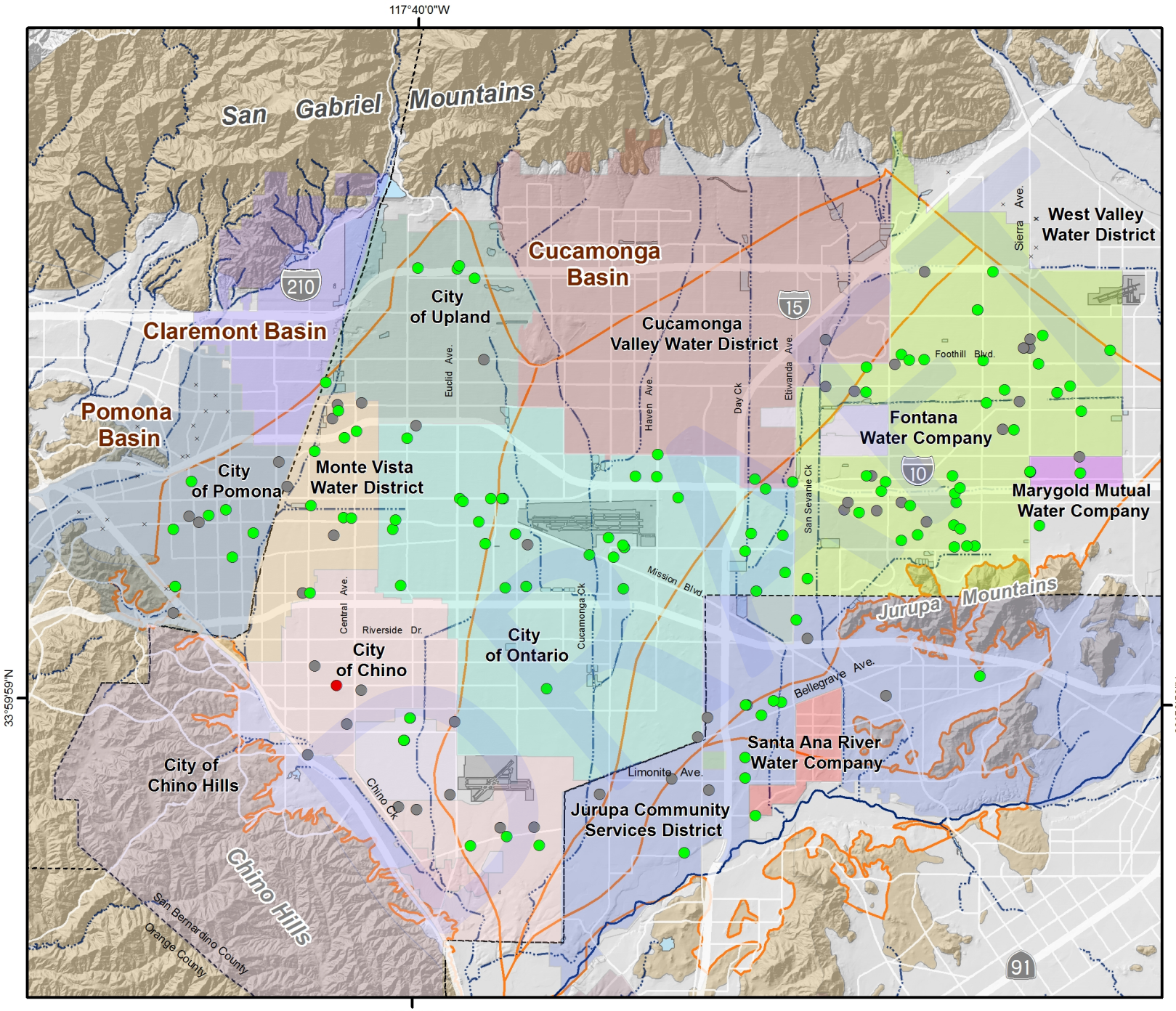
Inland Empire Utilities Agency A MUNICIPAL WATER DISTRICT

Chino Basin Watermaster

2018 Recharge Master Plan Update

MVWD Aquifer Storage and Recovery Wells

Figure 4-1



MS4 Compliance Through:

- Infiltration Features

  Infiltration features could include offsite or onsite infiltration basins, infiltration trenches, infiltration pits, underground infiltration, drywells, gravel bedding infiltration, and bioretention with no underdrain.

- Non-Infiltration Features

  Non-infiltration features could include pervious pavement, vegetated swales, retention basins, and biotreatment.

- MS4 Project Outside of Chino Basin Boundary

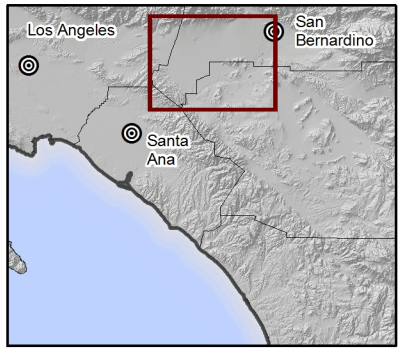
- Chino Fire Station No. 1

  See Footnote 7 in Table 4-6

- OBMP Management Zones
- Streams & Flood Control Channels
- Flood Control & Conservation Basins

Geology

- Quaternary Alluvium
- Undifferentiated Pre-Tertiary to Early Pleistocene Igneous, Metamorphic, and Sedimentary Rocks



Prepared by:

WEI
Wildermuth Environmental, Inc.

Author: SO
Date: 5/16/2018
Name: Figure_4-2_MS4_CB_Final

0 1 2 Miles
0 2 4 Kilometers

Inland Empire Utilities Agency
A Municipal Water District

Chino Basin Watermaster
Pioneer in Basin Management

2018 Recharge Master Plan Update

MS4 Projects Submitted to Watermaster
FY 2010/11 through FY 2016/17

Figure 4-2