Appendix D:
Impact Analysis for Alternative B-4

Table of Contents

List of Tables

List of Figures

(All figures follow the Appendix)

D-1 **Alternative B-4**

A Conceptual WQMP was previously prepared in support of the GPA/ZC application that considered Alternative B-4 and Alternative B-9 (GeoSyntec, 2004). This appendix describes the proposed development under the B-4 alternative, elements of the WQMP for the B-4 alternative, and the results of hydrologic and water quality modeling. Additionally, this appendix presents the impact analysis and findings of significance for the B-4 alternative, as presented in the earlier Conceptual WQMP (GeoSyntec, 2004).

D-1.1 <u>Cañada Chiquita Sub-Basin</u>

D-1.1.1 Future Land Uses

Alternative B-4 covers approximately 2,730 acres in Cañada Chiquita (Figure A-8 and Table D-1) within Planning Area 2. Catchment 18 depicted on Figure A-8 drains directly into San Juan Creek, but has been included in the Cañada Chiquita analysis. Under the B-4 Alternative, approximately 2,068 acres would remain as open space, with the remaining 663 acres being developed. The Alternative B-4 grading plan calls for 13 acres of the Chiquita Sub-basin to be regraded to drain toward Gobernadora Creek, while 16 acres of the Gobernadora Sub-basin would be graded to drain towards Chiquita Creek, for an overall gain of approximately 3 acres in the Chiquita Sub-basin. The proposed development occurs in the middle and lower portion of the sub-basin and primarily east of Chiquita Creek.

Table D-1: Project Land Uses and Areas in the Chiquita Sub-basin

Alternative	Land Uses	Land Use Area within the Chiquita Sub-basin (acres)[1]
B-4	Golf Course	113
	Golf Residential	211
	Proposed Development	339
	Open Space	2068
	TOTAL	**2731**

[1]Land use area within the pre-development sub-basin boundary.

D-1.1.2 Combined Control System: Elements and Sizes by Catchment

Although the specific types of developments have yet to be determined, the following mix of development types are likely and the following describes how the proposed combined control system might be configured for each type of development for the B-4 alternative.

Golf Course Residences

Golf Course residences may be located on the ridges along the east side of the canyon. The ridges contain substantial areas of hard pan caps, which combined with geotechnical considerations for slope stability, limit the feasibility of infiltration. To restrict infiltration, lined bioswales with an underdrain will be located along streets and driveways. The swale system will direct wet and dry weather flows to an engineered conduit that will carry water down the slope to the side canyons, or if required by grade considerations, to the main canyon floor. In the canyons, water will be directed to a combined control system. The combined control system will consist of three major elements: a FD/WQ basin, a separate infiltration basin or series of infiltration basins, and a vegetated bioinfiltration swale. The FD/WQ basin will store and treat wet and dry weather flows using natural treatment processes. The outlet structure will be designed to direct low flows to an infiltration basin to take advantage of the infiltrative soils in the side canyons and in the main canyon floor. Higher flows will be directed to a vegetated swale that will connect to the main stem of Chiquita Creek. Depending on topographic and grade considerations, the combined control system facilities will, to the extent feasible, be located near the head end of the side canyons where depth to groundwater is greatest.

Single Family Residential Development

The concept for controlling flow and water quality for the single family residential development is different than that for the less dense golf course residences. A series of vegetated swales within the development will direct flows to a FD/WQ basin located on the canyon floor. In order to avoid increasing base flows in lower Chiquita Creek, infiltration will not be implemented. Instead the excess flows that would have been infiltrated will be directed from the FD/WQ basin to either San Juan Creek, to non-domestic water supply reservoirs, or the wastewater treatment plant for treatment and non-potable water supply. (San Juan Creek, given its size and cobbly bed, is considered to be able to accept additional flows without causing erosion, and there are potential benefits to habitat and downstream water supply.) The higher flows will be directed from the FD/WQ basin to Chiquita Creek in a vegetated swale in order to maintain the hydrologic regime in the stream channel. These flows will be treated in the FD/WQ basin and swale prior to discharge into San Juan Creek.

Multifamily Development

The combined control system proposed for multi-family residential areas would be slightly different than those proposed for golf course and single family residential development. For each catchment, the FD/WQ basin is sized to capture and treat the water quality design volume. Low flows are then directed to an infiltration basin and high flows are directed to Chiquita Creek in a bioinfiltration swale

In Catchment 9, where development is located on the canyon floor in sandy soils having good infiltrative characteristics, there are a number of site design BMP options that are not feasible in less infiltrative soils. Roof runoff could be directed to stormwater planter areas or bioinfiltration swales, and landscaped areas could be used to treat runoff from parking and courtyard areas.

Street runoff and excess roof/parking area runoff would be directed to the combined control system described above.

Golf Course

Golf course water quality and flow controls will vary depending on the specific area under consideration as discussed below.

Greens: Greens will be constructed with a layered soil profile according to the United States Golf Association or similar specifications. This layered soil profile allows for water to be retained and held near the root zone, which conserves moisture and nutrients for the purposes of maintaining and promoting root growth and vigor while minimizing the loss of nutrients to groundwater. Excess water will be drained away from the root zone to a tile drainage system consisting of gravel and piping beneath the surface of the green. Flows in the sub-drains will be routed to non-domestic water supply reservoirs or water features (e.g., lakes or ponds) for recycling as irrigation water or may be directed to a nearby wastewater treatment plant for reclamation.. Surface runoff from greens is very limited because of the drainage system. However, what surface runoff does occur will be treated in a similar way to the water discharged from the sub-drains.

Fairway and Bunker Drainage: Fairway and bunker drainage will be directed to water features (e.g., lakes and ponds) designed for flow control, treatment and/or infiltration; bioinfiltration swales; or buffer strips.

Facilities and Sizing

The choice and size of facilities in the combined control systems for the Chiquita Sub-basin vary depending on the catchment, as illustrated in Table D-2. For most catchments, the combined control system consists of a FD/WQ basin, a separate infiltration basin, and a vegetated swale.

Table D-2: Combined Control System Requirements for Cañada Chiquita- Alternative B-4

Facility Id	Tributary Catchments	FD/WQ Basin	ED Basin	Infiltration Basin	Vegetated Swale		Direct Discharge to San Juan Creek	Non-domestic Water Supply Storage and Recycling	Comments
					Unlined	Lined			
Chiquita-2	2				✓			✓	Unlined swale provides adequate volume control and water quality treatment given limited runoff anticipated from golf course
Chiquita-3	3				✓			✓	Same as Chiqutia-2
Chiquita-4	4				✓			✓	Same as Chiqutia-2
Chiquita-5	5				✓			✓	Same as Chiqutia-2
Chiquita-9	9		✓	✓	✓			✓	Combined control system designed to control and treat approximately 80-90% of excess runoff. Complete control infeasible given sandy soils and low pre-development runoff.
Chiquita-10	10	✓		✓	✓			✓	Standard combined control system. Water is conveyed from the flow duration basin to the infiltration basin through vegetated swales, providing further water quality treatment.
Chiquita-11	11	✓		✓	✓			✓	Same as Chiquita-10
Chiquita-12	12	✓		✓	✓			✓	Same as Chiquita-10
Chiquita-13	13	✓		✓	✓			✓	Same as Chiquita-10
Chiquita-14	14	✓		✓	✓			✓	Same as Chiquita-10
Chiquita-16/17[1]	16/17	✓				✓	✓		Flow duration control required for discharge into Chiquita Creek. Excess flows are treated and discharged directly to San Juan Creek.
Chiquita-18	18		✓				✓		Discharge directed to San Juan Creek, no flow duration control required.

[1]Includes a small portion of Catchment 15

Where flow duration control is not necessary, as in Catchment 18 that discharges directly to San Juan Creek, an extended detention (ED) water quality basin has been provided.

Table D-3 shows the estimated sizes of the various facilities by catchment. In general, more volume control is required where the amount of impervious surface in the catchment is higher, as is the case in Catchments 16 and 17, and when development is placed on soils that are more infiltrative, as is the case of Catchment 9. Less volume control will be necessary for the less dense golf course residences which may be located on hardpan in catchments 10 through 14. The percent capture values indicated in Table D-3 illustrate that the water quality treatment achieved in the system as a whole.

Table D-3: Combined Control System Facilities and Sizes in Cañada Chiquita- Alternative B-4

Catchment Number	Facility Tributary Area[1] (acre)	F.D./W.Q. Basin			Infiltration Basin[3]		Vegetated Swale	
		% Capture[2]	Area (acres)	Volume (ac-ft)	Area (acres)	Volume (ac-ft)	Area (acres)	Volume (ac-ft)
2	10	-	-	-	-	-	0.3	0.8
3	17	-	-	-	-	-	0.5	1.3
4	26	-	-	-	-	-	0.4	1
5	9	-	-	-			0.6	1.6
9	59	85	1.6	4.6	1.2	2.6	-	-
10	18	89	0.8	0.9	1.0	1.9	-	-
11	37	96	0.1	0.1	1.1	2.3	-	-
12	58	96	0.2	0.4	2.4	4.7	-	-
13	46	94	1.6	4.6	1.2	2.4	1.0	1.0
14	44	88	1.1	4.2	0.5	0.9	-	-
16/17[4]	144	88	1.8	7.2	-	-	-	-
18	67	91	1.2	4.1	-	-	-	-

[1]Tributary area includes project development within the catchment; open space and existing development are not included.
[2]Percent of average annual runoff volume predicted by model that is captured and detained for 48 hours in the basin.
[3]Infiltration basin sizes assume no infiltration occurs in vegetated swales. Infiltration basin areas may be reduced during final design by taking into account infiltration achieved in vegetated swales.
[4]Includes a small portion of Catchment 15.

D-1.2 Cañada Gobernadora Sub-Basin

D-1.2.1 Future Land Uses

The development alternatives in Cañada Gobernadora addresses approximately 2,194 acres within Planning Areas 2 and 3 (Figure A-10 and Table D-4). Under the B-4 Alternative, approximately 1,078 acres would remain as open space, with the remaining area being developed into estates; single, multi-family, and golf residential housing; and transportation. Alternative B-4 grading plans call for approximately 39 acres of the sub-basin to be graded into the Central San Juan Sub-basin and approximately 16 acres into the Chiquita Sub-basin, while 16 acres of the Central San Juan Sub-basin and 13 acres of the Chiquita Sub-basin would be graded into the Gobernadora Sub-basin. Overall, the area of the Gobernadora Sub-basin would be reduced by approximately 26 acres. Residential development is planned to be located in Planning Area 2 (the eastern portion of Lower Gobernadora Canyon) and in Planning Area 3 (the western portion of Lower Gobernadora Canyon), while the riparian area and central portion of the valley floor is part of the Gobernadora Ecological Reserve Area.

Table D-4: Land Uses and Areas in Cañada Gobernadora

Alternative	Land Uses	Land Use Area within the Gobernadora Sub-basin (acres)[1]
B-4	Estate	140
	Golf Residential	25
	Proposed Development	933
	Open Space	1077
	TOTAL	**2,175**

[1]Land use area within the pre-development sub-basin boundary.

D-1.2.2 Combined Control System: Elements and Sizes by Catchment

The following describes the proposed combined facilities for each type of development for the B-4 alternative.

Estate Residences

Estate residences will be located on the ridge along the east side of the canyon. This area is covered by extensive areas of hard pan caps which, combined with geotechnical considerations for slope stability, argue for avoiding infiltration on the ridges. Lined bioswales with an underdrain will be located along streets and driveways. The swale system will direct wet and dry weather flows to an engineered conduit that will carry water down the slope to the canyon floor. Runoff will be directed to a treatment train consisting of a FD/WQ basin and bioinfiltration swale prior to discharge to Gobernadora Creek. In Catchment 10, water quality treatment would be provided in an extended detention basin; no flow control is required as only about five acres of estate housing is proposed.

Single Family Residential Development

Residential development is planned to be located in the eastern and western portion of lower Gobernadora Canyon. The riparian area and central portion of the valley floor is reserved as open space in the Gobernadora Ecological Reserve Area (GERA). The concept for controlling flow and water quality calls for a series of vegetated swales within the development and a combined facility located on the side canyon or main canyon floor, outside of the GERA. If portions of the development are located in the side canyons, roof runoff may be directed to infiltration trenches, planter boxes or infiltrative swales. Although depth to groundwater generally decreases in Lower Gobernadora because of the effects of inferred lake bed deposits, data indicates that infiltration is feasible in this area. Infiltration and flow management issues relating to excessive surface and sub-surface water flows from upstream development area addressed in Chapter 5. Centrally located non-domestic water supply reservoirs also may be feasible in this development and could be used for recycling dry and low wet weather flows for irrigation of common landscape areas.

In the side canyons and on the canyon floor, runoff will be treated by a combined facility designed to provide water quality treatment and flow control. The facility will consist of three main elements: a flow duration and water quality treatment detention basin, a separate infiltration basin or series of infiltration basins, and a vegetated swale. The flow duration and water quality treatment basin will store and treat wet and dry weather flows using natural treatment processes. The outlet structure will be designed to direct low flows to a series of infiltration basins to take advantage of the infiltrative soils in the side canyons. Higher flows will be directed to a vegetated swale that will connect to the main stem channel. The facility will be located to the extent feasible near the head end of the side canyons where depth to groundwater is greatest.

Facilities and Sizing

The choice and size of facilities in the combined control system introduced in Chapter 3 vary depending on the catchment as illustrated in Table D-5. For most catchments, the combined control system consists of a flow control/water quality basin, a separate infiltration basin, and a lined or unlined bioswale. Where flow duration control is not necessary, as in catchments that drain directly to San Juan Creek, an extended detention (ED) water quality basin has been provided.

Table D-6 shows the estimated sizes of the various facilities by catchment. In general, more volume control is required where the development will be located on sandy infiltrative soils, and where the development is more urbanized. Less volume control will be necessary for less dense development, i.e., having lower percent imperviousness and located on less permeable soils.

Table D-5: Combined Control System Requirements for Cañada Gobernadora- Alternative B-4

Facility ID	Tributary Catchments	FD/WQ Basin	ED Basin	Infiltration Basin	Vegetated Swale		Direct Discharge to San Juan Creek	Storage and Recycling	Storage and Recycling
					Unlined	Lined			
Gob-1	1		✓			✓	✓		Water quality treatment only. No flow control assumed to be required as discharge directed to San Juan Creek.
Gob-3	3	✓		✓	✓				Standard combined control system. Water is conveyed from the flow duration basin to the infiltration basin through vegetated swales, allowing further water quality treatment.
Gob-4	4		✓			✓			Water quality treatment only because catchment has 85 acres of outcrops and change in runoff with development small.
Gob-5	5	✓		✓	✓				Same as Gob-3
Gob-7	7	✓		✓	✓				Same as Gob-3
Gob-8	8	✓		✓	✓				Same as Gob-3
Gob-9	9	✓		✓	✓				Same as Gob-3
Gob-10	10		✓						Water quality treatment only. No flow control required as only about 5 acres of estate housing.

Table D-6: Combined Control System Facilities and Sizes in Cañada Gobernadora-Alternative B-4

Catchment Number	Facility Tributary Area[1] (acre)	F.D./W.Q. Basin			Infiltration Basin[3]	
		% Capture[2]	Area (acres)	Volume (ac-ft)	Area (acres)	Volume (ac-ft)
1	269	86	3.2	12	-	-
3	275	73	3.7	15	1.7	3.5
4	169	87	2.1	7.6	-	-
5	207	83	2.6	15	2.4	5.1
7	61	96	0.3	0.2	1.7	3.2
8	87	94	2.4	8	2.1	4.4
9	43	91	0.2	0.7	0.61	1.2
10	5	99	0.8	2.8	-	-

[1]Tributary area includes project development within the catchment; open space and existing development are not included.
[2]Percent of average annual runoff volume predicted by the model that is captured in the basin.
[3]Infiltration basin sizes assume no infiltration occurs in vegetated swales. Infiltration areas and volumes may be divided between infiltration basin and swales in detailed design, with consideration of maintaining flow durations.

D-1.3 Central San Juan and Trampas Sub-basin

D-1.3.1 Future Land Uses

The development alternatives in the Central San Juan and Trampas Sub-basin address approximately 4,770 acres in a portion of PA 3, all of PA 4, most of PA 5, and a small portion of PA 9 (Figure A-13 and Table D-7). Under the B-4 Alternative, approximately 2,058 acres would remain as open space and 2,698 acres would be developed. The B-4 alternative grading plan for this sub-basin would redirect runoff from approximately 4 acres from Trampas Canyon into the Cristianitos Sub-basin and 16 acres into the Gobernadora Sub-basin, while runoff from approximately 30 acres of the Cristianitos Sub-basin, 40 acres of the Gobernadora Sub-basin, and 67 acres of the Lower San Juan Sub-basin would be redirected into the Central San Juan Sub-basin. Overall, the Central San Juan and Trampas Sub-basin would gain approximately 115 acres.

Table D-7: Land Uses and Areas in the Central San Juan and Trampas Sub-basin

Alternative	Land Uses	Land Use Area within the Central San Juan and Trampas Sub-basin (acres)[1]
B-4	Estate	230
	Golf Course	12
	Proposed Development	2,475
	Open Space	2,055
	TOTAL	**4,772**

[1]Land use area within the pre-development sub-basin boundary.

D-1.3.2 Combined Control System: Elements and Sizes by Planning Area – Alternative B-4

The following describes the proposed combined facilities for each of the proposed planning areas in the Central San Juan and Trampas Sub-basin for Alternative B-4.

