ES-1 Introduction

In 2010 the San Juan Basin Authority (SJBA) engaged Wildermuth Environmental, Inc. (WEI) to update their San Juan Basin Groundwater Management and Facilities Plan (SJBGMFP). WEI teamed with Carollo Engineers and Michael Bradman and Associates to complete this work. This administrative draft report documents the efforts of the stakeholders and our team to update the SJBGMFP. Specifically, this report documents the current state of the basin (SOB), the conceptual model of the hydrologic system, the environmental and infrastructure resources in the investigation area, management goals and impediments to the goals, management alternatives, recommended management plan(s), and a monitoring and reporting plan.

The investigation considered all the water resources of the San Juan Creek watershed but limited the application of management activities to the surface and ground waters of the lower part of the watershed between the Pacific Ocean at the most downstream end of the watershed to the Ortega Highway bridge on San Juan Creek and to near the confluence of the Arroyo Trabuco and Oso Creeks on the Arroyo Trabuco. The investigation area is s referred to as the active management area or the active storage area later in this document. The active management area was developed in Task 4 and was approved by the SJBA TAC during the 2013 SJBGFMP development process.

ES-2 Planning Area and Its Resources

This section characterizes the major resources in the planning area for use in the development of the SJBGFMP and subsequent environmental documentation. The following topics are described in detail for the planning area: land use, aesthetics, biological and ecological resources, geologic hazards, hydrology, and transportation infrastructure. Approximately half of the land area within the SJBA service area is urbanized, while the remaining is undeveloped and mostly unincorporated. Most of the developed land within the basin is designated residential and commercial. Information was provided by the Southern California Association of Governments (SCAG), for land use designations within the SJBA service area.

Many of the maps contained in this planning section refer to the SJBA service area as the union of the SJBA member agencies service area. For clarity, the SJBGFMP contains management activities for surface and ground waters within the San Juan Creek watershed exclusively in the lower part of the watershed. The SJBGFMP management activities provide direct benefits to the SJBA member agencies. The service area boundaries of the SJBA member agencies extend beyond the boundaries of the watershed. This means that while the management activities of SJBGFMP occur within the San Juan Creek watershed (and exclusively in the lower part of the watershed), that the direct benefits of the management program can reach beyond the watershed, principally the service areas of the SJBA member agencies and the State.

The Rancho Mission Viejo (RMV) is a large land owner and riparian water user located in the San Juan Creek watershed whose lands and water use are upstream and not included in the SJBGFMP except through the recognition of the RMV upstream water uses. The

management activities included in the SJBGFMP occur completely downstream of the RMV and they do not interfere with the water rights and management activities of the RMV.

ES-3 Existing Water Resources

San Juan Creek Watershed

The San Juan Creek watershed is located in Southern Orange County on the western flank of the Santa Ana Mountains. The headwaters originate in the Cleveland National Forest near the Orange/Riverside County border at an elevation of approximately 3,300 feet above sea level and flow approximately 29 miles south-southwest to the Pacific Ocean at Doheny State Beach in Dana Point. The total watershed drainage area covers approximately 175 square miles and consists of two major tributaries to San Juan Creek, known as the Arroyo Trabuco and Oso Creek. The upper third of the watershed is extremely rugged with steep slopes and deep cutting narrow canyons with minor tributaries from these areas flowing out from sharp canyons. The center third is dominated by rolling hills, and the downstream third is a highly developed floodplain. As the streams come out of the canyon mouth, they widen out into several alluvial floodplains (Pace 2008). These floodplains comprise the alluvial sediments from which groundwater is extracted. Land rises from sea level, where San Juan Creek discharges to the Pacific Ocean, to 5,687 ft at the peak of Santiago Mountain. There are three principal streams that drain the watershed: Oso Creek, the Arroyo Trabuco and San Juan Creek. There are numerous other small streams that feed into these principal streams including Horno Creek, Oso Creek, Chiquita Canyon, Canada Gobernadora and Bell Canyon.

Groundwater Basins

Groundwater within the San Juan Creek watershed primarily occurs in the relatively thin alluvial deposits along the valley floors and within the major stream channels. The State Water Resources Control Board (SWRCB) has characterized this groundwater, from a water rights perspective, as flow of an underground stream. The Basin is bound to the north by the Santa Ana Mountains, composed of impermeable granitic and metamorphic bedrock, and to the south by the Pacific Ocean. Sedimentary bedrock formations form the sides of the water bearing canyons of the Upper Basin and Arroyo Trabuco (i.e. Cañada Chiquita, Cañada Gobernadora, and Bell Canyon).

