Section 6 Groundwater Management Alternatives

This section describes the groundwater management plan elements that can be applied to remove the impediments to achieving the management program goals discussed in Section 5 and to meet the water demands discussed in Section 4, using the resources described in Sections 2 and 3.

6.1 Management Alternatives for the Update of the San Juan Basin Groundwater Management and Facilities Plan

Four meetings were held with the SJBA TAC to review the impediments to the goals and the groundwater management plans that could be implemented to remove those impediments. The basic intent of the management alternatives is to manage production to the available yield: yield will vary from year to year based on hydrology, production will be managed consistent with the existing diversion permits and interagency agreements, modification to the diversion permits and interagency agreements will be made to maximize yield, and additional permits and interagency agreements will be required to incorporate novel groundwater management schemes. Furthermore, it has not been determined if the MWDOC SOCOD project will be implemented within the next few years or at all. Thus, management alternatives need to consider whether or not SOCOD will exist in the future. The SJBA TAC asked that the alternatives be structured for incremental expansion from the least resource intensive to the most resource intensive. This would allow the implementation of more resource intensive management elements as more information on their feasibility can be obtained and as future funding becomes available.

The alternatives that the SJBA TAC is considering are described below. The first six alternatives assume that the SOCOD project will either not be implemented or will be deferred by ten or more years. Alternatives 7 through 10 assume that the SOCOD project will be implemented within the next ten years.

6.1.1 SJBGFMP Alternatives Assuming SOCOD Is Not Implemented or that SOCOD Implementation Is Deferred for Ten or More Years

6.1.1.1 Alternative 1 – Adaptive Production Management within Existing Recharge and Production Facilities (the current plan or baseline alternative)

Alternative 1 is an attempt to refine the current status quo management plan to comply with the diversion permits held by the SJBA and SCWD and the interagency agreements. It involves the management of groundwater production by the CSJC and the SCWD to prevent or at least minimize seawater intrusion and to what is otherwise available on an annual basis. Alternative 1 is the future baseline. The average annual production or yield that can be developed from the basin is estimated to be about 9,200 acre-ft/yr, ranging from about 7,400 acre-ft/yr to 10,600 acre-ft/yr[31]. About 71 percent of the time, the production will be less

[31] These values correspond to the model period average, min and maximum model predicted production minus seawater intrusion.

than 11,000 acre-ft/yr, and about 15 percent of the time, production will meet or exceed the desired goal of 11,200 acre-ft/yr.

6.1.1.1.1 Summary of Features[32]

1a. Set groundwater level based production thresholds and use monitoring to adjust production.

1b. Implement water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater when groundwater production is reduced per 1a above.

1.c Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

6.1.1.1.2 Detailed Description

Alternative 1 is an attempt to refine the current status quo groundwater management and facilities plan to comply with the diversion permits held by the SJBA and SCWD and the interagency agreements. In Alternative 1, the SJBA would set annual groundwater production limits in the spring of each year, based on groundwater levels measured that spring and an estimate of groundwater storage that spring. These production limits would hold until the following spring. A storage-production relationship would be initially constructed based on groundwater model simulations and subsequently refined based on experience and future groundwater simulations. Figure 3-25 shows an example of such a relationship. This mode of operation is consistent with a provision in the SJBA and SCWD diversion permits issued from the State Board that limits production (diversion) when groundwater storage falls to less than half of the storage capacity (a provision included to protect other groundwater producers), which is predicted to occur about 71 percent of the time (see Figure 3-26a). Groundwater monitoring would be done by the SJBA, and the SJBA would determine production limits related to basin storage.

This mode of operation will reduce the rate of seawater intrusion but not eliminate it. Groundwater monitoring is required seaward of the SCWD desalter wells to monitor the progress of seawater intrusion and to guide future production limitations at the SCWD wells. Groundwater monitoring would be done by the SJBA, and the SJBA would determine production limits related to seawater intrusion.