Planning Area 3

The Central San Juan Sub-basin includes a portion of Planning Area 3 (PA 3) north of the San Juan River. The proposed development within PA 3 is described as "general development" and includes a segment of proposed roadway. Runoff generated from these areas is discharged directly to segments of San Juan Creek that have been identified as arroyo toad habitat. To protect breeding habitat for arroyo toads within the San Juan Creek, flow duration controls will be incorporated and managed in a manner compatible to that for other sub-basins/catchments with flow duration control systems. The portions of Planning Area 3 within the Central San Juan Sub-basin can be hydraulically divided into three separate subcatchments. Runoff from each subcatchment will be treated by a combined control facility that includes a FD/WQ basin, and infiltration basin, and a vegetated swale that will connect to the tributary channel.

Planning Area 4

Planning Area 4 (PA 4) is located in the eastern portion of the Central San Juan Sub-basin, southeast of San Juan Creek. The planning area includes 216 acres of estates with some additional roadways. As with PA 3 flow duration controls are required to protect breeding habitat for the arroyo toad. Runoff from PA 4 will be treated by a single combined control facility that includes a FD/WQ basin, and infiltration basin, and a vegetated swale that will connect to the tributary channel.

Planning Area 5

The southern portion of the Central San Juan and Trampas Sub-basin is the proposed location for Planning Area 5 (PA 5). PA 5 contains an existing sand mining and washing operation which is indicative of the highly infiltrative soils in the area. As with PA 3, PA 5 is primarily defined as "general development" and includes a segment of proposed roadway. PA 5 discharges to two separate tributaries of San Juan Creek: Trampas Creek and an unnamed creek west of Trampas.

These tributaries provide habitat that is sensitive to hydrologic changes. Therefore, flows from PA 5 will be managed for flow duration control.

PA 5 has been divided into four separate catchments. Runoff from each catchment will be treated by a combined control facility that includes a FD/WQ basin, and infiltration basin, and a vegetated swale that will connect to the tributary channel (Unnamed Creek or Trampas Creek).

Currently, most of the area occupied by the sand mine and washing facilities does not contribute surface flows to Trampas Creek or any other tributary of San Juan Creek. All surface water runoff is discharged to a tailings pond onsite and is recycled for mining operations. The construction of PA 5 will replace the sand mine and discharges from the developed area will be routed to a water quality/flow duration facility designated as CSJ-4. However, because the artificial lake does not discharge to Trampas Creek, the FD/WQ basin incorporated into CSJ-4 was sized to match flows into Trampas Creek before the mine was constructed, with the objective to restore flows in Trampas Creek to the pre-mine hydrologic regime.

Facilities and Sizing

Table D-8 presents the proposed combined control facilities for the Central San Juan and Trampas Sub-basin. Due to the sensitive nature of the receiving waters in the Central San Juan Sub-basin to changes in flow duration, all flows generated from the proposed development will be treated in combined control systems consisting of a flow control/water quality basin, a separate infiltration basin, and a lined or unlined bioswale (CSJ-1, CSJ-2, CSJ-3, CSJ-4, CSJ-5, CSJ-6, CSJ-7, CSJ-8).

Table D-9 shows the estimated sizes of the various facilities. In general, more volume control is required where the development will be located on sandy infiltrative soils, and where the development is more urbanized. This is evident in CSJ-4 were the majority of the runoff from developed conditions must be infiltrated into the subsurface in order to match the natural flow regime in Trampas Creek. Less volume control will be necessary for less dense development, i.e., having lower percent imperviousness and located on less permeable soils. This is the case for CSJ-8 that was designed to treat runoff from estate areas. A significant portion of PA 3 will be located on rock out-crop. Because these rocky areas produce significant runoff during existing conditions, the increase in runoff volume due to development is less significant. Consequently, less volume control is required to match the flows in San Juan Creek.

Table D-8: Combined Control System Requirements for the Central San Juan and Trampas Sub-basins- Alternative B-4

Facility ID	Tributary Catchments	FD/ WQ Basin	ED Basin	Infiltration Basin	Vegetated Swale		Inter Sub-basin Transfer	Storage and Recycling	Comments
					Unlined	Lined			
CSJ-1	13, 14, 17, 18a, 19, PA5-2	✓		✓		✓			Standard combined control system. Water is conveyed from flow duration basin to the infiltration basin through vegetated swales, allowing further water quality treatment. Bypassed flows are directed to xx Creek.
CSJ-2	18b, 23, PA5-1	✓		✓		✓			Same as CSJ-1
CSJ-3	22, PA5-3	✓		✓		✓			Standard combined control system. Water is conveyed from flow duration basin to the infiltration basin through vegetated swales, allowing further water quality treatment. Bypassed flows are directed to Trampas Creek.
CSJ-4	25a, 25b, PA5-4	✓		✓		✓			Same as CSJ-3
CSJ-5	33, 36[1], 37, PA3-4, PA3-5	✓		✓		✓			Standard combined control system. Water is conveyed from flow duration basin to the infiltration basin through vegetated swales, allowing further water quality treatment. Bypassed flows are directed to San Juan Creek.
CSJ-6	26, 28, 29, PA3-3, PA3-6	✓		✓		✓			Same as CSJ-5
CSJ-7	16, 20, 21, 27, PA3-1, PA3-2, PA3-7, PA3-8	✓		✓		✓			Same as CSJ-5
CSJ-8	32, 34, 36[1], 38	✓		✓		✓			Same as CSJ-5

[1]A small portion of Catchment 36 (designated as 'general developed') is included with PA 3. The remaining areas of the catchment are included in PA 4.

Table D-9: Combined Control System Facilities and Sizes in Central San Juan and Trampas Sub-basin- Alternative B-4

Facility ID	Tributary Catchment	Facility Tributary Area[1] (acre)	F.D./W.Q. Basin			Infiltration Basin[3]	
			% Capture[2]	Area (acres)	Volume (ac-ft)	Area (acres)	Volume (ac-ft)
CSJ-1	13, 14, 17, 18a, 19, PA5-2	316	76	5.7	21.8	2.7	5.5
CSJ-2	18b, 23, PA5-1	109	96	3.5	20.4	1.1	2.1
CSJ-3	22, PA5-3	215	98	7.2	40.5	2.7	5.4
CSJ-4	25a, 25b, PA5-4	555	98	11.2	83.5	8.9	18.0
CSJ-5	33, 36[4], 37, PA3-4, PA3-5	474	58	3.7	29.4	3.4	6.6
CSJ-6	26, 28, 29, PA3-3, PA3-6	335	81	3.75	16.5	5.0	9.7
CSJ-7	16, 20, 21, 27, PA3-1, PA3-2, PA3-7, PA3-8	560	74	8.1	56.5	2.6	5.0
CSJ-8	32, 34, 36[4], 38	229	25	2.1	8.6	0.3	0.5

[1]Tributary area includes project development within the catchment; open space and existing development are not included.
[2]Percent of average annual runoff volume predicted by the model that is captured in the basin.
[3]Infiltration basin sizes assume no infiltration occurs in vegetated swales. Infiltration areas and volumes may be divided between infiltration basin and swales in detailed design, with consideration of maintaining flow durations.
[4]A small portion of Catchment 36 (designated as 'general developed') is included with PA 3. The remaining areas of the catchment are included in PA 4 and are thus treated by a separate water quality basin.

D-1.4 Cristianitos Sub-basin

D-1.4.1 Future Land Uses

The development alternatives in the Cristianitos Sub-basin address approximately 1,275 acres within the RMV boundary in Planning Areas 6 and 7 (Figure A-15 and Table D-10). Under the B-4 Alternative, approximately 802 acres would remain as open space and 724 acres would be developed, including a 195 acre golf course. The Alternative B-4 grading plan for this sub-basin would redirect runoff from approximately 194 acres into the lower Gabino Sub-basin and 30 acres into the Central San Juan and Trampas Sub-basin within PA 5 and PA 6, while runoff from approximately 1 acre of the lower Gabino Sub-basin and 4 acres of the Central San Juan and

Trampas Sub-basin would be redirected into the Cristianitos Sub-basin. Overall, the Cristianitos Sub-basin would lose approximately 219 acres.

Table D-10: Land Uses and Areas in the Cristianitos Sub-basin

Alternative	Land Uses	Land Use Area within the Cristianitos Sub-basin (acres)[1]
B-4	Estate	2
	Golf Course	195
	Proposed Development	527
	Reserve Open Space	551
	TOTAL	**1,275**

[1]Land use area within the pre-development sub-basin boundary.

D-1.4.2 Combined Control System: Elements and Sizes by Planning Area

The following describes the proposed combined facilities for each of the proposed planning areas within the Cristianitos Sub-basin for Alternative B-4.

Planning Area 6

Planning Area 6 (PA6) includes 195 acres of proposed golf course and 52 acres of general development adjacent to the golf course. Runoff from the development area adjacent to the golf course will be captured and stored as non-potable water for golf course irrigation. The potential benefits of this concept include a reduction of runoff volumes typically associated with urban development and a reduction of water importation to meet irrigation demands. The storage facilities would additionally function as a wet pond for treatment of the stormwater, prior to use for irrigation. The main limitation is that runoff and peak irrigation demands are seasonally out of phase (runoff occurs in the wet season and peak irrigation demands are in the dry season).

Planning Area 7

Approximately 475 acres of Planning Area 7 (PA7) extends beyond the boundaries of the Gabino Sub-basin and into the Cristianitos Sub-basin. The planning area is designated as general development, but does include a section of proposed roadway throughout the eastern section of the sub-basin. The soils underlying the proposed development are primarily clay and clay loam, which limit the feasibility of infiltration, unless grading is used to create loam conditions in potential infiltration areas.

The gentle slope of the headwaters combined with the higher infiltration rates of the area in the western portion of the sub-basin comprising the Donna O'Neill Land Conservancy results in less "flashy'' hydrographs and lower peak flows in Cristianitos Creek than observed in other sub-basins in San Mateo. The lower reaches of the creek support a high diversity of wetland species that are attracted to the saturated conditions caused by near-perennial flows. However, the creek has been incising since 1938 and is potentially susceptible to further incising. Due to the sensitivity of the stream to changes in flow regime, runoff flows into Cristianitos Creek will be managed with FD/WQ basins.

Furthermore, the lack of infiltrative soils in the eastern portion of the sub-basin will necessitate the diversion of excess flows generated from PA7 out of the Cristianitos Sub-basin to lower Gabino Creek near the confluence with lower Cristianitos Creek. This is considered acceptable because lower Gabino Creek, like San Juan Creek, is a relatively large braided stream with coarse substrate that can accommodate increases in runoff without causing excessive erosion or inducing significant habitat changes. By comparison, increased runoff into Cristianitos Creek above existing conditions is considered likely to cause excessive erosion and possibly modify the existing alkaline wetland habitat.

PA7 is separated into four drainage areas, each draining to a combined control facility consisting of a FD/WQ basin, a low-flow diversion to Gabino Creek, and a series of lined vegetated swales for conveyance to Cristianitos Creek.

Facilities and Sizing

Table D-11 presents the proposed combined control system facilities for the Cristianitos Sub-basin.

Table D-11: Combined Control System Requirements for the Cristianitos Sub-basin- Alternative B-4

Facility ID	Tributary Catchments	FD/WQ Basin	ED Basin	Infiltration Basin	Vegetated Swale		Direct Discharge to Gabino Creek	Non-domestic Water Supply Storage and Recycling	Comments
					Unlined	Lined			
Cristianitos-1	PA7-9	✓				✓	✓		Flow duration control required for discharge into Cristianitos Creek. Excess flows are treated and discharged directly to Gabino Creek.
Cristianitos-2	PA7-10	✓				✓	✓		Flow duration control required for discharge into Cristianitos Creek. Excess flows are treated and discharged directly to Gabino Creek.
Cristianitos-3	54, PA7-11	✓				✓	✓		Flow duration control required for discharge into Cristianitos Creek. Excess flows are treated and discharged directly to Gabino Creek.
Cristianitos-4	55, 58, PA7-14, PA7-16	✓				✓	✓		Flow duration control required for discharge into Cristianitos Creek. Excess flows are treated and discharged directly to Gabino Creek.
Cristianitos-5	PA6-1, PA6-2, PA6-3, PA6-4		✓					✓	Excess surface flows will be collected and stored on the golf course to be reused as irrigation. The on-site storage facility provides water quality treatment.

Table D-12 presents the estimated sizes of the various facilities. The storage and recycling facility located in PA6 (designated as Cristianitos-5) requires 12 acre-feet of storage, which is significantly larger than the required treatment volume (WEF, 1998). The remaining facilities (Cristianitos-1 through 4) are combined FD/WQ basins. The predicted basin volumes are comparable in size with the exception of Cristianitos-4, which is slightly larger. Peak flows significantly increase from areas tributary to Cristianitos-4, thus requiring a larger storage volume.

Table D-12: Combined Control System Facilities and Sizes in the Cristianitos Sub-basin-Alternative B-4

Facility ID	Catchment Numbers	Facility Tributary Area[1] (acre)	F.D./W.Q. Basin			Infiltration Basin[3]	
			% Capture[2]	Area (acres)	Volume (ac-ft)	Area (acres)	Volume (ac-ft)
Cristianitos-1	PA7-9	56	91	1.3	6.6	-	-
Cristianitos-2	PA7-10	71	87	1.4	8.6	-	-
Cristianitos-3	54, PA7-11	78	96	1.6	7.1	-	-
Cristianitos-4	55, 58, PA7-14, PA7-16	72	85	1.6	12.2	-	-
Cristianitos-5	PA6-1, PA6-2, PA6-3, PA6-4	228	>90	3	12	-	-

[1]Tributary area includes project development within the catchment; open space and existing development are not included.
[2]Percent of average annual runoff volume predicted by the model that is captured in the basin.
[3]Infiltration basin sizes assume no infiltration occurs in vegetated swales. Infiltration areas and volumes may be divided between infiltration basin and swales in detailed design, with consideration of maintaining flow durations.

D-1.5 The Gabino portion of the Gabino and Blind Canyon Sub-Basin

D-1.5.1 Future Land Uses

The development alternatives in the Gabino Sub-basin address approximately 4,360 acres within the RMV boundary in Planning Areas 7 and 9 and only a very small portion of PA8.(Figure A-17 and Table D-13). Under the B-4 Alternative, approximately 3,661 acres would remain as open space (including a proposed stream buffer in the PA 9 golf course) and 699 acres would be developed, including 263 acres of golf course within PA 9 and PA 8, 20 acres of casitas in PA 9, 161 acres of estates in PA 7 and PA 9, 5 acres of residential land use associated with the golf course in PA 8, and 250 acres of general development in PA 7. The Alternative B-4 grading plan for this sub-basin would redirect runoff from approximately 1 acre into the Cristianitos Sub-basin and 37 acres into the Blind Sub-basin, while runoff from approximately 194 acres of the

Cristianitos Sub-basin and 18 acres of the Blind Sub-basin would be redirected into the Gabino Sub-basin. Overall, the Gabino Sub-basin would gain approximately 174 acres of drainage area.

Table D-13: Land Uses and Areas in the Gabino Sub-basin

Alternative	Land Uses	Land Use Area within the Gabino Sub-basin (acres)[1]
B-4	Casitas	20
	Estate	197
	Golf Course	263
	Golf Residential	5
	Golf Resort	0
	Proposed Development	269
	Open Space	3,606
	TOTAL	**4,360**

[1]Land use area within the pre-development sub-basin boundary.

D-1.5.2 Combined Control System: Elements and Sizes by Planning Area – Alternative B-4

The following describes the proposed combined facilities for each of the proposed planning areas within the Gabino Sub-basin for the B-4 alternative.

Planning Area 7

Planning Area 7 (PA7) is comprised of 250 acres of general development and 126 acres of estates. It straddles the Cristianitos and Gabino Sub-basins and, due to the grading plan, will divert a significant portion of the runoff from the Cristianitos Sub-basin to Gabino Creek. This is considered acceptable because lower Gabino Creek, like San Juan Creek, is a relative large braided stream with coarse substrate that can accommodate increases in runoff without causing excessive erosion or inducing significant habitat changes. By comparison, increased runoff into Cristianitos Creek is considered likely to cause excessive erosion and possibly modify the existing alkaline wetland habitat. Additionally, the ability to route excess surface flows at the lower end of lower Gabino Creek allows the utilization of the functional capacity of lower Cristianitos Creek to accept increased flows.

The treatment strategy for PA7 includes the use of an existing abandoned clay mine pit as a "wet" extended detention basin for treatment (designated as Gabino-1). A "wet" extended detention basin incorporates two pools: a permanent pool of water and a temporary water quality pool that is drawn down over 48 hours following a storm event. There is no pond outlet at this time, but an outlet structure would be provided to achieve the desired drain time. The pit is also hydraulically connected through the groundwater table to Gabino Creek so water that infiltrates into the pond will migrate as a subsurface flow into Gabino Creek. Enroute additional treatment will be achieved through filtration.

All flows generated in PA7 within the Gabino Sub-basin will be collected and conveyed to the Gabino-1 water quality basin located at the down gradient end of Catchment PA7-1. The water quality basin was designed according to the WEF method (WEF, 1998).

Planning Area 8

The grading plan of Planning Area 8 (PA8) diverts a small portion of the proposed golf course (approximately 50 acres) to Gabino Creek. As with PA6 within the Cristianitos Sub-basin (Section 4.5.3), the treatment strategy for this portion of PA8 is to capture and store runoff as a source of non-potable water for golf course irrigation. The storage facilities would additionally function as a wetpond for treatment of the stormwater, prior to irrigation use. The methodology used to size the storage facility is discussed in Section 4.5.3 above.

Facilities and Sizing

Table D-14 presents the proposed treatment facilities for the middle and lower Gabino Sub-basin. Due to the lack of infiltrative soils, runoff from PA7 will be treated in water quality basins without infiltration and will be then be discharged to Gabino Creek. Golf course runoff from PA8 will be stored in water features and recycled as irrigation.

Table D-15 presents the sizes for the proposed BMPs in Gabino Canyon. As previously stated, Gabino-1 was sized according to the WEF method, a method that typically provides a capture efficiency between 82 and 88% of the total runoff volume (WEF, 1998). However, the majority of PA7 is situated on clayey soils, thus producing a larger runoff volume and reducing the capture efficiency of the water quality basin. The storage reservoir required for Gabino-2 significantly exceeds the water quality volume required by the WEF method.