Four principal groundwater basins have been identified in the San Juan Creek watershed: (1) Lower Basin, (2) Middle Basin, (3) Upper Basin, and (4) Arroyo Trabuco. These basins were first delineated by the DWR in 1972, based on water quality differences. CDM (1987), NBS Lowery/PSOMAS (1994, annual reports), and others, have modified the DWR delineations to suit the needs of their respective studies. The Upper Basin, which underlies the Canada Chiquita, Canada Gobernadora, Bell Canyon, Dove Canyon and Upper San Juan Creek watersheds, was excluded because a majority of the land overlying the basin is privately owned and managed by the RMV, who would not make their data available to the SJBA, regardless; the groundwater resource is small and negligible to this study. For purposes of this investigation, The Arroyo Trabuco basin, at approximately Crown Valley Parkway, was divided into a lower and upper portion. The lower portion of Arroyo Trabuco, herein referred to as Lower Arroyo Trabuco, is included in this study. The Lower Trabuco, Middle, and Lower Basins contain approximately 5.9 square miles of water bearing alluvium.

The active management area is delineated in several map figures in Section 3 and is the surface and ground waters of the lower part of the watershed between the Pacific Ocean at the most downstream end of the watershed to the Ortega Highway bridge on San Juan Creek and to near the confluence of the Arroyo Trabuco and Oso Creeks on the Arroyo Trabuco.

Groundwater Recharge and Discharge

The predominant sources of recharge to the San Juan Basin include:

- Streambed infiltration in San Juan Creek, Horno Creek, Oso Creek, and the Arroyo Trabuco
- Subsurface boundary inflows at the head of the tributaries upstream boundaries and other minor subsurface inflows along the other boundaries
- Deep infiltration of precipitation and applied water
- Flow from fractures and springs

Groundwater discharge from the San Juan Basin occurs as:

- Groundwater production from wells
- Rising groundwater
- Evapotranspiration
- Subsurface outflow to the Pacific Ocean

In general, groundwater flow within the study area follows the surface topography: from areas of recharge in the surrounding highlands towards the central axis of the basin and then southwesterly along the axis of the basin before exiting into the Pacific Ocean.

Effective Base of the Freshwater Aquifer

Underlying this shallow alluvial aquifer system is what is commonly referred to in well completion reports as a green or blue clay/shale (believed to represent the Capistrano Formation), which likely acts as an aquitard preventing the downward movement of groundwater (Psomas, 2009). The effective base of the freshwater aquifer contours honored sixty borings that penetrated the alluvial aquifer with depths that range from 30 to 50 feet below ground surface (ft-bgs) near the bedrock outcrops to about 150 to 160 ft-bgs near the confluence of Arroyo Trabuco Creek and San Juan Creek.

Aquifer Storage Properties

Younger alluvial deposits comprise the aquifer material within the study area and consist of a heterogeneous mixture of sand, silts, and gravel.

Specific yield or effective porosity is a property of rocks that describes the ability of the rock to store water that can be recovered. A commonly used definition of specific yield is the quantity of water which a unit volume of aquifer, after being saturated, will yield by gravity, expressed either as a ratio or as a percentage of the volume of the aquifer. In other words,

specific yield is a measure of the water available to wells. The specific yield of the aquifer-system sediments in the San Juan Basin study area was estimated through the analysis of lithologic descriptions from well driller's reports. WEI maintains a library of well driller's reports of all known boreholes that have been drilled in the San Juan Basin. The lithologic descriptions from the well driller's reports were input into a relational database along with corresponding estimates of specific yield by sediment description. The volume of groundwater in storage as of fall 2010 was 20,400 acre-ft in the active management area. Section 3 also contains an analysis of storage changes based on recent groundwater modeling investigation conducted by Municipal Water District of Orange County (MWDOC) for its South Orange County Ocean Desalter (SOCOD) project.

Water Rights

Several water rights permits and agreements exist to allocate groundwater production from the San Juan Basin. A list of the existing and pending water rights permits is shown in the table below[1].