The existing interagency agreements require an equitable adjustment of production among the CSJC and SCWD based on the water available for production. This can be achieved through existing interconnections or exchange agreements and should not require the construction of new interconnections. The SJBA would determine when and how the adjustment of

[32] The number labels associated with the features indicate that they are common to other alternatives.

production would occur and how to equitably distribute production and exchange among the SJBA members.

Finally there exists in certain reaches of San Juan Creek and tributaries an invasive high water-consuming phreatophyte called arundo dornax. This plant species degrades habitat and reduces the amount of water available for useful habitat and human purposes. Eliminating this plant will improve habitat and water supplies. Arundo is immune to herbicides and must be mechanically removed in a systematic way so to manage its reemergence.

6.1.1.2 Alternative 2 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Injection Barrier

Alternative 2 is identical to Alternative 1 except a seawater injection barrier would be constructed to prevent seawater intrusion, and groundwater production would be reduced to what is otherwise available on an annual basis. The goals of Alternative 2 are to increase the yield of the basin during non-wet periods over the yield that would otherwise be developed in Alternative 1 and to prevent seawater intrusion as required in the SJBA and SCWD diversion permits. The minimum injection rate required to just replace the estimated seawater intrusion during dry periods is about 500 acre-ft/yr. The injection barrier is assumed herein to have an injection capacity of 1,000 acre-ft/yr, and the yield of the basin is expected to increase by the amount injected. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 10,000 acre-ft/yr.

6.1.1.2.1 Summary of Features

1a. Set groundwater level based production thresholds and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater.

1.c Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

2a. Construct injection wells seaward of the SCWD wells. Modulate injection rate to maintain barrier without surface discharge of groundwater or loss seaward of the barrier. Increase annual production from the San Juan Basin by the amount injected to recover the injected water. The source water for the injection barrier is based on least cost—assumed initially to come from MWDOC but could eventually be recycled water.

2b. Revise existing diversion permits, if necessary, to increase production rights at existing wells to ensure that injected water can be produced.

6.1.1.2.2 Detailed Description

Alternative 2 is an attempt to increase the yield of the basin during non-wet periods through the injection of supplemental water into the basin just seaward of the SCWD desalter wells. The supplemental water for injection would initially come from MWDOC but could be replaced in subsequent years by recycled water. Supplemental water would be injected at a rate to establish a pressure mound seaward of the SCWD extraction wells and would supplement the water available for production by SCWD and the CSJC on a one-for-one basis. None of the injected water would be lost. This will allow for the operation of the basin at slightly lower levels inland of the barrier and allow greater production during dry periods relative to Alternative 1. Figure 6-1 shows the conceptual location of up to four injection wells located seaward of the SCWD desalter wells. Two of these wells would be constructed initially, and up to two additional wells would be added later if necessary. The precise number of wells would be determined after the first two wells are constructed and operational.

The cost and yield of the injection project would be allocated to SJBA members under a cost sharing agreement based on their financial participation and benefit. There could be adjustments in the cost allocation to account for reductions in treatment costs experienced by the SCWD due to the SCWD desalter wells intercepting higher quality injected water. If the CSJC and SCWD are the only SJBA members producing groundwater from the San Juan Basin, the cost of the seawater injection project could be allocated on their annual production or a similar scheme that distributes costs based on benefit or potential benefit.

6.1.1.3 Alternative 3 – Adaptive Production Management within Existing Recharge and Production Facilities with a Seawater Extraction Barrier

Alternative 3 is identical to Alternative 2 except a seawater extraction barrier would be constructed to prevent seawater intrusion in lieu of an injection barrier. The goals of Alternative 3 are identical to those of Alternative 2: to increase the yield of the basin during non-wet periods over the yield that would otherwise be developed in Alternative 1 and to prevent seawater intrusion as required in the SJBA and SCWD diversion permits. The yield developed by this alternative would be greater than that developed by the seawater injection barrier in Alternative 2 because the extraction barrier can function independent of the amount of storage in the basin landward of the SCWD desalter wells; whereas, the injection barrier approach will have variable injection rates with lesser injection during high storage periods and more injection during dry periods when storage in the basin is low. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 12,200 acre-ft/yr.