Table D-14: Combined Control System Requirements for Gabino- Alternative B-4

Facility ID	Catchment Numbers	F.D. Basin	W.Q Basin	Infiltration Basin	Vegetated Swale		Inter Sub-basin Transfer	Storage and Recycling	Comments
					Unlined	Lined			
Gabino-1	68, 72, 73, 74, 76, 77, PA7-1, PA7-2, PA7-3, PA7-4, PA7-5, PA7-6, PA7-7, PA7-12, PA7-13, PA7-15		✓			✓			Water quality treatment only. It is assumed that no flow control is required because flows are directly discharged to Gabino Creek. Water quality treatment will be achieved using an existing quarry pond that will be modified to provide additional storage.
Gabino-2	PA8-12, PA8-14		✓					✓	Golf course area: Runoff will be collected and stored on-site to be used as irrigation. The on-site storage facility provides water quality treatment.

Table D-15: Combined Control System Facilities and Sizes in the Gabino Sub-basin- Alternative B-4

Facility ID	Catchment Numbers	Facility Tributary Area[1] (acre)	F.D./W.Q. Basin			Infiltration Basin[3]	
			% Capture[2]	Area (acres)	Volume (ac-ft)	Area (acres)	Volume (ac-ft)
Gabino-1	68, 72, 73, 74, 76, 77, PA7-1, PA7-2, PA7-3, PA7-4, PA7-5, PA7-6, PA7-7, PA7-12, PA7-13, PA7-15	560	78	2	21	-	-
Gabino-2	PA8-12, PA8-14	50	>90	3	12	-	-

[1]Tributary area includes project development within the catchment; open space and existing development are not included.
[2]Percent of average annual runoff volume predicted by the model that is captured in the basin.
[3]Infiltration basin sizes assume no infiltration occurs in vegetated swales. Infiltration areas and volumes may be divided between infiltration basin and swales in detailed design, with consideration of maintaining flow durations.

In the upper portion of the Gabino Sub-basin within Planning Area 9, the B-4 alternative would include very low density estate homes, casitas, and a golf course. The very low density housing would be incorporated within the large area of surrounding open space.

Given that the estate homes will be widely dispersed, controls for the estates are most feasible if conducted onsite or in common areas and will consist of site design, source control, and treatment practices, such as vegetated swales and planter boxes.

The combined control system for the golf course and casitas within Planning Area 9 would be similar to the system for the golf course located within Planning Area 6 described in Section 4.5.3 and will be sized using the method described.

D-1.6 The Blind Canyon portion of the Gabino and Blind Canyon Sub-Basin and the Talega Sub-Basin

D-1.6.1 Future Land Uses

The development alternatives in the Blind and Talega Sub-basins address approximately 1,974 acres within the RMV boundary in Planning Area 8 (Figure A-19 and Table D-16). Under the B-4 Alternative, approximately 1,092 acres would remain as open space and 882 acres would be developed, including 136 acres of golf course, 86 acres of residential and resort area associated with the golf course, and 661 acres of general development. The Alternative B-4 grading plan would redirect runoff from approximately 18 acres of the Blind Sub-basin into the Gabino Sub-basin and 3.4 acres into the lower Cristianitos Sub-basin, while runoff from approximately 37 acres of the Gabino Sub-basin and 478 acres of the Talega Sub-basin would be redirected into the Blind Sub-basin. Overall, the Blind Sub-basin would gain approximately 494 acres of drainage area. The Alternative B-4 grading plan would also redirect runoff from approximately 40 acres of the lower Cristianitos Sub-basin into the Talega Sub-basin, for an overall loss of approximately 437 acres in the Talega Sub-basin.

Table D-16: Land Uses and Areas in the Blind and Talega Sub-basins

Alternative	Land Uses	Land Use Area within the Blind and Talega Sub-basins (acres)[1]
B-4	Golf Course	136
	Golf Residential	66
	Golf Resort	20
	Proposed Development	661
	Open Space	1091
	TOTAL	**1,974**

[1]Land use area within the pre-development sub-basin boundary.

D-1.6.2 Combined Control System: Elements and Sizes by Planning Area – Alternative B-4

The following describes the proposed combined facilities for Planning Area 8 within the Blind and Talega Sub-basins for Alternative B-4.

Planning Area 8

Planning Area 8 (PA8) can be divided into two separate drainage areas divided by Blind Creek. The proposed development north of Blind Creek includes 170 acres of golf course with approximately 71 acres of low density residential development ("golf residential"). Areas of PA8 south of Blind Creek include 508 acres of general development and 130 acres of estates. The underlying soils are predominantly clay with moderate patches of sandy loam that limit the ability to infiltrate runoff.

The grading plan for PA8 will significantly alter the tributary areas to Blind Creek and Talega Creek. In order to protect arroyo toad breeding habitat in Talega Creek, approximately 478 acres of area currently tributary to Talega Creek will be graded in a manner that will divert excess flows towards Blind Canyon. The existing tributary area of Blind Creek is the smallest of any drainage area in the study area. Increases in surface water runoff resulting from increases in impervious area on Blind Canyon mesa and in drainage due to shifting 478 acres in the Talega Creek Sub-basin could significantly alter the flow regime of the Blind Canyon stream. To prevent this, runoff from the general development and estates will be treated and infiltrated. The control strategy for these areas includes the use of two extended detention water quality treatment basins, one treating runoff from the estates (Blind-3) and the other treating runoff from the 478 acres of general development in the Talega Sub-basin (Blind-1). Treated and bypassed flows from each of the water quality basins will be directed to separate lined vegetated swale that will discharge to two separate infiltration basins located in patches of sandy loam in the lower elevations of Blind Canyon.

Runoff from the golf course will be captured and stored onsite as a source of non-potable water for golf course irrigation. The storage facilities would additionally function as a wetpond for treatment of the stormwater, prior to use irrigation. The methodology used to size the storage facility is discussed in Section 4.5.3 above.

Talega Creek is of particular concern in that it hosts a "major population" of arroyo toads and supports some of the highest quality riparian habitat in the NCCP/SAMP study area. To maintain existing flows to Talega Creek, flows generated from portions of PA8 (specifically Catchment PA8-6) will be used to match the existing runoff conditions. This will incorporate the use of a single FD/WQ basin designated as Blind-2, with a vegetated swale that will connect to the main stem of Talega Creek.

Facilities and Sizing

Table D-17 presents the proposed treatment facilities for the Blind and Talega Sub-basins for Alternative B-4. The small patches of sandy loam located at the base of Blind Canyon will be used to infiltrate treated runoff from the general development and estate areas. A portion of the general development will be used to maintain flows in Talega Creek using a combined flow duration/water quality facility. As in the Gabino and Cristianitos Sub-basins, golf course runoff from PA8 will be stored in water features or non-domestic water supply reservoirs and recycled for irrigation.

Table D-18 presents the sizes for the proposed BMPs in the Blind and Talega Sub-basins. The water quality basins (Blind-1 and Blind-3) were sized according to the WEF method and are predicted to capture 88 percent of the runoff volume. The flow duration/water quality facility located in PA8-6 (Blind-2) was sized to divert 48 percent of the runoff to Talega Creek to maintain existing flows. The remaining 62 percent will be routed to an infiltration basin located near where Blind Canyon Creek joins with Gabino Creek. Flows from both basins would be routed through vegetated swales to provide additional water quality treatment. The storage reservoir sized for Blind-4 significantly exceeds the water quality volume required by the WEF method.

Table D-17: Combined Control System Requirements for Blind Canyon- Alternative B-4

Facility ID	Tributary Catchments	FD/WQ Basin	ED Basin	Infiltration Basin	Vegetated Swale		Graded to Divert Runoff from Talega to Blind	Non-domestic Water Supply Storage and Recycling	Comments
					Unlined	Lined			
Blind-1	PA8-3, PA8-4, PA8-5		✓	✓		✓	✓		Water quality treatment only. Flows are treated in detention basins in Blind Canyon before being discharged to infiltration basins located near the confluence of Gabino and Blind Creek.
Blind-2	PA8-6	✓		✓		✓	✓		Due to the proposed grading plan, areas once tributary to Talega Creek now discharge to Blind Creek. Flow duration control is used to preserve the existing flows in Talega Creek. Excess flows are treated and diverted to infiltration basins located in Blind Canyon.
Blind-3	PA8-7, PA8-8, PA8-9		✓	✓		✓	✓		Water quality treatment only. Flows are treated in detention basins in Blind Canyon before being discharged to infiltration basins located near the confluence of Gabino and Blind Creek.
Blind-4	PA8-10, PA8-11, PA8-13		✓					✓	Golf course area: Runoff will be collected and stored on-site to be used as irrigation. The on-site storage facility provides water quality treatment.

Table D-18: Combined Control System Facilities and Sizes in Blind Canyon-Alternative B-4

Facility ID	Tributary Catchments	Facility Tributary Area[1] (acre)	FD/WQ Basin			Infiltration Basin[3]	
			% Capture[2]	Area (acres)	Volume (ac-ft)	Area (acres)	Volume (ac-ft)
Blind-1	PA8-3, PA8-4, PA8-5	375	88	4.1	15.6	4.5	8.8
Blind-2	PA8-6	146	62	1.2	7.9	0.7	1.4
Blind-3	PA8-7, PA8-8, PA8-9	117	88	0.7	2.8	0.8	1.5
Blind-4	PA8-10, PA8-11, PA8-13	239	>90	3.8	15	-	-

[1]Tributary area includes project development within the catchment; open space and existing development are not included.
[2]Percent of average annual runoff volume predicted by the model that is captured in the basin.
[3]Infiltration basin sizes assume no infiltration occurs in vegetated swales. Infiltration areas and volumes may be divided between infiltration basin and swales in detailed design, with consideration of maintaining flow durations.

D-1.7 Verdugo Sub-basin

D-1.7.1 Future Land Uses

The development alternatives in the Verdugo Sub-basin addresses approximately 1,847 acres within the RMV boundary in Planning Area 4 and Planning Area 9 (Figure A-21 and Table D-19). Under the B-4 Alternative, approximately 1,791 acres would remain as open space and 56 acres would be developed, including 1 acre of golf course adjoining the golf course located within the upper Gabino Sub-basin in Planning Area 9, and 55 acres of estates, also in Planning Area 9.

Table D-19: Land Uses and Areas in the Verdugo Sub-basin

Alternative	Land Uses	Land Use Area within the Verdugo Sub-basin (acres)[1]
B-4	Golf Course	1
	Estates	108
	Proposed Development	0
	Non-reserve Open Space	0
	Reserve Open Space	1,738
	TOTAL	**1,847**

[1]Land use area within the pre-development sub-basin boundary.

D-1.8 The Narrow & Lower San Juan Sub-Basin and the Lower Cristianitos Sub-Basin

This section presents the WQMP elements for those sub-basins that would be impacted by the proposed development alternatives, but were not included in the sections above. Hydrologic and water quality modeling was conducted for most of the Planning Areas and the results of this modeling will be presented in Chapter 5, Impact Analysis. This modeling encompassed the range of terrains and proposed development types in the proposed alternatives, and therefore it was not necessary to model all of the planning areas. These remaining sub-basins were not modeled and therefore sub-basin specific combined control systems were not selected and sized. Using the management concepts employed in other sub-basins with comparable features and characteristics, the sub-basin specific WQMP elements in narrative form for these other sub-basins are presented.

D-1.8.1 Narrow and Lower San Juan Sub-basin

Planning Area 1 (PA1) encompasses approximately 540 acres in the western portion of the Narrow Canyon and Lower San Juan Creek Sub-basin, east of the City of San Juan Capistrano in the vicinity of Antonia Parkway and Ortega Highway. The proposed land uses within PA1 include 465 acres of general development and 75 acres of estates in the B-4 alternative.

A small portion of Planning Area 5 (PA5) is also located within the Narrow and Lower San Juan Sub-basin. In Alternative B-4, approximately 59 acres of general development in the southeast portion of the sub-basin adjoins the PA5 area located within the Central San Juan and Trampas Sub-basin. This area is currently undeveloped grassland or native vegetation. The Alternative B-4 grading plans call for this area and approximately 8 acres of open space to be graded into the Catchment PA5-2 in the Central San Juan and Trampas Sub-basin. This area would drain to combined control facility CSJ-1, which is a standard combined control system that includes a FD/WQ basin and an infiltration basin, with treated flows conveyed in a vegetated swale to the unnamed tributary to San Juan Creek.

D-1.8.2 Lower Cristianitos Sub-basin

The Lower Cristianitos Sub-basin is a small area encompassing approximately 290 acres located in the San Mateo Creek watershed south of the Cristianitos Sub-basin, southeast of the Donna O'Neill Conservancy at Rancho Mission Viejo, and west of the lower Gabino, Blind Canyon, and Talega Sub-basins. Alternative B-4 proposes 140 acres of general development, 5 acres of non-reserve open space, and 144 acres of reserve open space within the Lower Cristianitos Sub-basin. The general development land use is associated with Planning Area 8, which overlays the Lower Cristianitos, Gabino, Blind, and Talega Sub-basins. Grading plans for the B-4 alternative would redirect approximately 40 acres of the Lower Cristianitos Sub-basin into the Talega Sub-basin and would redirect approximately 3 acres of the Blind Sub-basin into the Lower Cristianitos Sub-basin, for a net gain of 37 acres in Lower Cristianitos.

The planning recommendations set forth in the *Draft Watershed and Sub-basin Planning Principles* for this sub-basin include protection of the integrity of arroyo toad populations in lower Cristianitos Creek by maintaining current hydrologic conditions. Under the B-4 alternative, the developed area proposed within this sub-basin will drain to a combined control system similar to those proposed in the Blind and Talega Sub-basins (Blind-1 and Blind-3), that include treatment in an extended detention basin followed by infiltration in the sandy soils in the main canyon. This system will mimic the current hydrologic conditions from this drainage area.

D-2 **Alternative B-4 Impact Analysis**

This section evaluates the impacts of the proposed B-4 alternative on pollutants of concern and hydrologic conditions of concern taking into account the WQMP elements described in Chapter 4. The site design features, source control measures, and combined control system facilities have been referred to as “BMPs” consistent with the Local WQMP. In this appendix, the BMPs associated with the Conceptual WQMP are referred to as “Project Design Features” (PDFs), which is consistent with the LIP’s CEQA guidance. The significance of impacts is evaluated based on significance criteria and thresholds described in Chapter 2.

Impacts are addressed for most of the sub-basins in the B-4 alternative based on sub-basin specific hydrologic and water quality modeling. For two sub-basins in the B-4 alternative, impacts are addressed based on extrapolation of modeling results, literature information on the effects of urbanization on water quality, and professional judgment.

It should be noted that the hydrologic and water quality modeling only takes into account the structural facilities in the combined control system, including the detention and infiltration basins, the diversions, and the non-domestic water supply reservoirs. The modeling also takes into account anticipated irrigation controls. The models do not take into account site design and source control BMPs that will limit runoff and prevent the introduction of pollutants in the runoff. Such controls include litter programs, pesticide application management, street sweeping, and other maintenance operations. In this respect, the model predictions are likely to overestimate the effects of the proposed development on hydrology and water quality.

D-2.1 __Impact Analysis for the Cañada Chiquita Sub-Basin__

This section evaluates the effectiveness of the WQMP for the Cañada Chiquita Sub-basin and evaluates the impacts of the proposed development on pollutants of concern and hydrologic conditions of concern.

D-2.1.1 Impacts on Hydrologic Conditions of Concern

Alternative B-4

Impacts on hydrologic conditions of concern in Cañada Chiquita for the B-4 alternative were evaluated based on the comparison of the pre- and post-development water balance results at the sub-basin scale and comparisons of pre- and post-development flow duration at the development bubble scale. The post-development condition reflects the effects of the combined control system for catchments affected by development, and in the case of the water balance assessments, reflects the additional effects of irrigating urban landscaping and the golf course and effects of vegetation changes on evapotranspiration (ET).

Hydrologic Condition of Concern #1: Increased Stormwater Runoff Flow Rate, Volume, and Flow Duration

In order to address this hydrologic condition of concern, the effects of the proposed development on runoff flow rate, peak discharge, and flow duration were evaluated with two types of analyses: (1) flow duration analysis, and (2) water balance analysis. The flow duration analysis was conducted first. The flow duration analysis results were used to select and size the combined control system facilities. Finally, the water balance was conducted taking into account the hydrologic control achieved with these facilities.

The flow duration analysis was conducted at the "development bubble scale", as this was the basis for sizing the facilities in the combined control system. Although the analysis was conducted for each catchment affected by development, the results for one example are provided here. The flow duration results for Chiquita Catchment 13 for the 53 year period of record are shown in Figure D-1. This figure shows the cumulative distribution of the duration of flows for the three development scenarios: pre-development discharge to the stream, post-development discharge to the stream, and post-development discharge with controls. The figure also shows the post-development 2 and 10 year peak flows, which is considered the approximate range of channel adjusting flows and are required to be analyzed by the Local WQMP. As indicated in the figure, the proposed control facilities achieve good flow duration matching over the entire range of flows including the 2 and 10 year peak flows. These results indicate that matching pre-development flow duration was possible utilizing the combined control system in Catchment 13. The extent to which flow duration matching was achieved for each catchment varied depending on conditions in each catchment. Catchments where it was more difficult to achieve matching were balanced by "over matching" in neighboring catchments where conditions were more favorable for matching.

Before conducting the water balance assessments, the effects of irrigation were analyzed based on the irrigation projections used by the Santa Margarita Water District in their report titled *Plan of Works for Improvement Districts 4CX, 4E, 5 and 6*, which includes the RMV Project area. Appendix A provides a detailed description of how irrigation volumes were estimated by month, by climatic condition, and for different land uses.