Applicant	Application Number	Permit Number	Diversion Amount Eligible Under Current Permit and Agreements (acre-ft/yr)	Diversion Amount Potentially Eligible to be Permitted and Agreement (acre-ft/yr)	Purpose of Use
South Coast Water District (SCWD)	A30337	21138	1,300	1,300	Municipal
SJBA	A30123	21074	8,026	10,702	Municipal
Santa Margarita Water District (SMWD)	A25557	17489	611 (Nov to Apr)	611 (Nov to Apr)	Irrigation
SMWD	A25733	17692	32 (Nov to Apr)	32 (Nov to Apr)	Irrigation
San Juan Hills Golf Course (SJHGC)	A30171	21142	450	450	Irrigation
City of San Juan Capistrano (CSJC)	A30696	N/A	3,325	3,325	Municipal
Totals			13,520	16,520	

[1] Note that the discussion of water rights contained herein is for illustrative purposes only and should not be construed as restricting, granting, or otherwise endorsing any particular claim of right. Rather, the discussion of water rights is for the purpose of explaining the amount of water rights that have been approved or applied for, and the agreements made by and amongst the parties to protect their existing or potential future rights. Any future projects proposed or implemented by the SJBA or other parties will need to address water rights, and the impacts the projects have on these rights, in more thorough detail.

Pursuant to SJHGC's current water rights permit, the State Board has only authorized the diversion of up to 450 acre-ft/yr. However, per the 1997 agreement between SJBA and SJHGC, the SJBA has agreed not to protest any increase to the SJHGC right up to a total right of 550 acre-ft/yr, subject to the terms of the agreement.

Water Supply and Distribution

Due to limited groundwater supplies, the SJBA members obtain most of its water supply (about 92 percent of potable and 78 percent of total demands) from imported water sources. The table below lists the estimated total water demand for each agency and the amount of water supplied from imported, recycled and native sources for fiscal 2010 (Section 4 presents a more rigorous discussion of water demands and supplies for the recent past and for the future through 2035).

Water Demand and Supply within the SJBA Service Area in 2010[2]

Water Agency	Total Water Demand (acre-ft/yr)	Water Supply (acre-ft/yr)		
		Native Potable Water	Recycled/ Non-Potable Water	Imported Water
Moulton Niguel Water District (MNWD)	36,593	-	6,858	29,735
CSJC	8,783	1,980	434	6,379
SMWD	34,169	65	6,027	28,077
SCWD	6,909	634	826	5,449
Total	86,454	2,679	14,145	69,640

ES-4 Historical and Projected Water Demands

The SJBA agencies currently[3] (2010) have a combined service area population of about 406,200 and a total water demand of about 86,400 acre-feet per year (acre-ft/yr). Of this, 84 percent (about 72,300 acre-ft/yr) is potable water demand, and 16 percent (about 14,100 acre-ft/yr) is non-potable demand. Imported water satisfies the majority of the study area's potable water demand at about 69,600 acre-ft/yr, compared to the 3,000 acre-ft/yr produced from the San Juan Groundwater Basin. Non-potable demands of about 14,100 acre-ft/yr are met with recycled water (about 11,700 acre-ft/yr), local surface water diversions (about 2,000 acre-ft/yr), and San Juan Basin Groundwater (400 acre-ft/yr).

By 2035, the SJBA service area population is projected to increase to about 486,500 with a total water demand of about 106,400 acre- ft/yr. Compared to current conditions, the ratio of potable to non-potable water demands is expected to decrease, primarily due to the planned increase in recycled water reuse by the SJBA member agencies: potable demands will account

[2] Sources include SJBA members agencies and MWDOC. See Section 4 and more specifically Table 4-1.

[3] The use of the modifier word "current" means 2010.

for about 76 percent (81,100 acre-ft/yr) of the total demand and will be met with a mix of imported water (about 72,200 acre-ft/yr) and groundwater from the San Juan Basin (8,900 acre-ft/yr), and non-potable demands will account for about 24 percent (25,300 acre-ft/yr) of the total demand and will be met with a mix of recycled water reuse (20,600 acre-ft/yr), local surface water diversions (2,700 acre-ft/yr) and untreated groundwater (2,700 acre-ft/yr).

ES-5 Management Goals and Impediments

During the period of September 2010 through November 2010, the SJBA Technical Advisory Committee (TAC) met four times to develop the scope of the SJBGFMP. These meetings were held at the SMWD on September 21st, October 5th, November 2nd, and November 16th. As part of this SJBGFMP scoping process, issues, needs, and interests were solicited from SJBA member agencies. These "issues, needs, and interests" are summarized in a tabular form in Tables ES-1 through ES-7. Each table refers to a class of issues, needs, and interests, including:

- safe yield
- native and imported water recharge
- quality and quantity
- reclaimed water
- conjunctive-use storage
- costs
- human resources and administration

Attribution for the source of each issue, need, and interest is listed in these tables. In some cases, a specific issue (need and interest) may show up in more than one class. These issues, needs, and interests were used to focus problem identification, SJBGFMP goals, and the resulting SJBGFMP update.