6.1.1.3.1 Summary of Features

1a. Set groundwater level based production thresholds and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater.

1c. Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

3a. Revise existing diversion permits to include new expanded production at the new extraction barrier wells.

3b. Construct and operate a seawater extraction barrier.

6.1.1.3.2 Detailed Description

Alternative 3 is an attempt to increase the yield of the basin throughout the year and to eliminate seawater intrusion into the basin landward of the seawater extraction barrier. This can be done through the creation of an extraction barrier seaward of the SCWD desalter wells and could include the SCWD wells. Figure 6-1 shows the potential extraction barrier well field area and its spatial relationship to the SCWD and CSJC wells. The source of water to the extraction barrier would initially be brackish groundwater and would eventually be seawater induced to flow inland due to production at the extraction barrier wells. The extraction barrier wells would be located between the Pacific Coast highway and the SCWD desalter wells and, unlike the proposed SOCOD wells, would be conventional vertically aligned wells. The treatment facilities for this project would be collocated with the SCWD desalter facility. The ultimate capacity of this project is unclear at this time, but it initially appears that about 2,000 to 3,000 acre-ft/yr of new supply could be developed long term through the production of 4,000 to 6,000 acre-ft/yr, respectively, of groundwater seaward of the SCWD desalter wells. The initial yield would be greater as the groundwater salinity will be significantly less than the salinity of seawater for a substantial period of time.

In contrast to Alternative 2, which uses a seawater injection barrier to inject imported water into the basin, the extraction barrier described herein will generate a new supply of water and reduce the use imported water.

The cost and yield of the extraction barrier project would be allocated to the SJBA members under a cost sharing agreement based on their financial participation and benefit.

6.1.1.4 Alternative 4 – Adaptive Production Management with Seawater Barrier and Construction of Ranney-Style Collector Well(s)

Alternatives 4A and 4B are identical to Alternatives 2 and 3, respectively, except that one or two Ranney-style collector wells would be constructed to increase production capacity during dry periods. The goals of Alternative 4 are to increase the production capacity of the basin during non-wet periods, to prevent seawater intrusion, and to increase the yield of the Basin through the inducement of more stormwater recharge. Replacement supplies would be provided to non-SJBA overlying groundwater producers, as necessary, to replace lost groundwater production at their wells when the basin is operated at lower groundwater levels. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 11,200 acre-ft/yr and 13,400 acre-ft/yr for Alternatives 4a and 4b, respectively.

6.1.1.4.1 Summary of Features

1a. Set groundwater level-based production thresholds and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater.

1c. Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

2a or 3b. Construct injection wells seaward of the SCWD wells (2a) or construct an extraction barrier seaward of the CVWD wells (3b). In either case, revise existing diversion permits, as necessary, to include new additional production at the injection or extraction wells.

4a. Revise existing diversion permits to include new additional production at the Ranney wells, the approval to provide alternative water supplies to existing overlier producers in lieu of them producing groundwater, and potentially to increase production rights to recover new stormwater recharge created by operating the basin at lower levels.

4b. Construct and operate Ranney-style collector well(s).

4c. Construct and operate interconnections with overlying water right holders to provide them with replacement water when groundwater levels are too low for them to operate their wells.

6.1.1.4.2 Detailed Description

Alternative 4 is an attempt to increase the production capacity of the basin during non-wet periods through the construction of one or two Ranney-style collector wells and potentially to increase the yield of the basin. Figure 6-2 is a schematic of a typical Ranney-style collector well. These collector wells would allow for increased groundwater production during non-wet periods, allow the production to be maintained at lower basin storage levels, and increase stormwater recharge by generally maintaining lower levels in the basin. Moreover, an increase in stormwater recharge would occur because the basin could be operated at lower storage levels and minimize the lost recharge during wet years. It is unclear as to how much additional stormwater recharge could be induced due to operating the basin at lower groundwater storage. Additional surface water and groundwater modeling work will be required to assess the expected increase in stormwater recharge. For planning purposes, 1,000 acre-ft/yr of new stormwater recharge was assumed.