The potential role of irrigation in the Chiquita Sub-basin is illustrated in Table D-20, which compares predicted irrigation volumes with historic precipitation volumes. Table D-20 shows that irrigation effects are most pronounced during the dry summer months. Considering all years, irrigation will add about 10 percent to the overall water balance for the sub-basin as a whole. Most, if not all, of this water will be infiltrated and/or evapotranspirated in the combined control system.

The irrigation estimates were incorporated into the SWMM modeling and the SWMM model was adapted so that results for surface runoff, evapotranspiration, and groundwater outflow could be compiled in the form of "water balances". These water balances, developed as described in Chapter 3, are tabulated in Tables D-20, D-21, and D-22 (and Appendix E) for the following three climatic conditions:

- All Years in the Available Rainfall Record (WYs 1949 - 2001),
- Dry Years (WYs 1947 - 1977 and 1984 - 1990), and
- Wet Years (WYs 1978 - 1983 and 1991 - 2001).

In each table the results are shown for two development scenarios: existing conditions and post-development conditions with the PDFs. For each scenario, the table shows the "inflows" or "deposits" to the balance, which consist of precipitation for the pre-development condition and precipitation plus irrigation for the post-developed condition. "Outflows" or "withdrawals" consist of surface runoff to the main stem channel or diversion outside the sub-basin, infiltration that results in groundwater outflow to streams, and evapotranspiration. The unit of measure in the water balance is inches and in parentheses, acre-ft, where the inches are the volume in acre-ft divided by the sub-basin area. In semi-arid areas the water balance also varies by season and the table shows the variability in the monthly water balance.

Lastly the rainfall analysis conducted for each sub-basin takes into account the effect of elevation on rainfall and, because of grading, this can introduce small changes in the precipitation between the pre- and post-development condition. Also the modeling itself can introduce small water balance errors; e.g., there can be a small change between the assumed initial groundwater storage at the start of the simulation and the final storage at the end of the simulation. These effects can result in very small, but perceptible changes between the inflow and outflow totals (e.g., for precipitation), but are not meaningful in terms of the overall water balance.

The "inflow" conditions for each table indicate that the mean annual rainfall on the Chiquita Sub-basin varies from about 14 inches per year during dry years to about 22 inches per year during wet years, or about 16 inches per year for all years considered. The projected effect of irrigation is to add about 1.6 inches per year (available irrigation projections did not address effects of climate cycles on irrigation rates) or about 7 to 11 percent depending on the climatic conditions.

The predicted effects of the proposed alternatives on sub-basin hydrology can be examined by comparing the mean annual values of runoff and groundwater outflow for the post-development with PDFs condition with the pre-development condition. For all years, which was the period used for sizing the control facilities, the surface runoff to Chiquita Creek is predicted to increase approximately 20 percent. These changes, in absolute terms, are less than changes associated with the natural variability in runoff. For example, the predicted effect of the proposed development on runoff volumes is to increase the mean runoff to Chiquita Creek to 135 acre-ft/yr from 112 acre-ft/yr, or a 20 percent change. However the predicted mean annual runoff prior to development during wet years is 201 acre-ft/yr or approximately an 80 percent change.

The water balance tables also show projected values for surface runoff discharged directly to San Juan Creek. These discharges, as described earlier, originate from Catchments 16, 17 and 18. Catchment 18 naturally drains to San Juan Creek. In the case of catchments 16 and 17, excess flows, defined as the difference between projected flows under post-development and projected existing flows, were re-directed to San Juan Creek. Surface runoff from direct discharges to San Juan Creek is predicted to increase from about 1 acre-foot per year in all years in the pre-developed condition to 95 acre-feet per year in the post-developed condition (Table D-20). The relatively small runoff of 1 acre-foot per year is because only Catchment 18 is presently discharging directly to San Juan Creek, and that catchment has highly infiltrative soils that limit surface runoff.

Table D-20: Alternative B-4 Chiquita Sub-basin Water Balance, All Years (inches (acre-ft))

	Pre-Development[1]						Post-Development with PDFs[2]							
	INFLOW	OUTFLOW					INFLOW			OUTFLOW				
	Precipitation	Runoff to Chiquita	Runoff to San Juan Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Chiquita	Runoff to San Juan Creek	GW Outflow	ET	Total
OCT	0.3 (116)	0.0 (1)	0.0 (0)	0.1 (40)	0.3 (122)	0.5 (163)	0.3 (114)	0.1 (37)	0.4 (151)	0.0 (1)	0.0 (2)	0.1 (47)	0.4 (155)	0.6 (205)
NOV	1.7 (602)	0.0 (7)	0.0 (0)	0.1 (33)	0.7 (235)	0.8 (275)	1.7 (592)	0.0 (16)	1.7 (608)	0.0 (9)	0.0 (10)	0.1 (52)	0.7 (239)	0.9 (310)
DEC	2.3 (794)	0.0 (10)	0.0 (0)	0.1 (41)	0.8 (274)	0.9 (325)	2.2 (781)	0.0 (11)	2.3 (793)	0.0 (13)	0.0 (13)	0.2 (72)	0.8 (266)	1.0 (364)
JAN	3.8 (1336)	0.1 (25)	0.0 (0)	0.4 (131)	0.9 (325)	1.4 (481)	3.8 (1314)	0.0 (10)	3.8 (1324)	0.1 (32)	0.1 (22)	0.5 (180)	0.9 (310)	1.6 (544)
FEB	3.5 (1234)	0.1 (46)	0.0 (1)	0.8 (277)	1.2 (422)	2.1 (747)	3.5 (1214)	0.0 (8)	3.5 (1222)	0.1 (52)	0.1 (20)	0.9 (314)	1.1 (399)	2.2 (784)
MAR	2.9 (1025)	0.0 (14)	0.0 (0)	1.1 (396)	1.8 (625)	3.0 (1035)	2.9 (1008)	0.1 (31)	3.0 (1039)	0.1 (19)	0.0 (17)	1.2 (423)	1.7 (590)	3.0 (1049)
APR	1.2 (417)	0.0 (5)	0.0 (0)	0.7 (242)	2.2 (784)	2.9 (1030)	1.2 (410)	0.2 (59)	1.3 (469)	0.0 (5)	0.0 (6)	0.7 (257)	2.1 (744)	2.9 (1013)
MAY	0.4 (138)	0.0 (1)	0.0 (0)	0.4 (145)	2.2 (771)	2.6 (917)	0.4 (136)	0.2 (75)	0.6 (212)	0.0 (1)	0.0 (2)	0.4 (154)	2.2 (754)	2.6 (912)
JUN	0.1 (49)	0.0 (0)	0.0 (0)	0.3 (96)	1.2 (416)	1.5 (512)	0.1 (48)	0.3 (89)	0.4 (138)	0.0 (0)	0.0 (1)	0.3 (103)	1.3 (464)	1.6 (568)
JUL	0.0 (11)	0.0 (0)	0.0 (0)	0.2 (75)	0.2 (55)	0.4 (130)	0.0 (11)	0.3 (91)	0.3 (102)	0.0 (0)	0.0 (0)	0.2 (82)	0.4 (140)	0.6 (222)
AUG	0.1 (40)	0.0 (0)	0.0 (0)	0.2 (59)	0.1 (40)	0.3 (99)	0.1 (39)	0.2 (84)	0.4 (123)	0.0 (0)	0.0 (1)	0.2 (66)	0.3 (118)	0.5 (186)
SEP	0.4 (123)	0.0 (1)	0.0 (0)	0.1 (46)	0.3 (92)	0.4 (140)	0.3 (121)	0.2 (60)	0.5 (181)	0.0 (2)	0.0 (2)	0.2 (55)	0.4 (147)	0.6 (205)
Total	**16.8 (5886)**	**0.3 (112)**	**0.0 (1)**	**4.5 (1581)**	**11.9 (4160)**	**16.7 (5854)**	**16.5 (5790)**	**1.6 (571)**	**18.2 (6360)**	**0.4 (135)**	**0.3 (95)**	**5.2 (1806)**	**12.3 (4326)**	**18.2 (6362)**

[1]Pre-development sub-basin area = 4200 acres. Volumes given are inches over the sub-basin area.
[2]Post-development sub-basin area = 4204 acres. Volumes given are inches over the sub-basin area.

Table D-21: Alternative B-4 Chiquita Sub-basin Water Balance, Dry Years (inches (acre-ft))

	Pre-Development[1]						Post-Development with PDFs[2]							
	INFLOW	OUTFLOW					INFLOW			OUTFLOW				
	Precipitation	Runoff to Chiquita	Runoff to San Juan Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Chiquita	Runoff to San Juan Creek	GW Outflow	ET	Total
OCT	0.3 (116)	0.0 (1)	0.0 (0)	0.1 (30)	0.4 (140)	0.5 (171)	0.3 (114)	0.1 (36)	0.4 (151)	0.0 (1)	0.0 (2)	0.1 (38)	0.5 (170)	0.6 (211)
NOV	1.9 (651)	0.0 (8)	0.0 (0)	0.1 (25)	0.7 (250)	0.8 (283)	1.8 (640)	0.0 (16)	1.9 (656)	0.0 (10)	0.0 (11)	0.1 (47)	0.7 (253)	0.9 (320)
DEC	2.4 (843)	0.0 (11)	0.0 (0)	0.1 (35)	0.8 (288)	1.0 (333)	2.4 (830)	0.0 (11)	2.4 (841)	0.0 (14)	0.0 (14)	0.2 (68)	0.8 (277)	1.1 (373)
JAN	2.8 (997)	0.0 (13)	0.0 (0)	0.2 (56)	0.9 (326)	1.1 (395)	2.8 (981)	0.0 (10)	2.8 (991)	0.0 (17)	0.0 (16)	0.3 (97)	0.9 (311)	1.3 (441)
FEB	2.5 (867)	0.1 (22)	0.0 (0)	0.3 (106)	1.2 (420)	1.6 (548)	2.4 (853)	0.0 (8)	2.5 (861)	0.1 (25)	0.0 (14)	0.4 (140)	1.1 (396)	1.6 (575)
MAR	2.0 (685)	0.0 (8)	0.0 (0)	0.5 (169)	1.8 (617)	2.3 (794)	1.9 (673)	0.1 (31)	2.0 (704)	0.0 (9)	0.0 (11)	0.6 (194)	1.7 (584)	2.3 (798)
APR	1.2 (433)	0.0 (5)	0.0 (0)	0.4 (133)	2.2 (772)	2.6 (909)	1.2 (426)	0.2 (58)	1.4 (484)	0.0 (5)	0.0 (7)	0.4 (150)	2.1 (736)	2.6 (898)
MAY	0.4 (137)	0.0 (1)	0.0 (0)	0.2 (81)	2.1 (732)	2.3 (815)	0.4 (135)	0.2 (74)	0.6 (209)	0.0 (1)	0.0 (2)	0.3 (92)	2.1 (725)	2.3 (820)
JUN	0.1 (35)	0.0 (0)	0.0 (0)	0.2 (57)	1.1 (371)	1.2 (428)	0.1 (35)	0.3 (88)	0.4 (123)	0.0 (0)	0.0 (0)	0.2 (65)	1.2 (428)	1.4 (494)
JUL	0.0 (15)	0.0 (0)	0.0 (0)	0.1 (46)	0.1 (49)	0.3 (95)	0.0 (15)	0.3 (90)	0.3 (104)	0.0 (0)	0.0 (0)	0.2 (54)	0.4 (134)	0.5 (189)
AUG	0.1 (45)	0.0 (0)	0.0 (0)	0.1 (37)	0.1 (42)	0.2 (79)	0.1 (44)	0.2 (83)	0.4 (127)	0.0 (1)	0.0 (1)	0.1 (46)	0.3 (118)	0.5 (165)
SEP	0.3 (117)	0.0 (1)	0.0 (0)	0.1 (30)	0.3 (92)	0.4 (124)	0.3 (115)	0.2 (60)	0.5 (175)	0.0 (1)	0.0 (2)	0.1 (40)	0.4 (145)	0.5 (189)
Total	**14.1 (4941)**	**0.2 (70)**	**0.0 (0)**	**2.3 (805)**	**11.7 (4099)**	**14.2 (4974)**	**13.9 (4860)**	**1.6 (565)**	**15.5 (5426)**	**0.2 (84)**	**0.2 (79)**	**2.9 (1031)**	**12.2 (4279)**	**15.6 (5473)**

[1]Pre-development sub-basin area = 4200 acres. Volumes given are inches over the sub-basin area.
[2]Post-development sub-basin area = 4204 acres. Volumes given are inches over the sub-basin area.

Table D-22: Alternative B-4 Chiquita Sub-basin Water Balance, Wet Years (inches (acre-ft))

	Pre-Development[1]						Post-Development with PDFs[2]								
	INFLOW	OUTFLOW					INFLOW			OUTFLOW					
	Precipitation	Runoff to Chiquita	Runoff to San Juan Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Chiquita	Runoff to San Juan Creek	GW Outflow	ET	Total
OCT	0.3 (115)	0.0 (1)	0.0 (0)	0.2 (61)	0.2 (83)	0.4 (145)	0.3 (113)	0.1 (37)	0.4 (150)	0.0 (1)	0.0 (2)	0.2 (67)	0.3 (122)	0.5 (192)
NOV	1.4 (498)	0.0 (6)	0.0 (0)	0.1 (49)	0.6 (202)	0.7 (257)	1.4 (490)	0.0 (16)	1.4 (506)	0.0 (8)	0.0 (8)	0.2 (64)	0.6 (210)	0.8 (289)
DEC	2.0 (691)	0.0 (8)	0.0 (0)	0.2 (53)	0.7 (246)	0.9 (308)	1.9 (679)	0.0 (11)	2.0 (691)	0.0 (11)	0.0 (12)	0.2 (82)	0.7 (241)	1.0 (345)
JAN	5.9 (2054)	0.1 (51)	0.0 (0)	0.8 (290)	0.9 (321)	1.9 (663)	5.8 (2020)	0.0 (10)	5.8 (2030)	0.2 (64)	0.1 (33)	1.0 (355)	0.9 (309)	2.2 (761)
FEB	5.7 (2012)	0.3 (98)	0.0 (3)	1.8 (642)	1.2 (426)	3.3 (1169)	5.6 (1979)	0.0 (8)	5.7 (1987)	0.3 (110)	0.1 (32)	1.9 (682)	1.2 (404)	3.5 (1228)
MAR	5.0 (1745)	0.1 (28)	0.0 (0)	2.5 (878)	1.8 (640)	4.4 (1546)	4.9 (1717)	0.1 (30)	5.0 (1747)	0.1 (41)	0.1 (29)	2.6 (907)	1.7 (605)	4.5 (1582)
APR	1.1 (382)	0.0 (4)	0.0 (0)	1.3 (472)	2.3 (810)	3.7 (1287)	1.1 (376)	0.2 (60)	1.2 (436)	0.0 (5)	0.0 (6)	1.4 (484)	2.2 (761)	3.6 (1256)
MAY	0.4 (141)	0.0 (2)	0.0 (0)	0.8 (280)	2.4 (854)	3.2 (1135)	0.4 (139)	0.2 (76)	0.6 (215)	0.0 (2)	0.0 (2)	0.8 (287)	2.3 (815)	3.2 (1106)
JUN	0.2 (78)	0.0 (1)	0.0 (0)	0.5 (178)	1.5 (510)	2.0 (689)	0.2 (77)	0.3 (89)	0.5 (166)	0.0 (1)	0.0 (1)	0.5 (183)	1.5 (539)	2.1 (724)
JUL	0.0 (4)	0.0 (0)	0.0 (0)	0.4 (135)	0.2 (67)	0.6 (202)	0.0 (4)	0.3 (91)	0.3 (95)	0.0 (0)	0.0 (0)	0.4 (140)	0.4 (151)	0.8 (291)
AUG	0.1 (29)	0.0 (0)	0.0 (0)	0.3 (104)	0.1 (36)	0.4 (140)	0.1 (29)	0.2 (84)	0.3 (113)	0.0 (0)	0.0 (0)	0.3 (109)	0.3 (118)	0.7 (228)
SEP	0.4 (136)	0.0 (2)	0.0 (0)	0.2 (81)	0.3 (94)	0.5 (176)	0.4 (134)	0.2 (60)	0.6 (194)	0.0 (2)	0.0 (2)	0.3 (88)	0.4 (149)	0.7 (240)
Total	**22.5 (7887)**	**0.6 (201)**	**0.0 (3)**	**9.2 (3223)**	**12.3 (4289)**	**22.0 (7716)**	**22.1 (7758)**	**1.6 (572)**	**23.8 (8330)**	**0.7 (244)**	**0.4 (127)**	**9.8 (3447)**	**12.6 (4425)**	**23.5 (8244)**

[1]Pre-development sub-basin area = 4200 acres. Volumes given are inches over the sub-basin area.
[2]Post-development sub-basin area = 4204 acres. Volumes given are inches over the sub-basin area.

The central portion of the main stem of San Juan Creek, downstream of Bell, Lucas, and Verdugo Canyons, consists of a meandering river with several floodplain terraces in a wide valley bottom (PCR et al, 2002). In this reach, San Juan Creek serves as a sediment transport conduit between the major sediment-producing sub-basins and downstream areas. The result is that the channel is made up of fairly coarse substrate including cobbles that is mobilized only under large events. The effect of the projected additional 95 acre-ft of runoff on San Juan Creek fall into three categories: the effect on channel stability, the effect on vegetation and habitat, and the effect on water supply. With respect to channel stability, the additional runoff volume will not result in increasing peak flows capable of mobilizing sediments, in part because the increase in peak flows from the development area will be small compared with peak flows in San Juan Creek, and in part because the peak flows from the development area have been shown to precede peak flows from the larger watershed (PCR et al, 2002). With respect to effects on habitat, much of the additional volume or runoff occurs in January through June, which corresponds to the arroyo toad breeding season, thereby providing water when it is a significant limiting factor to successful recruitment. With respect to water supply, much of the additional runoff volume will ultimately infiltrate into the wide San Juan channel and will help to sustain the groundwater aquifer for downstream water supply users.