The goal setting process involved the proposal of an initial set of goals, followed by group and individual discussions and group editing of the goals at those meetings. The TAC member's also articulated impediments to achieving the goals and the action items required to remove impediments. At the November 16, 2010 meeting, the TAC member's achieved consensus on goals, impediments to those goals, and the action items required to remove the impediments. The goals of the SJBGFMP are listed below.

- Goal No. 1 – Enhance Basin Water Supplies. In addition to local groundwater, this goal applies to all sources of water available for the enhancement of the San Juan Basin (Basin). The intent is to maximize the use of all available water in the Basin. This goal will be accomplished by increasing the recharge of all available waters, including storm water discharge, dry-weather discharge, and recycled water.
- Goal No. 2 – Protect and Enhance Water Quality. The intent of this goal is to improve surface and groundwater quality to ensure the maximum use and reuse of

available supplies and to minimize the cost of groundwater treatment. This goal will be accomplished by implementing activities that capture and treat contaminated groundwater for direct high-priority beneficial uses, implementing the recharge of storm water discharge, and encouraging better management of waste discharges that impact groundwater.

- Goal No. 3 – Maximize the Use of Unused Storage Space. The intent of this goal is to maximize the use of the Basin's storage capacity to improve water supply availability. This goal will be accomplished by determining the temporal and spatial availability of unused storage space in the Basin and subsequently determining how best to use that space to increase operational flexibility and water supply reliability.

- Goal No. 4 – Satisfy State Requirements for a Groundwater Management Program. The intent of this goal is to integrate the SJBGFMP into the South Orange County regional water management plan and to improve the opportunity of obtaining outside funding for SJBGFMP implementation. This goal will be accomplished by ensuring that the SJBGFMP contains the minimum elements required for a groundwater management plan and by inclusion of the SJBGFMP in the MWDOC Integrated Regional Water Management Plan.

- Goal No. 5 – Establish Equitable Share of the Funding, Benefits, and Costs of the SJBGFMP. The intent of this goal is to align the benefits of the SJBGFMP with individual SJBA member agencies and SJBGFMP implementation costs. This goal will be accomplished by clearly articulating the benefits of the SJBGFMP to each SJBA member agency and subsequently allocating the funding and costs in an equitable manner.

These goals, impediments to the goals, and the action items required to remove the impediments are discusses in Section 5.

ES-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.

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 set of alternatives assumes that the SOCOD project will either not be implemented or will be deferred by ten or more years. The second set of alternatives assumes that the SOCOD project will be implemented within the next ten years.

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 7,100 acre-ft/yr to 10,900 acre-ft/yr. About 71 percent of the time, the yield will be less than 11,000 acre-ft/yr, and about 14 percent of the time, production will meet the desired goal of 11,200 acre-ft/yr. 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.

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.

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. 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.

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.

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.

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.

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

This alternative is identical to Alternative 1 with SOCOD 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.

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 by 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.

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.

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.

Stormwater Recharge in Off-stream Facilities

During the review of the draft SJBGFMP report many stakeholders commented that there were no recommendations for diversion of stormwater to new 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.

ES-7 Evaluation of Groundwater Management Alternatives

Consistency with SJBGMFP Goals

The management goals of the SJBGMFP were developed by the SJBA TAC along with the impediments to achieving these goals and a list of actions that could be implemented to overcome the impediments. These goals include:

- Goal No. 1 – Enhance Basin Water Supplies.
- Goal No. 2 – Protect and Enhance Water Quality.
- Goal No. 3 – Maximize the Use of Unused Storage Space.
- Goal No. 4 – Satisfy State Requirements for a Groundwater Management Program.
- Goal No. 5 – Establish Equitable Share of the Funding, Benefits, and Costs of the SJBGFMP.

The alternatives were reviewed and evaluated by the SJBA TAC members using the following evaluation criteria, described in more detail in Section 7, and considerations of their individual agencies.

- Yield and Costs of the Management Alternatives
- Implementation Difficulty
- Adaptive Production
- Seawater Injection Barrier
- Seawater Extraction Barrier
- Ranney Collector Wells
- Enhanced Stormwater Recharge and Recycled Water Recharge
- Recommended Alternative

The features of the alternatives were described at two SJBA Board meetings in late 2012. Based on the management goals of the SJBGMFP articulated in Section 5 and the ability of these alternatives to attain these goals, the SJBA TAC has recommended the phased implementation of Alternative 6. If MWDOC proceeds with the SOCOD project then the SJBA TAC recommends the phased implementation of Alternative 10. The implementation plan for Alternatives 6 and 10 are discussed in Section 8.