The capacity of each Ranney-style collector well would range from about 2,900 to 5,800 acre-ft/yr, depending on groundwater levels. The benefit achieved by inducing more stormwater recharge is not currently knowable. Groundwater modeling will be required to estimate new induced recharge.

The cost of the Ranney-style collector wells and the additional yield would be allocated the SJBA members under a cost sharing agreement based on their financial participation and benefit.

6.1.1.5 Alternative 5 – Adaptive Production Management, with Seawater Barrier, Construction of Ranney-Style Collector Wells, and In-Stream Recharge

Alternatives 5A and 5B are identical to Alternatives 4A and 4B, respectively, except that a reach of San Juan Creek and the Arroyo Trabuco would be operated as stormwater recharge facilities. These recharge facilities would increase stormwater recharge and thus the yield of the basin. The goals of Alternative 5 are to increase the production capacity of the basin during non-wet periods, to improve water quality (principally reduce salt and nutrient concentrations in groundwater), to prevent seawater intrusion, and to increase the yield of the Basin through the inducement of more stormwater recharge. The average yield of the Basin would be increased from about 9,200 acre-ft/yr to about 12,000 acre-ft/yr and 14,200 acre-ft/yr for Alternatives 5a and 5b, respectively.

6.1.1.5.1 Summary of Features

1a. Set groundwater level based production thresholds and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater.

1c. Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

2a or 3b. Construct injection wells seaward of the SCWD wells (2a) or construct an extraction barrier seaward of the CVWD wells (3b). In either case, revise existing diversion permits, as necessary, to include new additional production at the injection or extraction wells.

4a. Revise existing diversion permits to include new additional production at the Ranney wells, the approval to provide alternative water supplies to existing overlier producers in lieu of them producing groundwater, and potentially to increase production rights to recover new stormwater recharge created by operating the basin at lower levels.

4b. Construct and operate Ranney-style collector wells.

5a. Revise diversion permit to include the right to divert, recharge, and store new stormwater recharge, and subsequently recover this water.

5b. Construct and operate in-stream recharge facilities.

6.1.1.5.2 Detailed Description

Alternative 5 is an attempt to increase the yield of the basin through the recharge of stormwater. In-stream recharge is the only viable large-scale recharge method for the San Juan Basin due to the lack of suitable off-stream sites for stormwater storage and recharge, and the inability of the basin to accept large amounts of recharge at a specific site. Off-stream sites are not practical either because they do not overly the San Juan Basin proper and will not provide enough regulatory storage to divert and store a significant amount of stormwater for subsequent infiltration into the basin. There is also a limitation in the ability of the basin to take in significant amounts of stormwater at conventional recharge basins located over the San Juan Basin. Offstream recharge sites will readily clog with fine grain sediments in the stormwater. The in-stream facilities proposed herein would provide for a significant amount of diffuse stormwater recharge with the recharge distributed over a large area, similar to what happens currently with stormwater recharge in the Arroyo Trabuco and San Juan Creek. The proposed in-stream recharge facilities would increase the magnitude of stormwater recharge.