Hydrologic Condition of Concern #2: Decreased Infiltration and Groundwater Recharge

Given the reliance on infiltration in the combined control system, changes to groundwater infiltration and outflow are more pronounced. Annual groundwater infiltration is predicted to increase from about 1,581 acre-ft under existing conditions to 1,806 acre-ft under the developed condition, for an increase of approximately 200 acre-ft/yr.

So with respect to this hydrologic condition of concern, the effect of the development is likely to increase infiltration and groundwater recharge; it is very unlikely that infiltration and groundwater recharge would be reduced.

Hydrologic Condition of Concern #3: Changed Base Flows

The increase in infiltration and groundwater outflow leads to increases in base flows of approximately 200 acre-ft/yr. This additional water could be carried down Chiquita Creek to San Juan Creek, infiltrate in the stream channel, or enhance existing or support additional riparian vegetation. There is evidence that the quality of the existing riparian vegetation in lower Chiquita could benefit from additional water. The Restoration Ecologist, in consultation with the Reserve Owner/Manager, will assess the opportunities for enhancement of existing riparian vegetation and creation of new riparian/wetland vegetation that would yield the maximum benefit from the additional water.

The potential benefits of increased base flows obviously depend on a number of factors, including groundwater transport processes in the alluvial aquifer. Such processes will affect where base flow increases may occur and the magnitude of those increases. The proposed approach would be to adopt an adaptive management strategy that would try to take advantage of the additional anticipated water. If increased groundwater infiltration and increased base flows is determined to be beneficial to riparian habitats, no changes would be made to flow management. If it is determined that increased base flows are causing negative environmental effects, such as facilitating the invasion of exotic plant and wildlife species (e.g., bullfrogs), modifications in the flow management system to control these adverse effects will be evaluated and implemented. Such modifications could include additional routing of surface flows out of the sub-basin to San Juan Creek, or additional utilization of surface runoff for non-domestic water supply to decrease or offset increases in groundwater infiltration. A long-term adaptive management program is presented in Chapter 6.

D-2.1.2 Impacts on Pollutants of Concern

The section presents the water quality modeling results used to address impacts of stormwater runoff on sediments, nutrients, and trace metals. The modeling approach has been described in Chapter 3, and more technical details can be found in Appendix B. The modeling results are in the form of mean annual loads and mean annual concentrations. Concentration is defined as the mass of pollutant contained in a unit volume of water in the runoff. A common measure of concentration in stormwater is the Event Mean Concentration (EMC), which is the average concentration during a runoff event. Load is the mass of pollutant associated with an event or series of events. The mean annual load is the mass of a given pollutant that on average is discharged annually. It is estimated in the water quality model as the average of the predicted annual loads over the 53 year simulation period. The mean annual concentration is the mean annual load divided by the mean annual runoff volume.

Results are provided for the three development scenarios: pre-development, post-development, and post-development with PDFs; for three climatic conditions: all years in the 53 year rainfall record, dry years, and wet years; and for discharges to Chiquita Creek and to San Juan Creek. The mean annual loads and mean annual concentrations reflect the entire portion of the sub-basin that discharges to each creek, including the catchments that drains to the combined control system (the area within the development) and untreated areas (the open space outside of the development). The numbers in the tables in this and all subsequent sections have been rounded-off. The percent change values in the tables are based on the unrounded results.

TSS Loads and Concentrations

Table D-23 summarizes TSS loads and concentrations and shows the percent change associated with the proposed development. During wet years, the predicted mean annual TSS load to Chiquita Creek, post development with PDFs, is estimated to be about 43 tons, which is a decrease of about 16 percent over pre-development conditions (51 tons). During dry years, the mean annual load is predicted to be 13 tons, which is about 12 percent less than the pre-development condition. Again, the changes associated with climatic conditions are larger than the changes associated with the proposed development.

The TSS loads to San Juan Creek from Chiquita Catchments 16, 17, and 18 are predicted to increase substantially relative to the pre-development condition because the loads under the pre-development condition are quite low. The net effect of development on TSS loads and concentrations is given in the bottom four rows of Table D-23 and indicate a reduction in concentration of 42 to 47 percent, and no net change in TSS loads overall (all years).

Table D-24 shows the predicted mean annual TSS concentration compared to water quality criteria and observed in-stream TSS concentrations. The criterion for TSS in the San Diego Basin Plan is narrative and states that "levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors". The combined control system is designed to treat by detention and infiltration 80 to 90 percent of the runoff and would address urban particulates containing other pollutants. The predicted TSS concentration of 93 mg/L is in the lower end of the range of observed data (ND – 3100 mg/L) reported by Wildermuth (the majority of TSS measurements are in the high end of the range). Thus discharges to the stream are projected to have lower TSS concentrations than the stream.

Table D-23: Predicted Average Annual TSS Loads and Concentrations for the Chiquita Sub-basin (Alternative B-4)

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Chiquita Creek	Pre-Developed	26	14	51	168	150	181
	Developed	46	31	76	116	106	127
	Dev w/ PDFs	22	13	43	134	122	142
	Percent Change	-15	-12	-16	-20	-18	-21
San Juan Creek	Pre-Developed	0.3	0.1	0.8	224	224	224
	Developed	4	3	6	81	80	82
	Dev w/ PDFs	4	3	6	35	35	36
	Percent Change	1217	3866	615	-84	-84	-84
Total Sub-basin Area	Pre-Developed	26	14	52	168	150	182
	Developed	50	35	82	112	103	122
	Dev w/ PDFs	26	16	48	93	80	106
	Percent Change	0	11	-6	-45	-47	-42

Table D-24: Comparison of Predicted TSS Concentration with Water Quality Objectives and Observed In-Stream Concentrations for the Chiquita Sub-basin (Alternative B-4)

Predicted Average Annual TSS Concentration[1] (mg/L)	San Diego Basin Plan Water Quality Objectives	Range of Observed In-Stream Concentrations[2] (mg/L)
93	TSS levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors	None Detected – 3,100

[1]Modeled concentration for total project area developed conditions with PDFs in wet years.
[2]Range of concentrations observed at four San Juan watershed stations during storm events
NA – not applicable

Nutrient Loads and Concentrations

TKN is a measure of the total organic nitrogen and ammonia-nitrogen, which is an inorganic form of nitrogen. Nitrate-nitrogen and ammonia-nitrogen are bio-available forms of nitrogen that can cause excessive algal growth in streams. Elevated ammonia is usually associated with wastewater and moreover, the nitrogen cycle in most aerobic streams tends to convert the nitrogen in ammonia to the nitrate form. Therefore nitrate-nitrogen tends to be the more important nitrogen nutrient form with regards to stimulating algal growth.

Table D-25 summarizes the nutrient loads and shows percent changes for all years, dry years, and wet years for all three nutrients and for discharges into Chiquita Creek and for direct discharges into San Juan Creek. Predicted nitrate loads to Chiquita Creek for development with controls range from 170 lbs/yr during dry years to 562 lbs/yr during wet years, while mean annual TKN loads are projected to be about 394 lbs/yr during dry years and 1,080 lbs/yr during wet years. The nitrate load is predicted to be 3 percent less than pre-development loads during wet years, while the TKN load prediction increases by 42 percent. The nitrate and TKN loads are about 4 percent and 32 percent higher than pre-development conditions, respectively, during dry years.

Table D-26 summarizes the nutrient concentrations and shows percent changes for all years, dry years, and wet years for all three nutrients and for discharges into Chiquita Creek and for direct discharges into San Juan Creek. Mean annual concentrations of nitrate-nitrogen in discharges to Chiquita Creek from development with PDFs are predicted to be about 0.8 mg/L for all climatic conditions, which reflects a decrease in nitrate-nitrogen concentration ranging from 3 to 10 percent. These predicted concentrations of nitrate-nitrogen are within the range of 0.6 - 1.2 mg/L range reported by Wildermuth (Table D-27). Mean annual concentrations of TKN are predicted to increase to about 1.6 mg/L. In comparison, Wildermuth found in-stream TKN to range from none-detected to 2.8 mg/L.

Total phosphorus loads are predicted to increase with development, but the addition of PDFs reduces the increase in loads such that during the wet years the predicted loads to Chiquita Creek in the developed condition with PDFs is 166 lbs/yr, which is about a 43 percent increase over pre-development loads. During dry years the mean annual load is predicted to be about 63 lbs/yr, which is about 27 percent higher than pre-development conditions.

These predicted increases for phosphorous may be inflated because the existing runoff of total phosphorus, used as the baseline assumption for modeling purposes, is based on 0.27 mg/L derived from the vacant land use station in the LA County database. Projections of phosphorous loads for vacant land use are affected significantly by local geology. Although no directly comparable local runoff data are available for the alternatives area, in-stream data collected by Wildermuth indicates that the Los Angeles runoff data may be low. Also geologic information cited in Appendix B of the Baseline Water Quality Conditions report indicates that approximately 8 percent of the sub-basin is underlain by Monterey Shale bedrock and therefore "nitrogen and phosphorous loadings from this sub-basin are likely quite high" (Balance Hydrologics, 2001a). This evidence suggests that model predictions of the pre-development loads, especially phosphorous, may be underestimated, which would lead to an overestimate of changes associated with the proposed development.

The water quality concern with nutrients is excessive algal growth. The Basin Plan narrative objective is "Concentrations of nitrogen and phosphorous, by themselves or in combination with other nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth." Given the geological sources of phosphorous, it would appear that nitrogen nutrients are the more limiting nutrients (PCR et al, 2002). Moreover, as discussed earlier, nitrate-nitrogen is the more important nitrogen form with regard to stimulating algal growth. Table D-26 indicates that nitrate-nitrogen concentrations are projected to decrease with development, and the results in Table D-27 indicate that the projected nitrate-nitrogen concentrations are within the range of observed in-stream concentrations.

The combined control system, which incorporates wetlands, infiltration basins, and vegetated swales, is specifically designed to treat nutrients. With respect to treatment effectiveness, constructed wetlands have been shown to be quite effective in reducing nitrates. Noteworthy examples in the region include Irvine Ranch Water District's San Joaquin Marsh, used to treat water in San Diego Creek upstream of Newport Bay; and the Prado Wetlands which treat nutrients in reclaimed water entering Prado Reservoir and prior to being recharged in the downstream Santa Ana River recharge basins. Constructed wetlands and infiltration basins would be utilized as part of the combined control treatment system to treat low flows and small storm flows thereby reducing nutrient discharges to receiving streams.

Based on the model projections and the choice of nutrient treating elements in the combined control system, the potential for discharges from the proposed project to stimulate algal growth in Chiquita Creek or San Juan Creek is limited.

Table D-25: Predicted Average Annual Nutrient Loads for the Chiquita Sub-basin (Alternative B-4) (lbs)

Modeled Area	Site Condition	Nitrate-N Load			TKN Load			Total Phosphorus Load		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Chiquita Creek	Pre-Developed	298	164	582	447	299	759	71	50	116
	Developed	688	493	1102	1647	1283	2417	255	200	370
	Dev w/ PDFs	296	170	562	614	394	1080	96	63	166
	Percent Change	-1	4	-3	37	32	42	35	27	43
San Juan Creek	Pre-Developed	4	0.98	9.13	3	0.82	7.67	0	0.10	0.97
	Developed	67	54	93	242	199	332	41	34	56
	Dev w/ PDFs	78	65	107	412	343	558	69	57	94
	Percent Change	2076	6492	1073	13535	41543	7173	17917	54917	9513
Total Sub-basin Area	Pre-Developed	302	165	591	450	300	767	72	50	117
	Developed	755	547	1195	1889	1482	2749	296	234	426
	Dev w/ PDFs	374	235	669	1025	736	1637	165	121	260
	Percent Change	24	43	13	128	145	113	131	142	121

Table D-26: Predicted Average Annual Nutrient Concentrations the Chiquita Sub-basin (Alternative B-4) (mg/L)

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			Total Phosphorus Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Chiquita Creek	Pre-Developed	0.87	0.77	0.94	1.3	1.4	1.2	0.21	0.24	0.19
	Developed	0.79	0.76	0.83	1.9	2.0	1.8	0.29	0.31	0.28
	Dev w/ PDFs	0.80	0.75	0.85	1.7	1.7	1.6	0.26	0.28	0.25
	Percent Change	-7	-3	-10	28	22	33	26	18	33

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			Total Phosphorus Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
San Juan Creek	Pre-Developed	1.2	1.2	1.2	1.0	1.0	1.0	0.1	0.1	0.1
	Developed	0.6	0.6	0.6	2.1	2.1	2.1	0.4	0.4	0.3
	Dev w/ PDFs	0.3	0.3	0.3	1.6	1.6	1.6	0.3	0.3	0.3
	Percent Change	-74	-74	-73	64	63	64	116	115	117
Total Sub-basin Area	Pre-Developed	0.87	0.77	0.9	1.3	1.4	1.2	0.21	0.23	0.19
	Developed	0.77	0.74	0.8	1.9	2.0	1.8	0.30	0.31	0.29
	Dev w/ PDFs	0.60	0.53	0.7	1.6	1.7	1.6	0.26	0.27	0.26
	Percent Change	-31	-32	-30	26	17.9	32.6	28	16.02	37.51

Table D-27: Comparison of Predicted Nutrient Concentrations with Observed In-Stream Concentrations the Chiquita Sub-basin (Alternative B-4)

Nutrient	Predicted Average Annual Concentration[1] (mg/L)			Observed Range of In-Stream Concentrations[2] (mg/L)
	All Years	Dry Years	Wet Years	
Nitrate-nitrogen	0.60	0.53	0.7	0.15 – 1.5
TKN	1.6	1.7	1.6	None Detected – 3.0
Total Phosphorus	0.26	0.27	0.26	None Detected – 2.8

[1]Modeled concentration for total project developed conditions with PDFs.
[2]Range of means observed at four San Juan watershed stations during the wet years.

Trace Metals

Tables D-28 and D-29 show the predicted mean annual loads and mean annual concentrations for aluminum, cadmium, copper, lead, and zinc for the three development scenarios and for the three climatic conditions. Except for aluminum, the concentrations are all in the dissolved form, which is the form of the California Toxics Rule (CTR) water quality criteria.

For aluminum the criteria used is 750 µg/L taken from the National Ambient Water Quality Criteria (NAWQC) acute value for a pH range of 6.5 to 9.0, as the CTR does not include aluminum. The range of pH values observed by Wildermuth within the San Juan Creek watershed was 8.1 – 8.6, which indicates that the NAWQC criteria is applicable to the San Juan watershed. For the wet years, the predicted mean annual aluminum concentration in discharges to Chiquita Creek decreases from 669 µg/L under pre-development conditions, to 599µg/L under developed with PDFs conditions, a reduction of about 10 percent. During dry years, the post-development with PDFs concentration is predicted to be about 592 µg/L and during all years, the post-developed with PDFs concentration is predicted to be 596 µg/L.

Table D-30 compares the predicted trace metals concentrations with water quality criteria and observed data. In wet years under the developed with PDFs scenario, the mean annual concentrations in discharges to Chiquita Creek from the total project area are: cadmium 0.46 µg/L, copper 11 µg/L, lead 2.4 µg/L, and zinc 65 µg/L. The corresponding range in mean values for the four stations in the San Juan watershed monitored by Wildermuth are: cadmium 0.06 - 0.12 µg/L, copper 1.6 - 5.5 µg/L, lead 0.17 - 0.91 µg/L, and zinc 3.9 - 10.4 µg/L. All values are for the dissolved form. The runoff concentrations predicted by the model tend to be somewhat higher than the in-stream monitoring data, which may be related to a combination of dilution effects and re-partitioning effects.

As shown in Table D-30, aluminum, cadmium, copper, lead, and zinc predicted mean annual concentrations are well below acute aquatic CTR and NAWQC criteria.