ES-8 Implementation and Monitoring Plans

Implementation of the Recommended SJBGFMP

Table ES-8 lists the implementation steps for the recommended alternatives, a proposed ten-year implementation plan, and a reconnaissance-level cost estimate up to and excluding construction cost. The intent of Table ES-8 is to characterize the schedule, scope, and cost of activities required to implement the recommended alternatives. This characterization is provided below.

Adaptive Production Management

Adaptive production management will refine the current status quo management plan to comply with the diversion permits held by the CSJC, the SJBA, and the SCWD, and related 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. The SJBA, in its role as the Basin Manager, will set an Annual Safe Yield based on groundwater in storage in the spring of each year and the spring assessment of seawater intrusion. The SJBA will depend on groundwater level and chemistry monitoring and the interpretation of the monitoring data to make its determination. The implementation time frame illustrated in Table ES-8 shows the monitoring occurring each year and the SJBA, acting as the Basin Manager, setting the Annual Safe Yield each year. The time frame also shows the occurrence of a triennial update of the criteria that the SJBA will use to set the Annual Safe Yield. The annual cost, shown in Table ES-8, would be about $140,000 (current cost of monitoring and reporting) for two out of three years and about $160,000 in years when the Annual Safe Yield assessment criteria are reviewed and updated (current cost of monitoring and reporting plus cost to review and update tool used by the SJBA to set the Annual Safe Yield).

In the implementation of the recommended alternative it is proposed to include the groundwater substitution program element within the adaptive production management program element. By replacing the water supplied by private wells with an alternative supply, the SJBA and SCWD will have greater flexibility in complying with their diversion permits in the near term and when the more aggressive program elements are implemented. The implementation steps include:

- Preliminary engineering to identify all the private wells and the water demands placed on those wells
- Determine the facilities and operations required to provide those water users a substitute supply
- Assess feasibility
- Complete CEQA documentation
- Finalize agreements with private well owners
- Obtain permits
- Prepare final designs
- Construct conveyance facilities to enable substitute supplies

The implementation of the groundwater substitution program element is proposed to start in year 1 (2013-14) and be completed in year 3 (2015-16). The implementation cost, excluding construction, is estimated to be about $190,000.

Planning and CEQA Process for the Recommended Alternative

The recommend alternatives contain very complex water management program elements that will require additional investigations to determine their feasibility, their integration into the existing water resource management plans, and their impacts on the environment. This information will evolve in the early engineering and feasibility investigations required for implementation. Some of the program elements in the recommended plan may end up not being feasible as described herein. For planning purposes it was assumed that a programmatic environmental impact report (PEIR) will be completed. The implementation steps include:

- Conduct CEQA process through the preparation of a draft PEIR for the SJBGFMP
- Prepare application/change petitions for new points of diversions, revised diversion amounts, surface water diversion for recharge, storage and subsequent recovery
- Conduct engineering investigations to develop alternative preliminary designs, determine feasibility, and to identify fatal flaws for:
    - Groundwater extraction barrier
    - In-stream stormwater recharge
    - In-stream recycled water recharge and groundwater recycled water reuse
- Finalize and certify programmatic EIR
- Finalize SWRCB application/change petitions

The planning and CEQA process are proposed to occur in years 2 (2014-15) to 4 (2016-17). This phase of the work is estimated to cost about $1,800,000.

Complete Agreements for SJBA Members Participation, Construction and Operation

The prior implementation efforts will provide detailed estimates of new yield and its associated costs. Agreements will be drafted to define participation by individual SJBA members, their responsibilities in the construction and operations of facilities, their yield allocations, financing arrangements, their cost share and other arrangements as required to implement the SJBGFMP. The effort to prepare implementation agreements is proposed to occur in years 3 (2015-16) to 4 (2016-17). The cost to negotiate and prepare these agreements is projected to be about $200,000.

Design and Construction

By the end of year 4 (2016-17), all the planning for the program elements and implementation agreements will have been completed. The time frames and cost (through design) for each program element is summarized below:

- Groundwater extraction barrier

  - The design will take about two years to complete and is assumed to start in year 5 (2017-18)
  - Design and permit acquisition costs are projected to be about $4,000,000
  - Construction will take about two years

- In-stream stormwater recharge
  - The design will take about a year to complete and is assumed to start in year 5 (2017-18)
  - Design and permit acquisition costs are projected to be about $150,000
  - Operation of the temporary in-stream recharge facilities will start in year 6 (2018-19)

- In-stream recycled water recharge and groundwater recycled reuse
  - The design will take about two years to complete and is assumed to start in year 5 (2017-18)
  - Design and permit acquisition costs are projected to be about $4,000,000
  - Construction will take about three years

The permits referred in this implementation step include all the permits related to construction and operation exclusive of the SWRCB and the Regional Board. The cost to implement Alternative 6 up to and excluding construction is about $12 million. The cost to implement Alternative 10 through and excluding construction is about $8 million.