Figure 6-1 shows the potential location of the stream reaches where this recharge could be accomplished. Temporary berms would be constructed in these reaches, making discharge in the channel flow "bank to bank" whenever stormwater is available and thereby maximizing the wetted area and recharge. The OCWD has been successfully conducting this type of recharge in the Santa Ana River since the mid-1900s. Figure 6-3 illustrates the berm configurations used by the OCWD. These berms would be damaged or washed out during some storms and would need to be reconstructed periodically throughout the year with the number of reconstructions dependent on the number and magnitude of storms during the year. Temporary "T" and "L" berms would be constructed in the reach illustrated in Figure 6-3 that would make the discharge in the channel flow "bank to bank" for smaller stormwater events, thereby maximizing the wetted area and recharge. The berms would washout completely during the onset of significant flood events and would not interfere with the flood control function of the channel. Alternatively rubber dams could also be constructed along the streams and used to intercept and store stormwater. All the dry-weather discharge that currently reaches the ocean could be intercepted and recharged providing water quality benefits at Doheny Beach. Detailed hydraulic modeling would have to be done to precisely estimate the expected new recharge from these proposed in-stream recharge facilities. For planning purposes, it is reasonable to assume that the annual increase in stormwater recharge could range from 500 to 2,000 acre-ft/yr and that to achieve this recharge, the basin would have to be operated such that there is always storage space available to accept recharge.

The cost and yield from the implementation of in-stream recharge would be allocated to the SJBA members under a cost sharing agreement based on their financial participation and benefit.

6.1.1.6 Alternative 6 – Adaptive Production Management, Creation of a Seawater Barrier, In-stream Recharge, and Recycled Water Recharge

The goals of Alternative 6 are to increase the production capacity of the basin during non-wet periods, to prevent seawater intrusion, to increase the yield of the Basin through the inducement of more stormwater recharge, and to increase the yield through the recharge of large amounts of recycled water. The in-stream recharge facilities used for stormwater recharge in Alternative 5 would be modified to create a corridor for small summer storms to pass through the basin, and most of the channel would be bermed-off into discrete cells to receive and recharge recycled water. Recycled water would be recharged from May through September. Approximately 27 acres of streambed would be used for recharge. This would provide the SJBA with about 10,000 acre-ft/yr of supplemental water recharge capacity. Groundwater production and treatment would be increased to recover this recharge. The yield of the Basin would be increased from about 9,200 acre-ft/yr to about 21,400 acre-ft/yr—an increase of about 12,000 acre-ft/yr.

6.1.1.6.1 Summary of Features

1a. Set groundwater level based production thresholds, based on spring groundwater levels, and use monitoring to adjust production.

1b. May require water exchanges and possibly an interconnection among SJBA members to ensure equitable sharing of groundwater..

1c. Implement a groundwater level, quality, and production monitoring program to determine water in storage in the spring of each year, to assess ambient quality, to manage seawater intrusion, and to comply with specific recharge permit conditions.

1.d Implement an aggressive program to eliminate the invasive water-consuming phreatophyte called Arundo Dornax.

3a. Construct extraction barrier seaward of the SCWD wells to increase basin yield by 4,000 acre-ft/yr and eliminate seawater intrusion.

4a. Revise existing diversion permits to include the approval to provide alternative water supplies to existing overlying producers in lieu of them producing groundwater.

4b. Site[33] and construct new wells to increase production capacity.

5a. Revise the existing diversion permit to include the right to divert, recharge, and store new stormwater recharge; subsequently recover this water; and allow production in the seawater extraction barrier.

5b. Construct and operate in-stream recharge facilities to enhance the recharge of stormwater from October through April. Reconstruct as necessary during the year. Yield increase will be about 2,000 acre-ft/yr.

6a. Complete Title 22 Engineering Report for a recycled water recharge project (Groundwater Recharge Reuse Project or GRRP in Title 22 vernacular) and subsequent permitting process with the Regional Board and DPH to obtain a recharge permit.

6b. Revise diversion permit to include the right to recharge and store recycled water recharge and subsequently recover this water.[34]

6c. Construct and operate recycled water recharge facilities. Yield increase will be 10,000 acre-ft/yr.

6d. Expand existing or construct new desalting facilities to enable the recovery of recycled water recharge.

[33] At higher levels of recycled water recharge, the Ranney collector wells may not be necessary.

[34] This is done to protect the recycled water recharge from other producers and to update the permit to include monitoring for the same.