Table D-28: Predicted Average Annual Trace Metal Loads the Chiquita Sub-basin (Alternative B-4) (lbs)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Chiquita Creek	Pre-Developed	228	140	415	0.16	0.12	0.24	3.3	2.4	5.3	0.6	0.4	1.1	28	21	44
	Developed	470	343	739	0.47	0.38	0.66	9.8	7.7	14.2	2.2	1.7	3.2	60	47	88
	Dev w/ PDFs	219	135	397	0.20	0.14	0.32	4.1	2.8	6.8	0.9	0.6	1.5	31	22	50
	Percent Change	-4	-4	-4	24	14	35	24	18	30	35	31	39	10	7	13
San Juan Creek	Pre-Developed	2.1	0.57	5.3	0.00	0.00	0.00	0.02	0.00	0.04	0.00	0.00	0.01	0.11	0.03	0.29
	Developed	58	48	80	0.11	0.09	0.15	1.9	1.6	2.7	0.3	0.3	0.5	10	8.0	13
	Dev w/ PDFs	141	118	191	0.10	0.08	0.14	3.2	2.6	4.3	0.7	0.6	0.9	11	9.4	16
	Percent Change	6638	20543	34800	27264	82461	14726	20354	62481	10785	17174	52769	9088	9884	30145	5282
Total Sub-basin Area	Pre-Developed	230	141	420	0.16	0.12	0.24	3	2	5	0.7	0.4	1.1	28	21	44
	Developed	528	390	819	0.58	0.47	0.81	12	9	17	2.5	2.0	3.7	70	55	101
	Dev w/ PDFs	361	253	588	0.30	0.22	0.46	7	5	11	1.5	1.1	2.4	42	31	65
	Percent Change	57	80	40	86	81	93	119	129	110	137	155	121	50	52	47

Table D-29: Predicted Average Annual Trace Metal Concentrations the Chiquita Sub-basin (Alternative B-4) (µg/L)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Chiquita Creek	Pre-Developed	665	660	669	0.47	0.58	0.39	10	11	8	1.9	2.1	1.7	82	97	71
	Developed	542	529	556	0.54	0.59	0.50	11	12	11	2.5	2.6	2.4	69	73	66
	Dev w/ PDFs	596	592	599	0.54	0.62	0.49	11	12	10	2.4	2.6	2.3	84	97	75
	Percent Change	-10	-10	-10	15	6	26	16	9	21	26	21	30	3	0	5
San Juan Creek	Pre-Developed	679	679	679	0.12	0.12	0.12	5	5	5	1.3	1.3	1.3	37	37	37
	Developed	496	495	496	0.95	0.95	0.94	17	17	17	2.9	2.9	2.9	83	84	83
	Dev w/ PDFs	549	549	549	0.39	0.39	0.40	12	12	12	2.6	2.6	2.6	44	44	45
	Percent Change	-19	-19	-19	228	223	235	146	145	146	107	107	108	20	18	22
Total Sub-basin Area	Pre-Developed	665	661	669	0.47	0.58	0.38	10	11	8	1.9	2.1	1.7	82	97	71
	Developed	537	524	550	0.59	0.63	0.55	12	13	11	2.6	2.7	2.5	71	74	68
	Dev w/ PDFs	576	571	582	0.48	0.51	0.46	12	12	11	2.5	2.6	2.4	68	71	65
	Percent Change	-13	-14	-13	3	-13	20	21	10	30	31	22	37	-17	-27	-9

Table D-30: Comparison of Predicted Trace Metals Concentrations with Water Quality Criteria and Observed In-Stream Concentrations the Chiquita Sub-basin (Alternative B-4)

Trace Metals	Predicted Average Annual Concentration[1] (µg/L)			California Toxics Rule Criteria[2] (µg/L)	Observed Range of In-Stream Concentrations[3] (µg/L)
	All Years	Dry Years	Wet Years		
Total Aluminum	576	571	582	750[4]	Not Monitored
Dissolved Cadmium	0.48	0.51	0.46	5.2	None Detected – 0.09
Dissolved Copper	12	12	11	15.9	2.1 – 4.0
Dissolved Lead	2.5	2.6	2.4	78.7	None Detected – 3.9
Dissolved Zinc	68	71	65	137	None Detected – 15.0

[1]Modeled concentration for total project developed conditions with PDFs.
[2]Hardness = 120 mg/L, minimum value of monitoring data in San Juan Creek.
[3]Mean observed in San Juan watershed stations.
[4] NAWQC criteria for pH 6.5 – 9.0.

D-2.1.3 Findings of Significance

Hydrologic Conditions of Concern and Significance Thresholds

The following discusses the implications of the flow duration and water balance results on the hydrologic conditions of concern.

1. Increase Stormwater Runoff Volumes, Peak Discharges, and Flow Duration

Significance Threshold A: Substantially alter the existing drainage pattern of the site or area, including alteration of the course of a stream or river, in a manner that would cause substantial erosion or siltation.

The WQMP was designed specifically to preserve and protect the existing drainage patterns in the main stem of Chiquita Creek and in side canyon tributaries. Specifically, WQMP facilities will be located to the extent feasible in the upper ends of the side canyons and will be operated to mimic the current conditions in the tributary channels. Drainage patterns will be altered within the development bubble where drainage infrastructure will be provided; however, drainage swales or other more natural drainage features will be utilized to the extent feasible.

Significance Threshold B: Substantially increase the frequencies or duration of channel adjusting flows.

Changes in the frequency and duration of flows were analyzed for each development bubble with the aid of the EPA SWMM Model. The combined control system for each development bubble was sized and configured to match, to the extent possible, the flow durations over the entire range of predicted flows, including flows up to and beyond the 10 year peak flow event. If flow duration is matched, peak flows are also matched. A water balance was conducted that took into account the effects of anticipated irrigation and the operation of the PDFs. The results of the water balance indicated that surface water runoff volume to Chiquita Creek would increase slightly over the pre-developed condition, but in absolute terms, the predicted increase is less than changes associated with climatic conditions. On this basis, the effect of the proposed development in Cañada Chiquita on flow duration and volume within the range of channel adjusting flows is determined to be less than significant.

2. Decreased Infiltration and Groundwater Recharge

Significance Threshold A: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge that would cause a net deficit in aquifer volumes or lowering of the local groundwater table.

The significance threshold for this hydrologic condition of concern is a reduction in post-development infiltration volumes over pre-development infiltration volumes that would cause a significant reduction in groundwater recharge. The water balance indicates that infiltration volumes will likely increase over pre-development conditions, the extent of which will depend on whether it is a wet or dry cycle. On this basis, the impact of the proposed project on decreasing infiltration and groundwater recharge is considered less than significant.

3. Change in Base Flow

Significance Criteria A: Substantially increase or decrease base flows as to negatively impact riparian habitat.

A comparison of the water balance results with observed base flow observations indicated that base flows were projected to increase by about 200 acre-ft/yr. This increase in base flows was determined to be potentially beneficial in terms of improving the health of existing vegetation or providing for additional riparian habitat. To the extent that such increases could affect San Juan Creek, additional water could potentially provide additional habitat for the arroyo toad during the sensitive breeding season.

Significance Threshold B: Substantially increase or decrease low flow estimates where high groundwater elevations are considered important.

Sustaining high groundwater elevations are important where riparian vegetation depends upon ground water within two to ten feet of the ground surface, and where ground water is pumped for water supply. High ground water is particularly important where sustaining both uses, concurrently and conjunctively, as is the case in lower San Juan Creek. The projected increases in base flow, although modest on the scale of the San Juan watershed, can add substantially to the reliability of recharge during dry years, helping to sustain riparian vegetation in areas where it is critical to bank stability within the cities of San Juan Capistrano and Capistrano Beach.

Additionally, more reliable recharge and recharge earlier in the season will allow more effective development of ground water from the downstream alluvial aquifer of lower San Juan Creek by enabling pumping earlier in the winter, during drier years when recharge might otherwise be minimal, and by diluting with fresher recharge the concentrated salts introduced into the aquifer from leaching of local bedrock.

Pollutants of Concern

The following are the conclusions regarding the significance of impacts for the pollutants of concern under wet and dry weather conditions.

Sediments: Mean total suspended solids concentrations are predicted to be less in the post development condition than in the existing conditions because of the stabilization associated with urban landscaping and paving. In order to preserve the coarse sediment supply, water treatment facilities are designed to capture and treat runoff from the developed portions of the B-4 alternative which would tend to generate finer solids, and to bypass larger flows that are more likely to carry coarser sediments needed to maintain a stable equilibrium in the main stem channel. On this basis the impact of the B-4 alternative on suspended sediments is considered less than significant.

Nutrients (Nitrogen and Phosphorous): The local geology results in relatively high background phosphorous concentrations and suggests that the systems are likely to be nitrogen limited. Projection of concentrations for nitrate-nitrogen, the more bioavailable form of nitrogen, indicate a reduction in concentration associated with the implementation of controls that specifically address nitrate-nitrogen. On this basis, the impact of the B-4 alternative on nutrients and algal stimulation is considered less than significant.

Trace Metals: Mean concentrations of total aluminum and dissolved cadmium, copper, lead, and zinc are predicted to increase relative to predicted concentrations under existing conditions. However, mean concentrations of aluminum, cadmium, copper, lead, and zinc are well below benchmark NAWQC and CTR criteria. On this basis, the impact of the B-4 alternative on trace metals is less than significant.

D-2.2 <u>Impact analysis for the Cañada Gobernadora Sub-Basin</u>

This section evaluates the impacts of the proposed development on pollutants of concern and hydrologic conditions of concern, taking into account the PDFs associated with the WQMP described in Chapter 4. The methods of analysis and those PDFs that are similar to those described for Chiquita Canyon in Section 5.2 are not re-iterated here.

D-2.2.1 Impacts on Hydrologic Conditions of Concern

Hydrologic Condition of Concern #1: Increased Stormwater Runoff Flow Rate, Volume, and Flow Duration

Flow Duration Analysis

Although the flow duration analysis was conducted for each catchment affected by development, the results are presented here for one example. Figure D-2 shows the results of the flow duration analysis for Catchment 3, which contains approximately 274 acres of single family residential and transportation land uses and approximately 86 acres of open space. The impervious percentage for the developed area is estimated to be about 44 percent. Also shown on the figure are the estimated 2 and 10 year return period post-development peak flows. These flows were estimated based on a frequency analysis of peak flows from the SWMM output for the 53 year rainfall record. The figure indicates that the flow controls effectively match the pre-development flow duration curve for a range of flows up to and beyond the 10 year peak flow. These results indicate that matching pre-development flow duration up to the 10 year peak flow was possible utilizing the combined control system in Catchment 3. Similar success with flow duration matching was achieved in other catchments in Gobernadora in which development is proposed.

Water Balance Analysis

The potential role of irrigation in the Gobernadora Sub-basin is illustrated in Table D-31, which compares predicted irrigation volumes with historic precipitation volumes. Table D-31 shows that irrigation effects are most pronounced during the dry summer months. Considering all years, irrigation will add about 11 percent to the overall water balance for the sub-basin as a whole. Most, if not all, of this water will be infiltrated and/or evapotranspirated in the combined control system.

The irrigation estimates then were incorporated into the SWMM modeling and SWMM results for surface runoff, evapotranspiration, and groundwater outflow were compiled in the form of annual water balances. These water balances, developed as described in Chapter 3, are tabulated for the Gobernadora Sub-basin in Tables D-31, D-32, and D-33 for all years, dry years, and wet years respectively.

Note that the effects of the existing Coto de Caza development in Upper Gobernadora and Wagon Wheel are included in the Tables D-31, D-32, and D-33.

Table D-34 isolates the effects of Coto de Caza from that of the proposed development in Lower Gobernadora. As shown in Table D-34, the model predictions indicate that current runoff from Coto de Caza is about 1,378 acre-ft compared to an estimated 258 acre-ft from the catchments below Coto de Caza. Thus runoff from Coto de Caza is predicted to currently contribute about 85 percent of the sub-basin surface flow.

Table D-34 also isolates the effect of the proposed development. The effect of the proposed development on sub-basin hydrology can be examined by comparing the mean annual values of runoff and groundwater outflow for the "post-development with PDFs" condition with the pre-development condition. For all years, which was the period used for sizing the control facilities, the surface runoff is predicted to remain essentially unchanged.

The Gobernadora Multi-purpose Basin, presently under consideration, is intended to improve hydrologic and water quality conditions in Lower Gobernadora Creek and San Juan Creek. A conceptual layout for these facilities, developed by Balance Hydrologics, calls for approximately a 400 acre-foot basin with a four day drain time. Water from the basin would be pumped to a non-domestic water supply reservoir. The operation of the basin was modeled in SWMM for the 53 year period of record. A water balance for existing conditions (no facility) and with the Multi-purpose Basin are presented in Table D-35. The table indicates that for all of the 53 year period of record, the basin would reduce surface runoff to lower Gobernadora from an estimated 3.4 inches (1378 acre-ft/yr) to 0.4 inches (161 acre-ft/yr) or approximately 90 percent. Expressed a different way, runoff volume entering lower Gobernadora would be reduced from about 23 percent of precipitation to about 3 percent of precipitation, corresponding approximately to pre-urban conditions. Water from the Gobernadora Multi-purpose Basin would be pumped to a non-domestic water supply reservoir. The reservoir operation was not modeled, and the assumption is that demand for non-domestic water and reservoir capacity would not constrain pumping from the Multi-purpose Basin.

Hydrologic Condition of Concern #2: Decreased Infiltration and Groundwater Recharge

Given the reliance on infiltration in the combined control system, changes to groundwater infiltration and outflow are more pronounced. As indicated in Table D-34, groundwater outflow from the development in lower Gobernadora is predicted to increase from 847 acre-ft under existing conditions to 1,140 acre-ft under the developed condition for an increase of about 300 acre-ft or about 35 percent. The corresponding increase for dry years is about 290 acre-ft or 50 percent, and 309 acre-ft or 21 percent during the wet years. The largest effect is therefore during the dry years.

The projected increase in groundwater infiltration and outflows will not reduce recharge, but would increase recharge instead. However, groundwater levels are already high near the mouth of Cañada Gobernadora because of the apparent groundwater barrier. There is concern that these levels would prevent groundwater infiltration in these areas. If this were the case, other options, such as diversion of excess runoff directly to San Juan Creek would be considered and would be provided for as part through the adaptive management program.

Hydrologic Condition of Concern #3: Changed Base Flows

The increase in infiltration and groundwater outflow leads to increases in base flows. As discussed above, the increase in base flows would be about 300 acre-ft which would constitute an increase of about 50 percent during dry years and about 20 percent during wet years.

Analysis of vegetation in the GERA indicates that additional water could improve the condition of riparian vegetation in the GERA. The additional water could also possibly be used to increase the riparian habitat if the erosion effects caused by surface and subsurface flows from existing upstream development can be reduced by the proposed Gobernadora Multi-Purpose Basin (if constructed).

If increases in base flows were determined to be detrimental, the proposed Gobernadora Multi-purpose Basin also could be used to reduce base flow contributions from Coto de Caza to offset increases in lower Gobernadora associated with the proposed development. A second alternative, as discussed above, would involve routing excess flows directly to San Juan Creek, thereby reducing or eliminating the need for infiltration, at least in those catchments in lower Gobernadora close to San Juan Creek. This management option would also be a management measure that could be employed if the proposed Gobernadora Multi-purpose Basin is not constructed.

Table D-31: Gobernadora Sub-basin Water Balance*, All Years (Alternative B-4) (inches (acre-ft))

	Pre-Development[1]						Post-Development with PDFs[2]							
	INFLOW	OUTFLOW					INFLOW			OUTFLOW				
	Precipitation	Runoff to Gobernadora Creek	Runoff to San Juan Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Gobernadora Creek	Runoff to San Juan Creek	GW Outflow	ET	Total
OCT	0.3 (172)	0.0 (16)	0.0 (0)	0.2 (116)	0.3 (185)	0.5 (317)	0.3 (171)	0.1 (64)	0.4 (235)	0.0 (16)	0.0 (2)	0.2 (125)	0.4 (245)	0.7 (388)
NOV	1.5 (891)	0.2 (131)	0.0 (0)	0.2 (103)	0.5 (267)	0.9 (501)	1.5 (888)	0.0 (27)	1.6 (915)	0.2 (135)	0.0 (13)	0.2 (135)	0.5 (282)	1.0 (565)
DEC	2.0 (1175)	0.3 (193)	0.0 (0)	0.2 (111)	0.5 (289)	1.0 (593)	2.0 (1172)	0.0 (20)	2.0 (1192)	0.3 (196)	0.0 (18)	0.3 (164)	0.5 (284)	1.1 (662)
JAN	3.4 (1974)	0.6 (376)	0.0 (0)	0.3 (169)	0.6 (337)	1.5 (881)	3.4 (1969)	0.0 (16)	3.4 (1985)	0.6 (375)	0.1 (30)	0.4 (246)	0.5 (322)	1.7 (973)
FEB	3.1 (1826)	0.8 (483)	0.0 (2)	0.4 (252)	0.7 (430)	2.0 (1167)	3.1 (1821)	0.0 (12)	3.1 (1834)	0.8 (480)	0.0 (28)	0.5 (310)	0.7 (406)	2.1 (1225)
MAR	2.6 (1517)	0.5 (301)	0.0 (0)	0.6 (354)	1.0 (602)	2.1 (1258)	2.6 (1513)	0.1 (49)	2.7 (1562)	0.5 (296)	0.0 (24)	0.7 (400)	1.0 (571)	2.2 (1292)
APR	1.0 (616)	0.1 (84)	0.0 (0)	0.5 (296)	1.2 (695)	1.8 (1074)	1.0 (614)	0.2 (94)	1.2 (708)	0.1 (83)	0.0 (9)	0.5 (321)	1.1 (656)	1.8 (1069)
MAY	0.4 (206)	0.0 (19)	0.0 (0)	0.4 (237)	1.2 (676)	1.6 (932)	0.3 (205)	0.2 (122)	0.6 (327)	0.0 (19)	0.0 (3)	0.4 (250)	1.2 (678)	1.6 (950)
JUN	0.1 (73)	0.0 (5)	0.0 (0)	0.3 (188)	0.9 (539)	1.2 (732)	0.1 (73)	0.2 (146)	0.4 (218)	0.0 (5)	0.0 (1)	0.3 (194)	1.1 (644)	1.4 (844)
JUL	0.0 (17)	0.0 (1)	0.0 (0)	0.3 (166)	0.7 (384)	0.9 (551)	0.0 (17)	0.3 (150)	0.3 (166)	0.0 (1)	0.0 (0)	0.3 (169)	0.9 (528)	1.2 (698)
AUG	0.1 (60)	0.0 (6)	0.0 (0)	0.2 (145)	0.5 (274)	0.7 (426)	0.1 (59)	0.2 (140)	0.3 (199)	0.0 (7)	0.0 (1)	0.3 (150)	0.7 (407)	1.0 (564)
SEP	0.3 (183)	0.0 (22)	0.0 (0)	0.2 (125)	0.3 (201)	0.6 (348)	0.3 (182)	0.2 (101)	0.5 (283)	0.0 (22)	0.0 (2)	0.2 (133)	0.5 (294)	0.8 (452)
Total	**14.8 (8708)**	**2.8 (1636)**	**0.0 (2)**	**3.9 (2262)**	**8.3 (4879)**	**14.9 (8780)**	**14.8 (8685)**	**1.6 (940)**	**16.4 (9625)**	**2.8 (1635)**	**0.2 (132)**	**4.4 (2598)**	**9.1 (5317)**	**16.5 (9682)**

* Includes effects of Coto de Caza
[1]Pre-development sub-basin area = 7049 acres. Volumes given are inches over the sub-basin area.
[2]Post-development sub-basin area = 7033 acres. Volumes given are inches over the sub-basin area.