Minimum Monitoring Program Required for Implementation of the SJBGFMP

The scope of work is designed to rely on groundwater and surface water data collected by others in the basin to the extent possible, and supplements this data with data collected in a field-monitoring program to fill in data gaps. The Basin Management Monitoring and Reporting Program is divided into three tasks: Field Monitoring Program, Data Acquisition and Management, and Reporting. The scope of work that follows is paraphrased from the current monitoring contract issued to WEI for 2013 that includes the monitoring required for implementation of the SJBGFMP. The objectives, sub-tasks, schedule of implementation, and deliverables for each task are described below.

- Task 1 –Field Monitoring Program.
  - Task 1.1 Quarterly Groundwater Level Monitoring.
  - Task 1.2 – Quarterly Groundwater Quality Monitoring.
  - Task 1.3 – Surface Water Quality Monitoring.
  - Task 1.4 – Vegetation Monitoring.

- Task 2 – Data Acquisition and Management.
  - Task 2.1 – Data Acquisition from Collecting Agencies.
  - Task 2.2 – Data QA/QC, Processing, and Upload to Relational Database.
- Task 3 – Reporting.
  - Task 3.1 – Water Rights Permit Reporting.
  - Task 3.2 – CASGEM Reporting.
  - Task 3.3 – Spring and Fall Storage Estimate and Annual Safe Yield Reports.
  - Task 3.4 – Seawater Intrusion Monitoring Report.
  - Task 3.5 – Presentations to the SJBA Board of Directors.

Table ES-1
Safe Yield Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Ability to continue to divert foreign developed water for irrigation purposes			●					
Increase the District's reliability	●	●	●	●				
Identify project(s) to obtain water from SJBA			●					
Future level of participation in SJBA			●					
Maximize interconnections between agencies			●					
Identify the safe yield of the basin			●					
Identify and propose mitigation for impacts from proposed ocean desalination			●					
Confirm the modeling efforts are developing safe yields			●					
Review and recommend any proposed changes to the monitoring efforts			●					
Develop a uniform reporting methodology for monitoring			●					
Coordinate water harvesting with private entities			●					
Identify short and long term goals for the basin			●					
Flexible supply/Transfer/Over-Production Methodology	●							
Increase Safe Yield Based on Past Engineering Studies	●							
Dedicate Increases in Safe Yield to Agencies for Specific Basin Management Projects	●							
Need to continue to rely on stable safe yield	●							
Monitor fluctuations in basin and changes in production patterns to ID basin issues	●							
explore impacts to safe yield from basin development	●							
allow parties to use basin in their best interest and mitigate impacts	●							
Determine and assess storage losses in the basin	●							
Increase safe yield by installing wells	●							
coordinate/reduce/relocate production to reduce subsidence	●							
Evaluate impacts of desalter operations on safe yield	●							
Support sole and/or cooperative efforts to develop a	●							
Vet the GSSI groundwater model		●						
Verify impacts of Desalination project and develop mitigation measures		●						
Confirm basin safe yield		●						
Define management objectives to maintain basin safe yield		●						
Identify project(s) to optimize water from SJBA				●				
That the Basin Plan provides safe yields for current and future needs				●				
Identify the safe yield of the basin without projects versus with projects				●				

Table ES-2
Native and Imported Water Recharge Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Support sole and/or cooperative efforts to develop additional economically feasible recharge facilities for both native and imported water	•		•					
Develop program to increase recharge of native runoff and create a mechanism to pledge the value of the increase in safe yield from these "new water" sources to help pay for the construction of these facilities	•		•					
Recharge high quality runoff and reclaimed water as hydrologically high as possible in the basin	•		•					
Determine availability of imported water for recharge		•						
Ability to utilize recycled water for recharge			•	•				
Ability to utilize stormwater for recharge			•	•				
Identify potential projects for economical recharge			•	•				