6.1.1.6.2 Detailed Description

Alternative 6 is an attempt to increase the sustainable yield of the basin through the recharge of storm and recycled waters, the creation of a seawater extraction barrier that will desalt seawater and generate a new supply of water, the recharge of large amounts of recycled water, and the recovery of the new recharge by expanding groundwater production facilities and treatment. Figure 6-1 shows the potential location of the stream reaches where storm and recycled water recharge could be accomplished. Temporary "T" and "L" berms would be constructed in the reaches illustrated in Figure 6-1, making discharge in the channel flow "bank to bank" for smaller stormwater events, thereby maximizing the wetted area and recharge. During the dry-weather period of May through September (a period of 123 days), the SBJA would modify the berms to create a corridor along the north side of the channel for passage of small storm discharge and a series of cascading recharge cells along the southeast side of the channel for use in the recharge of recycled water. Inundation depths in the recycled water recharge cells would be one foot or less to ensure that the ponds can be dewatered by infiltration in advance of storms. Approximately 27 acres of ponds could be created providing the SJBA with up to 10,000 acre-ft of recycled water recharge capacity. Tertiary-treated Title 22 effluent from SOCWA would be used for recharge. The amount of recycled water recharged each year would be based on spring groundwater levels and storage. New groundwater wells will be required to recover the increased recharge, and the existing desalters would have to either be expanded or new desalters would have to be built.

In implementation, the recycled water recharge part of Alternative 6 would be ramped up slowly, allowing the SJBA to conduct monitoring to develop data on soil-aquifer treatment and recycled water contribution at each production well. These data and their interpretations would be reported to the Regional Board and the State DPH in compliance with a recharge permit and to demonstrate to the regulatory agencies that the project can be operated pursuant to the recharge permit. The amount of recycled water recharge would be ratcheted up each year based on these demonstrations to the ultimate design recharge capacity. Production would also have to ratchet up to recover the recycled water. The recycled water sources for this project could include the J. B. Latham plant, the 3A plant, the Chiquita plant, and recycled water from storage.

The cost and yield from the implementation of recharge would be allocated to the SJBA members under a cost sharing agreement based on their financial participation and benefit.

6.1.2 SJBGFMP Alternatives Assuming SOCOD Is Implemented in the Next Ten Years

6.1.2.1 Alternative 7– Adaptive Production Management within Existing Recharge and Production Facilities (Alternative 1 with SOCOD)

This alternative is identical to Alternative 1 with SOCOD and with the expectation that the average yield of the basin will be lowered by about 1,600 to 2,000 acre-ft/yr with greater losses in yield occurring in dry years. There will be no need for a seawater intrusion barrier as the SOCOD project will eliminate seawater intrusion.

6.1.2.2 Alternative 8 – Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells

This alternative is identical to Alternative 7 with the addition of one or more Ranney-style collector wells (as described in Alternative 4). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 8,700 acre-ft/yr.

6.1.2.3 Alternative 9 – Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), Construction of Ranney-Style Collector Wells, and In-stream Recharge

This alternative is identical to Alternative 8 with the addition of in-stream recharge facilities (as described in Alternative 5). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 9,500 acre-ft/yr.

6.1.2.4 Alternative 10 – Adaptive Production Management, Existing Recharge and Production Facilities (Alternative 1 with SOCOD), In-stream Recharge, and Recycled Water Recharge

This alternative is identical to Alternative 9 with the utilization in-stream recycled water recharge (as described in Alternative 6). The average yield of the Basin would be increased from about 7,500 acre-ft/yr to about 16,700 acre-ft/yr.

6.2 Stormwater Recharge in Off Stream Facilities

Many stakeholders commented that there were no recommendations for diversion of stormwater to off stream recharge facilities included in the SJBGFMP. Early in the investigation the concept of off stream recharge was discussed with the TAC committee and it concluded in those discussions that there were few suitable sites for off stream recharge and for off stream recharge to work there would be a need for significant storage for which it was concluded that there no suitable storage sites. These conclusions should be revisited prior to or during the next SJBGFMP update.