Table D-32: Gobernadora Sub-basin Water Balance*, Dry Years (Alternative B-4) (inches (acre-ft))

	Pre-Development[1]						Post-Development with PDFs[2]							
	INFLOW	OUTFLOW					INFLOW			OUTFLOW				
	Precipitation	Runoff to Gobernadora Creek	Runoff to San Juan Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Gobernadora Creek	Runoff to San Juan Creek	GW Outflow	ET	Total
OCT	0.3 (172)	0.0 (15)	0.0 (0)	0.1 (85)	0.3 (202)	0.5 (302)	0.3 (172)	0.1 (63)	0.4 (235)	0.0 (16)	0.0 (2)	0.2 (95)	0.4 (258)	0.6 (371)
NOV	1.6 (961)	0.2 (143)	0.0 (0)	0.1 (76)	0.5 (284)	0.9 (503)	1.6 (959)	0.0 (27)	1.7 (985)	0.3 (147)	0.0 (14)	0.2 (112)	0.5 (296)	1.0 (570)
DEC	2.1 (1245)	0.4 (206)	0.0 (0)	0.1 (86)	0.5 (299)	1.0 (591)	2.1 (1242)	0.0 (20)	2.2 (1262)	0.4 (209)	0.0 (19)	0.2 (142)	0.5 (291)	1.1 (662)
JAN	2.5 (1469)	0.4 (252)	0.0 (0)	0.2 (104)	0.6 (324)	1.2 (680)	2.5 (1465)	0.0 (16)	2.5 (1481)	0.4 (255)	0.0 (23)	0.3 (172)	0.5 (309)	1.3 (758)
FEB	2.2 (1280)	0.4 (234)	0.0 (0)	0.2 (130)	0.7 (401)	1.3 (764)	2.2 (1277)	0.0 (12)	2.2 (1289)	0.4 (230)	0.0 (19)	0.3 (186)	0.6 (374)	1.4 (810)
MAR	1.7 (1012)	0.3 (148)	0.0 (0)	0.3 (183)	1.0 (587)	1.6 (917)	1.7 (1009)	0.1 (50)	1.8 (1059)	0.2 (142)	0.0 (16)	0.4 (226)	0.9 (554)	1.6 (938)
APR	1.1 (638)	0.2 (88)	0.0 (0)	0.3 (168)	1.2 (714)	1.7 (970)	1.1 (637)	0.2 (94)	1.2 (730)	0.1 (88)	0.0 (9)	0.3 (198)	1.2 (677)	1.7 (972)
MAY	0.3 (204)	0.0 (16)	0.0 (0)	0.2 (137)	1.2 (707)	1.5 (859)	0.3 (203)	0.2 (121)	0.6 (324)	0.0 (16)	0.0 (3)	0.3 (152)	1.2 (711)	1.5 (882)
JUN	0.1 (53)	0.0 (3)	0.0 (0)	0.2 (111)	1.0 (566)	1.2 (680)	0.1 (52)	0.2 (146)	0.3 (198)	0.0 (3)	0.0 (1)	0.2 (119)	1.2 (677)	1.4 (799)
JUL	0.0 (22)	0.0 (1)	0.0 (0)	0.2 (100)	0.7 (435)	0.9 (536)	0.0 (22)	0.3 (150)	0.3 (171)	0.0 (1)	0.0 (0)	0.2 (106)	1.0 (578)	1.2 (685)
AUG	0.1 (67)	0.0 (8)	0.0 (0)	0.2 (89)	0.5 (297)	0.7 (394)	0.1 (67)	0.2 (140)	0.4 (206)	0.0 (8)	0.0 (1)	0.2 (96)	0.7 (429)	0.9 (533)
SEP	0.3 (173)	0.0 (21)	0.0 (0)	0.1 (78)	0.4 (212)	0.5 (310)	0.3 (173)	0.2 (101)	0.5 (274)	0.0 (21)	0.0 (2)	0.1 (88)	0.5 (304)	0.7 (416)
Total	**12.4 (7297)**	**1.9 (1133)**	**0.0 (0)**	**2.3 (1346)**	**8.6 (5027)**	**12.8 (7507)**	**12.4 (7277)**	**1.6 (939)**	**14.0 (8217)**	**1.9 (1137)**	**0.2 (110)**	**2.9 (1690)**	**9.3 (5458)**	**14.3 (8394)**

*Includes effects of Coto de Caza

[1]Pre-development sub-basin area = 7049 acres. Volumes given are inches over the sub-basin area.

[2]Post-development sub-basin area = 7033 acres. Volumes given are inches over the sub-basin area.

Table D-33: Gobernadora Sub-basin Water Balance*, Wet Years (Alternative B-4) (inches (acre-ft))

	Pre-Development[1]						Post-Development with PDFs[2]							
	INFLOW	OUTFLOW					INFLOW			OUTFLOW				
	Precipitation	Runoff to Gobernadora Creek	Runoff to San Juan Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Gobernadora Creek	Runoff to San Juan Creek	GW Outflow	ET	Total
OCT	0.3 (171)	0.0 (17)	0.0 (0)	0.3 (182)	0.3 (151)	0.6 (350)	0.3 (170)	0.1 (64)	0.4 (234)	0.0 (17)	0.0 (2)	0.3 (189)	0.4 (217)	0.7 (426)
NOV	1.3 (741)	0.2 (106)	0.0 (0)	0.3 (158)	0.4 (232)	0.8 (496)	1.3 (739)	0.0 (27)	1.3 (766)	0.2 (110)	0.0 (11)	0.3 (184)	0.4 (252)	0.9 (556)
DEC	1.7 (1027)	0.3 (166)	0.0 (0)	0.3 (163)	0.5 (268)	1.0 (597)	1.7 (1024)	0.0 (20)	1.8 (1044)	0.3 (167)	0.0 (16)	0.4 (210)	0.5 (268)	1.1 (662)
JAN	5.2 (3045)	1.1 (638)	0.0 (0)	0.5 (307)	0.6 (362)	2.2 (1307)	5.2 (3037)	0.0 (16)	5.2 (3053)	1.1 (628)	0.1 (46)	0.7 (404)	0.6 (350)	2.4 (1428)
FEB	5.1 (2983)	1.7 (1010)	0.0 (6)	0.9 (510)	0.8 (492)	3.4 (2019)	5.1 (2975)	0.0 (12)	5.1 (2987)	1.7 (1008)	0.1 (47)	1.0 (573)	0.8 (474)	3.6 (2104)
MAR	4.4 (2585)	1.1 (627)	0.0 (0)	1.2 (718)	1.1 (635)	3.4 (1980)	4.4 (2579)	0.1 (48)	4.5 (2627)	1.1 (623)	0.1 (42)	1.3 (770)	1.0 (607)	3.5 (2041)
APR	1.0 (568)	0.1 (75)	0.0 (0)	1.0 (566)	1.1 (655)	2.2 (1296)	1.0 (566)	0.2 (95)	1.1 (662)	0.1 (73)	0.0 (8)	1.0 (581)	1.0 (613)	2.2 (1275)
MAY	0.4 (209)	0.0 (25)	0.0 (0)	0.8 (451)	1.0 (611)	1.8 (1087)	0.4 (209)	0.2 (123)	0.6 (332)	0.0 (25)	0.0 (3)	0.8 (457)	1.0 (608)	1.9 (1094)
JUN	0.2 (116)	0.0 (10)	0.0 (0)	0.6 (352)	0.8 (482)	1.4 (843)	0.2 (116)	0.2 (146)	0.4 (262)	0.0 (10)	0.0 (1)	0.6 (353)	1.0 (575)	1.6 (941)
JUL	0.0 (6)	0.0 (0)	0.0 (0)	0.5 (306)	0.5 (275)	1.0 (581)	0.0 (6)	0.3 (150)	0.3 (156)	0.0 (0)	0.0 (0)	0.5 (305)	0.7 (422)	1.2 (727)
AUG	0.1 (44)	0.0 (4)	0.0 (0)	0.4 (264)	0.4 (225)	0.8 (493)	0.1 (44)	0.2 (140)	0.3 (183)	0.0 (4)	0.0 (1)	0.5 (264)	0.6 (359)	1.1 (628)
SEP	0.3 (202)	0.0 (24)	0.0 (0)	0.4 (223)	0.3 (180)	0.7 (427)	0.3 (202)	0.2 (101)	0.5 (302)	0.0 (24)	0.0 (3)	0.4 (229)	0.5 (272)	0.9 (528)
Total	**19.9 (11697)**	**4.6 (2701)**	**0.0 (7)**	**7.2 (4201)**	**7.8 (4567)**	**19.5 (11475)**	**19.9 (11666)**	**1.6 (943)**	**21.5 (12609)**	**4.6 (2691)**	**0.3 (180)**	**7.7 (4520)**	**8.6 (5018)**	**21.2 (12408)**

* Includes effects of Coto de Caza

[1] Pre-development sub-basin area = 7049 acres. Volumes given are inches over the sub-basin area.

[2] Post-development sub-basin area = 7033 acres. Volumes given are inches over the sub-basin area.

Table D-34: Gobernadora Sub-basin Average Annual Water Balance, Upper/Lower Sub-basin (Alternative B-4) (all values are acre-ft)

Development Condition	Portion of Sub-basin	All Years					Dry Years					Wet Years				
		Runoff to Gobern.	Runoff to SJC	GW flow to Gobern.	GW flow to SJC	ET Total	Runoff to Gobern.	Runoff to SJC	GW flow to Gobern.	GW flow to SJC	ET Total	Runoff to Gobern.	Runoff to SJC	GW flow to Gobern.	GW flow to SJC	ET Total
Pre-Development	Coto de Caza/ Wagon Wheel	1378	0	1302	0	3477	972	0	708	0	3615	2237	0	2561	0	3185
	Lower Gobernadora	258	2	847	112	1403	161	0	580	58	1412	464	7	1411	228	1382
	Total Sub-basin	1636	2	2149	112	4879	1133	0	1288	58	5027	2701	7	3972	228	4567
Post-Development With PDFs	Coto de Caza/ Wagon Wheel	1378	0	1302	0	3477	972	0	708	0	3615	2237	0	2561	0	3185
	Lower Gobernadora	257	132	1140	155	1840	164	110	867	116	1843	454	180	1720	239	1833
	Total Sub-basin	1635	132	2442	155	5317	1137	110	1574	116	5458	2691	180	4281	239	5018

Table D-35: Effectiveness of Gobernadora Multi-purpose Basin (Alternative B-4) (inches (acre-ft))

Climatic Period	Current Condition					Current Condition with Multi-purpose Basin					
	INFLOW	OUTFLOW				INFLOW	OUTFLOW				
	Precipitation	Runoff to Gobernadora Creek	GW Outflow	ET	Total	Precipitation	Withdrawal from Multi-purpose Basin	Runoff to Gobernadora (Bypass)	GW Outflow	ET	Total
All Years	14.9 (6108)	3.4 (1378)	3.2 (1302)	8.5 (3477)	15.1 (6157)	14.9 (6108)	3.0 (1232)	0.4 (161)	3.2 (1302)	8.5 (3485)	15.1 (6180)
Dry Years	12.5 (5119)	2.4 (972)	1.7 (708)	8.8 (3615)	12.9 (5295)	12.5 (5119)	2.2 (901)	0.1 (28)	1.7 (708)	8.9 (3622)	12.9 (5259)
Wet Years	20.1 (8203)	5.5 (2237)	6.3 (2561)	7.8 (3185)	19.5 (7983)	20.1 (8203)	4.7 (1933)	1.1 (443)	6.3 (2561)	7.8 (3185)	19.9 (8122)

D-2.2.2 Impacts on Pollutants of Concern

The section presents the water quality modeling results used to address impacts of stormwater runoff on sediments, nutrients, and trace metals. The modeling analysis has been described in Chapter 3. In order to isolate the effects of the proposed development, the model results do not include the effects of existing development in Wagon Wheel and Coto de Caza. However, as indicated in the water balance discussion, the effect of runoff from existing upstream development is likely to dominate water quality conditions in Lower Gobernadora.

TSS Loads and Concentrations

Table D-36 summarizes TSS loads and concentrations and shows the percent change associated with the proposed development. During wet years, the mean annual load to Gobernadora Creek, post-development with controls, is estimated to be about 71 tons, which is a decrease of about 45 percent over pre-development conditions. During dry years, the mean annual load is predicted to be 20 tons, which is about 55 percent lower than the pre-development condition. The reduction in TSS loads is typical of development, which has the effect of stabilizing soils with vegetation and covering soils with impervious surfaces.

Catchment 1 (just east of Chiquadora Ridge) is located on the western side and near the mouth of the Gobernadora Sub-basin. It is the only catchment in Gobernadora that currently discharges directly into San Juan Creek. The TSS loads to San Juan Creek from Catchment 1 are predicted to increase dramatically as the current runoff from this catchment into San Juan Creek is predicted to be only about 2 acre-ft/yr because of the infiltrative soil conditions. With development, the runoff volume is projected to increase to 132 acre-feet per year post-development with PDFs. So, although the TSS concentration is predicted to decrease by approximately 80 percent, the load will increase. It is important however to consider this increase in an absolute sense rather than as a percentage increase because, as just discussed, the projected pre-development loads are very small. Therefore any increase is large as a percent. In absolute terms, the additional sediment loads to the San Juan Creek will be quite small in comparison to sediment transport in San Juan Creek.

Table D-37 shows the mean annual TSS concentration of 91 mg/L for the total project area during wet years and how it compares with water quality criteria and observed concentrations. The criterion for TSS in the San Diego Basin Plan is narrative and states that “levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors”. The combined control system is designed to detain and infiltrate 80 to 90 percent of the runoff and would address urban particulates containing other pollutants. The range of observed TSS data collected by Wildermuth at the four stations in the San Juan watershed was 368 to 1,372 mg/L, so the projected mean TSS concentration in the runoff is less than the range of observed data.

In summary, projected runoff loads and concentrations into Gobernadora Creek will decrease and will be less than observed instream concentrations reported by Wildermuth. For Catchment

1, which currently drains directly to San Juan Creek, loads will increase because under current conditions very little runoff is projected to discharge from this catchment. Nonetheless, the load from Catchment 1 is quite small compared to the large sediment flux carried by the San Juan system.

Table D-36: Predicted Average Annual TSS Loads and Concentrations for the Gobernadora Sub-basin (Alternative B-4)

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gobernadora Creek	Pre-Developed	71	44	128	224	224	224
	Developed	80	56	131	130	120	139
	Dev w/ PDFs	36	20	71	115	99	128
	Percent Change	-49	-55	-45	-48	-56	-43
San Juan Creek	Pre-Developed	0.7	0.1	1.9	224	224	224
	Developed	18.8	15.6	25.7	114	113	115
	Dev w/ PDFs	7.0	5.4	10.4	43	40	47
	Percent Change	952	6447	446	-81	-82	-79
Total Sub-basin Area	Pre-Developed	72	44	130	224	224	224
	Developed	99	71	157	126	119	134
	Dev w/ PDFs	43	25	81	91	75	105
	Percent Change	-40	-43	-38	-60	-66	-53

Table D-37: Comparison of Predicted TSS Concentration with Water Quality Objectives and Observed In-Stream Concentrations for the Gobernadora Sub-basin

Predicted Average Annual TSS Concentration[1] (mg/L)	San Diego Basin Plan Water Quality Objectives	Range of Observed In-stream Concentrations[2] (mg/L)
91	TSS levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors	None Detected – 3,100

[1]Modeled concentration for total project developed conditions with PDFs in wet years.
[2]Range of means observed at four San Juan watershed stations during the wet years.
NA – not applicable

Nutrient Loads and Concentrations

Table D-38 summarizes nutrient loads and shows percent changes for all years, dry years, and wet years respectively, for each receiving water. Nitrate loads to Gobernadora Creek for development with PDFs range from about 276 lbs/yr during dry years to 930 lbs/yr during wet years, a decrease of about 36 to 46 percent. Mean annual TKN loads are projected to be about 824 lbs/yr during dry years and 2,260 lbs/yr during wet years, an increase of about 84 to 93 percent.

Table D-39 summarizes nutrient concentrations and shows percent changes for all years, dry years, and wet years respectively, for each receiving water. Mean annual TKN concentrations in discharges to Gobernadora Creek from development with PDFs are predicted to be about 1.8 mg/L during all conditions. In comparison, Wildermuth found in-stream TKN to be between 0.7 and 2.9 (Table D-40). Mean annual concentrations of nitrate-nitrogen are predicted to be about 0.8 mg/L during wet years and about 0.6 mg/L during dry years. Total phosphorus loads are predicted to increase with development, but the addition of controls reduced the increase in loads such that during the wet years the predicted load in discharges to Gobernadora Creek from development with PDFs is 331 lbs/yr, which is about a 112 percent increase over pre-development loads. During dry years, the mean annual load is predicted to be about 125 lbs/yr, which is about 130 percent greater than pre-development conditions.

As with Cañada Chiquita (Section 5.2), these predicted increases may be inflated because the existing runoff of total phosphorus is based on relatively low concentration of 0.27 mg/L derived from the vacant land use station in the LA County database. Local geology suggests that concentrations in the runoff from undeveloped portions of the sub-basin could be higher.

Table D-40 shows a comparison of the average annual concentrations of nutrients with observed data from Wildermuth. The water quality concern here is excessive algal growth. The Basin Plan narrative objective is “Concentrations of nitrogen and phosphorous, by themselves or in combination with other nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth." As discussed earlier for the Chiquita Sub-basin, the systems appear to be nitrogen limited, and the loads and concentrations of the more bioavailable form of nitrogen, namely nitrate-nitrogen, are projected to decrease with development. Moreover, the combined control system includes constructed wetlands for treating dry weather flows and small storm flows. Runoff concentrations associated with larger events, that may only receive partial treatment, would benefit from dilution.