Table ES-3
Quality and Quantity Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop sellable and/or exportable water insurance rights to replenish overproduction during drought and/or encourage basin clean-up	•							
Identify and regulate sources of contamination	•							
Develop "credit type" program to encourage development and implementation of water quality improving and conservation programs	•							
Assess the impacts of groundwater production and recharge on water quality of down gradient producers	•							
Incorporate existing remediation projects in basin water quality management program	•							
Increase conservation and develop new sources of water	•							
Manage basin to maintain/improve water quality of water supply sources to meet discharge standards	•							
Re-examine basin water quality objectives and establish naturally-occurring limits	•							
Produce maps showing problem areas and projected problem areas	•							
Identify projects to develop locate water supply source		•						
Increase the District's reliability through ground water supply				•				
Identify and propose mitigation for impacts from proposed ocean desalination				•				
Identify sources of contaminants				•				
Comprehensive groundwater quality monitoring plan				•				
Identify components required to develop and implement a Salt and Nutrient Plan				•				
Determine impacts of naturally occurring minerals on Salt and Nutrient Plan				•				
Determine impacts of naturally occurring minerals on Salt and Nutrient Plan			•					
Identify sources of contaminants			•					
Identify components required to develop and implement a Salt and Nutrient Plan			•					
Modify Basin Plan as appropriate			•	•				
Support economical programs that mitigate water quality issues	•							

Table ES-4
Recycled Water Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop reuse and recharge projects to maximize use	•							
Establish agreement with RWQCB on mitigation credits for pumping in bottom and recharge in top	•							
Modify basin water quality objectives to increase levels of water recycling	•							
Coordinate basin water quality plans to permit increased levels of recycling	•							
Use reclaimed water to flush lower basin								
Confirm availability of recycled water for recharge		•						
Determine if recycled water is best used for recharge		•						
Identify recycled water recharge opportunities		•						
Coordinated review and impact of the Salt and Nutrient Plans		•						
Coordinate recycled water recharge with regulatory agencies		•						
Determine water quality impacts from MS4 permits and City enforcement		•						
Identify regional availability of recycled water				•				
Ability to utilize recycled water for recharge				•				
Ability to continue to utilize recycled water			•					
Identify regional availability of recycled water			•					
Maximize the use of reclaimed water	•							
Recharge high quality runoff and reclaimed water as hydrologically high as possible in the basin	•							

Table ES-5
Conjunctive Use Storage Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop ability to market basin losses	•							
Provide transfer mechanisms between pools to ensure beneficial use of water	•							
Determine and assess storage losses	•							
Develop programs to construct facilities and deliver water between agencies	•			•				
Develop pumping regimes to optimize basin production				•				
Analyze benefit of water harvesting with private entities, agencies or the SJBA				•				
Coordinate facilities with the Orange County Southern Sub region Habitat Conservation Plan				•				
Characterize unused storage space within the basin		•						

Table ES-6
Cost Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Seek financial aid to meet management goals, including grants and loans	•	•	•	•				
Develop five year capital improvement program, identify projects out 20 years			•	•				
Identify realistic and economically feasible long-term goals	•							
Develop incentives to encourage basin management objectives	•							
Develop equity and the perception of equity in the operation of the basin	•							
Estimate costs and benefits for water supply and recharge projects (recycled, storm and imported)		•						

Table ES-7
Human Resources and Administration Issues, Needs and Wants

	San Juan Basin Authority				Other Interested Parties			
	SJC	MNWD	SMWD	SCWD	MWDOC	TCWD	RMV	SJHGC
Develop and maintain centralized database for the San Juan Basin	•	•	•	•				
Develop comprehensive groundwater and surface water monitoring program for basin management	•			•				
Prepare regular "State of the Basin" reports with recommendations for monitoring plan modifications	•			•				
Develop rules intended to prevent agency impacts and avoid litigious situations	•							
Coordinate efforts with other appropriate entities (SOCWA, MWDOC)		•						
Staffing requirements for alternatives of governance				•				
Accounting for cyclic and local losses				•				
Clearly define water rights				•				
Verify to what extent previous hydraulic models are still valid				•				
Utilization of “Paper Swaps”				•				
Identify short and long term goals for the basin				•				
Authority proactive in legislation and regulations				•				
Coordinate facilities with the Orange County Southern Sub region Habitat Conservation Plan			•					

Table ES-8
Major Implementation Steps for the Recommended SJBGMFP Alternatives 6 and 10[1]