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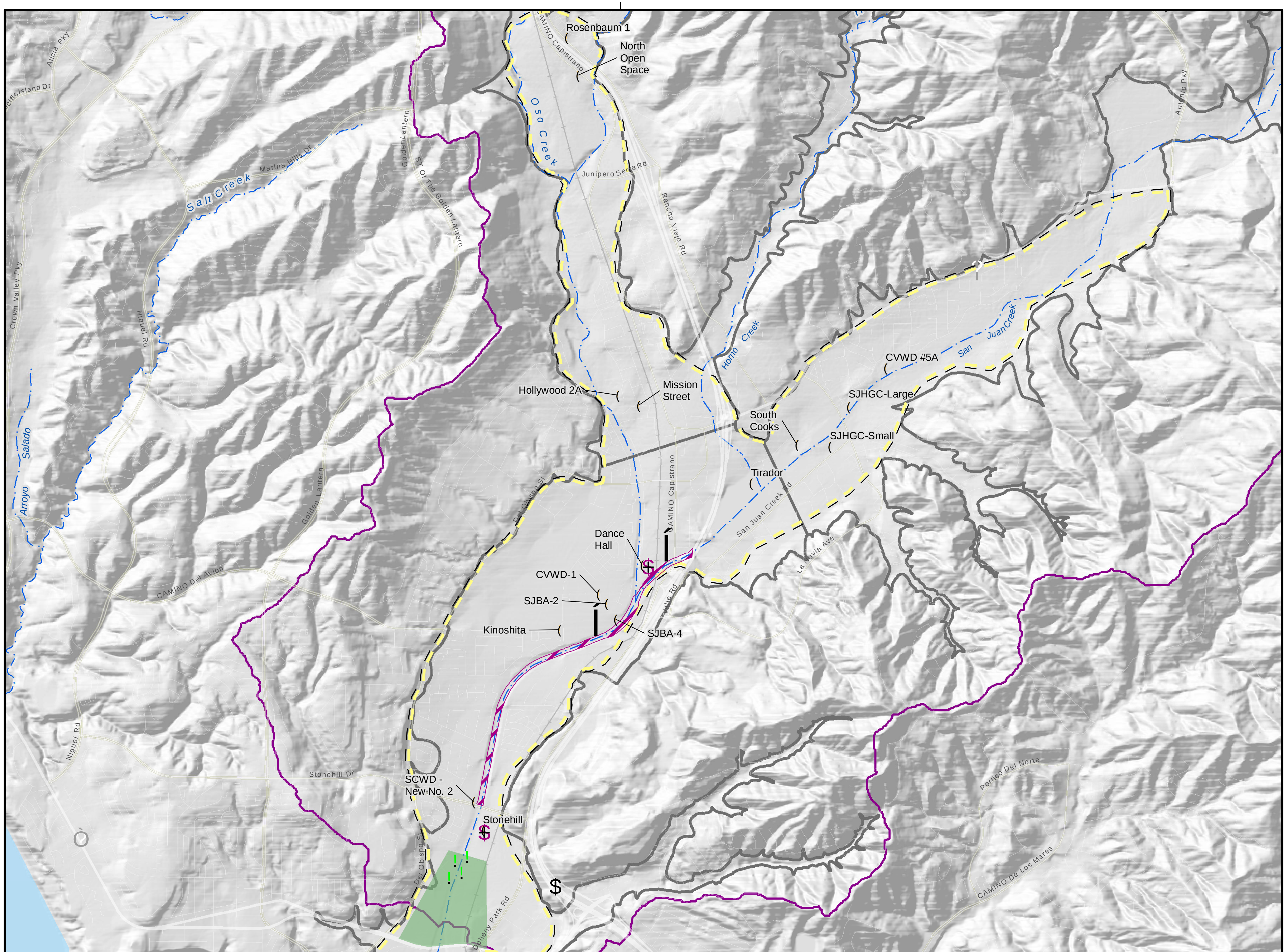