Program Element / Feature	Implementation Steps	Ten-Year Implementation Schedule										Annual Implementation Cost by Year Excluding Construction[2] ($1,000)										
		1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	Total
Adaptive Production Management												**$260**	**$230**	**$140**	**$160**	**$140**	**$140**	**$160**	**$140**	**$140**	**$160**	**$1,670**
Groundwater level monitoring and the development of groundwater level maps and storage estimates; and groundwater chemistry monitoring to assess state of seawater intrusion and determine if SJBGMFP is contributing to degradation																						
	Currently being implemented by the SJBA[3]	■	■	■	■	■	■	■	■	■	■	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	*$140*	$140	*$1,400*
The SJBA, in its role as "Basin Manager" will establish an annual production amount for the CSJC and the SCWD as required to not interfere with private pumpers, and to ensure sustainable production																						
	The SJBA establishes the Basin Management Committee which is empowered by the March 1998 settlement agreement to set an annual Available Safe Yield	■	■	■	■	■	■	■	■	■	■											*$0*
	The SJBA will need to develop and periodically revise a relationship between Available Safe Yield and Spring groundwater storage; the relationship will depend on the then existing production and conveyance facilities	■			■			■			■	*$20*			*$20*			*$20*			*$20*	*$80*
Groundwater substitution																						
	Conduct preliminary design and assess feasibility	■										*$50*										*$50*
	Complete CEQA process	■										*$30*										*$30*
	Finalize agreements with private well owners	■	■									*$20*	*$20*									*$40*
	Obtain permits		■										*$20*									*$20*
	Prepare final design		■										*$50*									*$50*
	Construct conveyance facilities to enable substitute supply			■																		
Planning and CEQA Process												**$0**	**$875**	**$600**	**$325**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1,800**
Conduct CEQA process through the preparation of a draft PEIR			■	■									*$125*	*$125*								*$250*
Prepare application/petition to SWRCB for new points of diversion, new pumping, to divert surface water, store and subsequently recover																						
	Prepare initial application/petition, review with SWRCB staff until application/petition is accepted		■	■									*$50*	*$50*								*$100*
	Coordinate with SWRCB to complete process and acquire diversion permits			■	■									*$25*	*$25*							*$50*
Conduct engineering investigations to develop alternative preliminary designs, determine feasibility and to identify fatal flaws																						
	Groundwater extraction barrier		■	■									*$200*	*$200*								*$400*
	In-stream stormwater recharge		■										*$100*									*$100*
	In-stream recycled water recharge and groundwater recycled water reuse		■	■	■								*$400*	*$200*	*$200*							*$800*

Table ES-8
Major Implementation Steps for the Recommended SJBGMFP Alternatives 6 and 10[1]

Program Element / Feature	Implementation Steps	Ten-Year Implementation Schedule 1	2	3	4	5	6	7	8	9	10	Annual Implementation Cost by Year Excluding Construction[2] ($1,000) 1	2	3	4	5	6	7	8	9	10	Total
	Finalize and certify PEIR for the SJBGFMP														*$50*							*$50*
	Finalize SWRCB application/petition														*$50*							*$50*
Complete Agreements for SJBA Member Participation, Construction and Operation														**$100**	**$100**							**$200**
Design and Construction												**$0**	**$0**	**$0**	**$0**	**$4,150**	**$4,000**	**$0**	**$0**	**$0**	**$0**	**$8,150**
	Groundwater Extraction Barrier																					
	Obtain permits															*$50*	*$50*					*$100*
	Complete design															*$1,900*	*$1,900*					*$3,800*
	Construct extraction barrier																					
	In-stream Stormwater Recharge																					
	Obtain permits															*$50*						*$50*
	Complete design															*$100*						*$100*
	Operate in-stream stormwater recharge																					
	In-stream Recycled Water Recharge and Groundwater Recycled Reuse (Indirect Potable Reuse)																					
	Obtain permits															*$50*	*$50*					*$100*
	Complete design															*$2,000*	*$2,000*					*$4,000*
	Construct recycled water conveyance, recovery wells and treatment system																					
Totals for Alternative 6												**$260**	**$1,105**	**$840**	**$585**	**$4,290**	**$4,140**	**$160**	**$140**	**$140**	**$160**	**$11,820**
Totals for Alternative 10[4]												**$260**	**$905**	**$640**	**$585**	**$2,340**	**$2,190**	**$160**	**$140**	**$140**	**$160**	**$7,520**

[1] Alternative 10 contains all the program elements of Alternative 6 except the extraction barrier

[2] Costs shown in italics total to the cost shown above in the grey bar highlighting the program element.

[3] Costs of current program and recommended program for this part of the recommended SJBGFMP. Significant additional cost will be incurred with recycled water recharge.

[4] There could be additional reduced cost in the processing of SWRCB applications and in the CEQA process if the extraction barrier is excluded.