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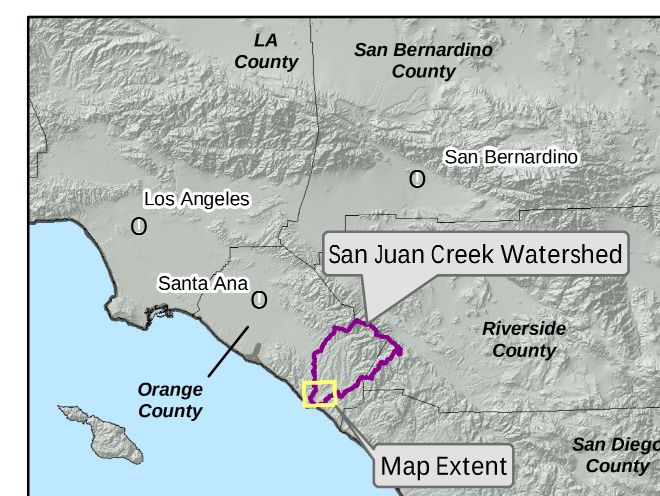
Main Features

- Proposed Instream Recharge Facilities
- Proposed Extraction Barrier Area
- (Existing Well
- ! Proposed Injection Well
- Proposed Ranney Collector Well - (location shown is conceptual)
- $ Existing Desalter Facility

Hydrologic Features

- Groundwater Sub-basin
- San Juan Creek Watershed Boundary
- Active Managment Area



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Author: lboehm
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0 2,500 5,000 Feet

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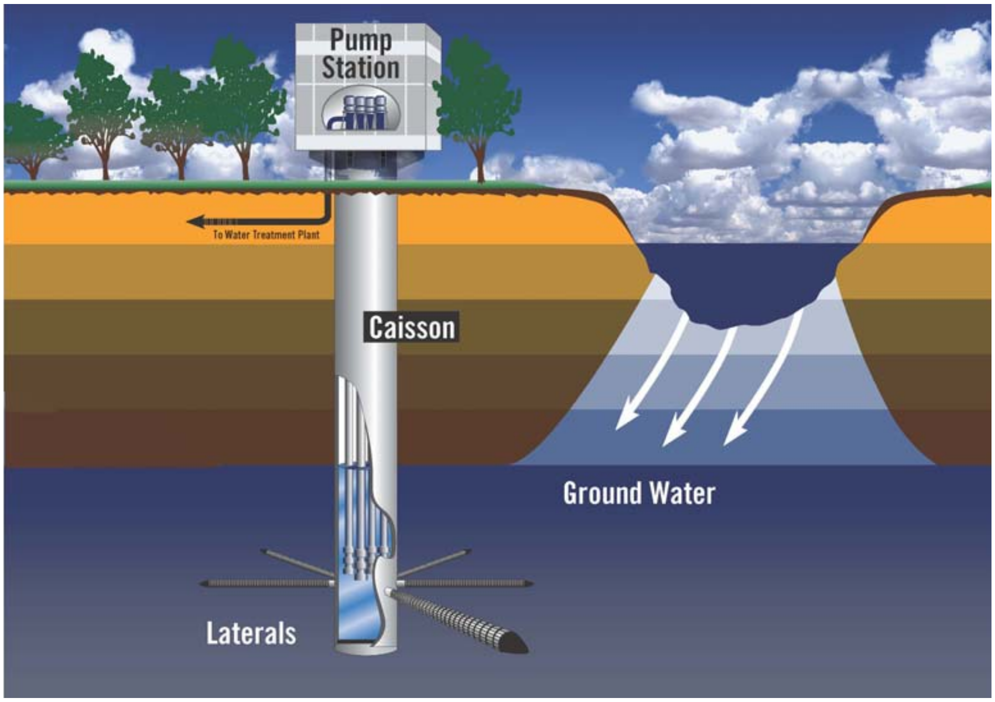
Management Components

Figure 6-1

Figure 6-2 - Schematic Illustration of a Ranney Collector Well



Source: Layne Christensen, 2013

Figure 6-3 - "T" Levees in the Santa Ana River