For the discharges to San Juan Creek from the "Chiquadora Catchment" (Catchment 1), the percent increases in nutrient loads are high because pre-development runoff from this catchment is predicted to be quite small. The increase in loads to a large system like San Juan Creek are less important than the effect on concentrations, which as discussed above are projected to be less than or in the lower range of observed concentrations in San Juan Creek.

Table D-38: Predicted Average Annual Nutrient Loads for the Gobernadora Sub-basin (lbs)

Modeled Area	Site Condition	Nitrate-N Load			TKN Load			Total Phosphorus Load		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gobernadora Creek	Pre-Developed	815	508	1465	684	427	1230	87	54	156
	Developed	1096	785	1753	3093	2439	4479	441	350	635
	Dev w/ PDFs	486	276	930	1285	824	2260	191	125	331
	Percent Change	-40	-46	-36	88	93	84	120	130	112
San Juan Creek	Pre-Developed	8	1.0	22	6	0.8	18	1	0.1	2
	Developed	276	229	377	1031	859	1396	145	121	196
	Dev w/ PDFs	125	99	181	619	501	870	101	82	140
	Percent Change	1536	10303	729	9557	62830	4652	12258	81181	5913
Total Sub-basin Area	Pre-Developed	823	509	1486	691	428	1248	88	54	158
	Developed	1372	1014	2130	4124	3298	5875	586	470	830
	Dev w/ PDFs	611	375	1111	1904	1325	3130	291	207	471
	Percent Change	-26	-26	-25	176	210	151	232	281	197

Table D-39: Predicted Average Annual Nutrient Concentrations for the Gobernadora Sub-basin (mg/L)

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			Total Phosphorus Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gobernadora Creek	Pre-Developed	1.2	1.2	1.2	1.0	1.0	1.0	0.1	0.1	0.1
	Developed	0.8	0.8	0.8	2.3	2.4	2.2	0.3	0.3	0.3
	Dev w/ PDFs	0.7	0.6	0.8	1.9	1.9	1.9	0.3	0.3	0.3
	Percent Change	-39	-46	-34	91	91	90	123	128	119
San Juan Creek	Pre-Developed	1.2	1.2	1.2	1.0	1.0	1.0	0.1	0.1	0.1
	Developed	0.8	0.8	0.8	2.8	2.8	2.8	0.4	0.4	0.4
	Dev w/ PDFs	0.4	0.3	0.4	1.7	1.7	1.8	0.3	0.3	0.3
	Percent Change	-70	-72	-68	77	72	83	126	122	131
Total Sub-basin Area	Pre-Developed	1.2	1.2	1.2	1.0	1.0	1.0	0.1	0.1	0.1
	Developed	0.8	0.8	0.8	2.4	2.5	2.3	0.4	0.4	0.3
	Dev w/ PDFs	0.6	0.5	0.7	1.8	1.8	1.8	0.3	0.3	0.3
	Percent Change	-50	-56	-44	86	84	88	124	126	122

Table D-40: Comparison of Predicted Nutrient Concentrations with Observed In-Stream Concentrations for the Gobernadora Sub-basin

Nutrient	Predicted Average Annual Concentration[1] (mg/L)			Observed Range of In-Stream Concentrations[2] (mg/L)
	All Years	Dry Years	Wet Years	
Nitrate	0.6	0.5	0.7	0.15 – 1.5

TKN	1.8	1.8	1.8	None Detected – 3.0
Total Phosphorus	0.3	0.3	0.3	None Detected – 2.8

[1]Modeled concentration for developed conditions with PDFs in wet years.
[2]Range of means observed at four San Juan watershed stations during the wet years.
NA – not applicable

Trace Metals

Tables D-41 and D-42 show the predicted mean annual loads and mean annual concentrations for aluminum, cadmium, copper, lead, and zinc for the three development scenarios and for the three climatic conditions. Except for aluminum, the concentrations are all in the dissolved form, which is the form of the California Toxics Rule water quality criteria.

Aluminum

The National Ambient Water Quality Criteria (NAWQC) acute value of 750 µg/L within the pH range of 6.5 to 9.0 was used for comparison, as the CTR does not include aluminum. The range of pH values observed by Wildermuth within the San Juan Creek watershed was 8.1 – 8.6, which indicates that the pH range is suitable for application of the NAWQC criteria. For the wet years, the mean annual concentration in discharges to Gobernadora Creek is predicted to range from 679 µg/L under pre-development conditions to 584 µg/L under developed with controls, a reduction of about 14 percent. During dry years, the post-development concentration with PDFs is predicted to be about 572 µg/L. This information would suggest that the mean aluminum concentration is likely not to exceed the NAWQA criteria in this sub-basin.

Table D-43 compares the predicted trace metals concentrations with water quality criteria and observed data. The criteria for selected metals varies depending on hardness. A hardness value of 120 mg/L, which corresponds to the minimum observed in-stream hardness reported by Wildermuth, was used in estimating the criteria in Table D-43. Thus the criteria are very conservative, i.e., likely represent a lower bound. In wet years under the developed with controls scenario, the mean annual concentrations in discharges from the total project area are: cadmium 0.33 µg/L, copper 9.5 µg/L, lead 2.9 µg/L, and zinc 40 µg/L. The corresponding range in mean values for the four stations in the San Juan watershed monitored by Wildermuth are: cadmium 0.06 - 0.12 µg/L, copper 1.6 - 5.5 µg/L, lead 0.17 - 0.91 µg/L, and zinc 3.9 - 10.4 µg/L. All values are for the dissolved phase. The predicted concentrations tend to be somewhat higher than the monitored in-stream data, which may reflect the higher TSS levels in the stream. TSS levels affect the geochemical partitioning between the dissolved and particulate phases. Specifically, higher TSS values may decrease the dissolved fraction of trace metals and increase the particulate fraction. Table D-43 also indicates that the predicted concentrations are all well below the CTR criteria.

Table D-41: Predicted Average Annual Trace Metal Loads for the Gobernadora Sub-basin (lbs)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gobernadora Creek	Pre-Developed	476	297	856	0.1	0.1	0.2	3.5	2.2	6.3	0.9	0.6	1.6	26	16	46
	Developed	731	533	1150	0.5	0.4	0.7	13.9	11.0	20.1	4.8	3.8	6.9	66	50	97
	Dev w/ PDFs	400	252	712	0.2	0.1	0.4	6.4	4.2	11.1	2.0	1.3	3.6	28	18	50
	Percent Change	-16	-15	-17	164	176	155	83	93	76	133	141	126	8	9	7
San Juan Creek	Pre-Developed	4.5	0.6	12.7	0.01	0	0	0	0.1	0.03	0.01	0	0.02	0.2	0.03	0.7
	Developed	199	165	271	0.13	0.1	0.2	3.2	5.3	3.9	1.7	1.4	2.3	14	12	19
	Dev w/ PDFs	196	163	267	0.13	0.1	0.2	3.2	5.2	3.8	1.0	0.8	1	14	11	19
	Percent Change	4294	29247	1997	16140	108886	7600	77878	5422	11531	12276	80429	6002	5597	38013	2612
Total Sub-basin Area	Pre-Developed	481	298	868	0.08	0.05	0.2	3.5	2.2	6.40	0.9	0.6	2	26	16	47
	Developed	930	698	1421	0.7	0.5	0.9	17.8	14.2	25.40	6.5	5.2	9	79	62	116
	Dev w/ PDFs	596	415	979	0.4	0.3	0.6	10.3	7.4	16.3	3.1	2.1	5	42	29	68
	Percent Change	24	39	13	312	378	264	189	238	154	245	291	212	60	80	45

Table D-42: Predicted Average Annual Trace Metal Concentrations for the Gobernadora Sub-basin (µg/L)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gobernadora Creek	Pre-Developed	679	679	679	0.1	0.1	0.1	5.0	5.0	5.0	1.3	1.3	1.3	37	37	37
	Developed	537	522	551	0.4	0.4	0.4	10.2	10.7	9.7	3.5	3.7	3.3	48	49	47
	Dev w/ PDFs	578	572	584	0.3	0.3	0.3	9.3	9.6	9.1	3.0	3.0	2.9	40	40	40
	Percent Change	-15	-16	-14	168	173	163	86	92	82	136	139	134	10	8	11
San Juan Creek	Pre-Developed	679	679	679	0.12	0.12	0.12	5.00	5.00	5.00	1.25	1.25	1.25	37	37	37
	Developed	546	545	547	0.36	0.36	0.36	10.64	10.67	10.61	4.75	4.76	4.73	38	38	38
	Dev w/ PDFs	546	545	547	0.36	0.36	0.36	10.64	10.67	10.61	2.83	2.76	2.93	38	38	38
	Percent Change	-20	-20	-19	197	198	196	113	113	112	127	120	134	4	4	4
Total Sub-basin Area	Pre-Developed	679	679	679	0.12	0.12	0.12	5.00	5.00	5.00	1.25	1.25	1.25	37	37	37
	Developed	539	528	550	0.37	0.40	0.35	10.30	10.72	9.84	3.77	3.95	3.57	46	47	45
	Dev w/ PDFs	567	561	573	0.33	0.34	0.33	9.76	10.02	9.52	2.91	2.90	2.92	40	39	40
	Percent Change	-16	-17	-16	178	183	173	95	100	90	133	132	134	8	7	9

Table D-43: Comparison of Predicted Trace Metals Concentrations with Water Quality Criteria and Observed In-Stream Concentrations for the Gobernadora Sub-basin

Trace Metals	Predicted Average Annual Concentration[1] (μg/L)			California Toxics Rule Criteria[2] (μg/L)	Observed Range of In-Stream Concentrations[3] (μg/L)
	All Years	Dry Years	Wet Years		
Total Aluminum	567	561	573	750[4]	Not Monitored
Dissolved Cadmium	0.33	0.34	0.33	5.2	None Detected – 0.09
Dissolved Copper	9.8	10.0	9.5	15.9	2.1 – 4.0
Dissolved Lead	2.9	2.9	2.9	78.7	None Detected – 3.9
Dissolved Zinc	40	39	40	137	None Detected – 15.0

[1]Modeled concentration for developed conditions with PDFs.
[2]Hardness = 120 mg/L, minimum value of monitoring data.
[3]Range of means observed at four San Juan watershed stations during the wet years.
[4] NAWQC criteria for pH 6.5 – 9.0.

D-2.2.3 Findings of Significance

Hydrologic Conditions of Concern and Significance Thresholds

The following discusses the implications of the water balance results on the hydrologic conditions of concern.

1. Increased Stormwater Runoff Flowrate, Volume and Flow Duration

Significance Threshold A: Substantially alter the existing drainage pattern of the site or area, including alteration of the course of a stream or river, in a manner that would cause substantial erosion or siltation.

The WQMP was designed specifically to preserve and protect the existing drainage patterns in the main stem of Gobernadora Creek and in side canyon tributaries. Specifically, WQMP facilities will be located to the extent feasible in the upper ends of the side canyons and will be operated to mimic the current conditions in the tributary channels. Drainage patterns will be altered within the development bubble where drainage infrastructure will be provided. However, drainage swales or other more natural drainage features will be utilized to the extent feasible.

Significance Threshold B: Substantially increase the frequencies and duration of channel adjusting flows.

Changes in the frequency and duration of flows were analyzed for each development bubble with the aid of the EPA SWMM Model. The combined control system for each development bubble was sized and configured to match, to the extent possible, the flow durations over the entire range of predicted flows, including the 2 ands 10 year peak flows. A water balance also was conducted that took into account the effects of anticipated irrigation and the operation of the BMPs. The results of the water balance indicated that surface water runoff volume to Gobernadora Creek would effectively match the pre-developed condition.

On this basis, the effect of the proposed development in Cañada Gobernadora on altering existing drainage or increasing the frequency and duration of channel adjusting flows is determined to be less than significant.

2. Decreased Infiltration and Groundwater Recharge

Significance Threshold A: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge that would cause a net deficit in aquifer volumes or lowering of the local groundwater table.

The water balance indicates that infiltration volumes will likely increase by about 300 acre-ft/yr over pre-development conditions, and therefore groundwater levels, at least in the vicinity of the proposed infiltration basins, would increase rather than decrease. On this basis, the impact of the proposed project on decreasing infiltration and groundwater recharge is considered less than significant.

However, groundwater levels are already high near the mouth of Cañada Gobernadora because of the apparent groundwater barrier. There is concern that these levels would prevent groundwater infiltration in these areas. Because of this concern, excess runoff volume would be discharged directly to San Juan Creek, or diverted to a non-domestic water supply reservoir for recycling or the nearby WWTP for reclamation.

On this basis, the potential effect of the proposed development on infiltration and groundwater recharge are considered less than significant.

3. Changed Base Flows

Significance Threshold A: Substantially increase or decrease base flows as to negatively impact riparian habitat.

The increase in infiltration and groundwater outflow leads to increases in base flows. As discussed above, the increase in base flows would be about 300 acre-ft/yr, which would constitute an increase of about 50 percent during dry years and about 20 percent during wet years. Analysis of vegetation in the GERA indicates that additional water could provide a benefit to improving the condition of riparian vegetation. The additional water could also possibly be used to increase the riparian habitat if the erosion effects caused by surface flows from existing upstream developed areas can be reduced by the Gobernadora Multi-purpose Basin (if constructed).

If increases in base flows were determined to be detrimental, the proposed Gobernadora Multi-purpose Basin also could be used to reduce base flow contributions from Coto de Caza to offset increases in lower Gobernadora associated with the proposed development. A second alternative, as discussed above, could involve routing excess flows directly to San Juan Creek thereby reducing or eliminating the need for infiltration, at least in those catchments in lower Gobernadora close to San Juan Creek. Excess base flows, especially between February and June, could improve breeding habitat for the arroyo toad and other sensitive aquatic species such at the southwestern pond turtle and arroyo chub.

Significance Threshold B: Substantially increase or decrease low flow estimates where high groundwater elevations are considered important.

To the extent that the projected increase in base flows enter San Juan Creek, the effect could potentially raise the groundwater elevations downstream, which would be beneficial to local and downstream aquatic habitats and potentially to downstream water supply pumping operations.

On this basis, the effect of the proposed development in altering base flows such as to adversely affect habitat or downstream groundwater levels for water supply purposes is considered less than significant.

Pollutants of Concern

The following are the conclusions regarding the significance of impacts for the pollutants of concern under wet conditions.

Sediments: Mean total suspended solids concentrations are predicted to be less in the post-development condition than in the existing condition. Sources of coarse sediments generated within the sandy soils of the main valley will be protected, while the development location will potentially reduce the generation of fine sediment from tributary drainage characterized by clay soils. On this basis the impact of the B-4 alternative on suspended sediments is considered less than significant.

Nutrients (Nitrogen and Phosphorous): Given the geologic sources of phosphorus, the systems appear to be nitrogen limited and the more bioavailable form of nitrogen nutrient is nitrate-nitrogen. The concentration and load of nitrate-nitrogen is predicted to decrease with development and will be within the range of observed in-stream concentrations in Gobernadora Creek. Moreover, the combined control system includes facilities such as constructed wetlands, which have been shown to be effective in treating nutrients. On this basis, the impact of the B-4 alternative on nutrients is considered less than significant.

Trace Metals: Mean concentrations of total aluminum and dissolved cadmium, copper, lead, and zinc are predicted to increase relative to predicted concentrations under existing conditions. However, mean concentrations of aluminum, cadmium, copper, lead, and zinc are well below benchmark NAWQC and CTR criteria. On this basis, the impact of the B-4 alternative on trace metals is less than significant.

D-2.3 Impact analysis for the Central San Juan and Trampas Sub-Basin

This section evaluates the effectiveness of the WQMP for the Central San Juan and Trampas Sub-basin and evaluates the impacts of the proposed development on pollutants of concern and hydrologic conditions of concern.

A distinct feature in the Trampas Sub-basin is the existing Oglebay Norton sand mining and washing facilities that include an artificial lake that serves as a tailings reservoir, a desilting pond, and a temporary storage pond. This mining operation would be discontinued with the proposed project. The impact analysis considers conditions with and without the mine in the hydrologic modeling.

D-2.3.1 Impacts on Hydrologic Conditions of Concern

Hydrologic Condition of Concern #1: Increased Stormwater Runoff Volume, Peak Discharge, and Flow Duration

Flow Duration Analysis

Although the flow duration analysis was conducted for each catchment affected by development, the results are presented here for one example. Figure D-3 shows an example of the flow duration analysis for one of the two catchments that discharge into Trampas, and the estimated 2 and 10 year peak flows. In Trampas Canyon, the flow duration analysis used the pre-mine condition (the undeveloped condition) as the baseline for matching flow duration. The catchments in Trampas Canyon have very infiltrative soils and predicted flows in the pre-mining condition were quite limited in magnitude and duration. Matching the pre-mine flow duration condition was reasonable for the more frequent flows, but difficult for infrequent higher flows. This example is provided to show one of the more difficult flow duration matching efforts.

Water Balance Analysis

The water balance analysis for Central San Juan Sub-basin was conducted for each of the planning areas as follows:

- North Central San Juan (PA 3),
- East Central San Juan (PA 4),
- South Central San Juan/Trampas Canyon (PA 5)

Planning Area 5 in South Central San Juan was subdivided into two areas in order to isolate the effects of the proposed development on Trampas Creek. This subdivision of PA 5 also allowed the evaluation of the effects of the existing Oglebay Norton sand mining and washing facilities located in upper Trampas Canyon. Because this facility has such a major effect on hydrology in Trampas Canyon, the water balance was conducted with and without the facility.

The water balance results are presented as follows:

- All years - Tables D-44 (with sand mine) and Table D-45 (without sand mine)
- Dry years - Table D-46 (with sand mine) and Table D-47 (without sand mine)
- Wet Years - Table D-48 (with sand mine) and Table D-49 (without sand mine)

Note that because of the effects of grading, the pre- and post-development areas often change. Those changes are noted at the bottom of each table. Also note that the water balance results are provided in terms of inches of runoff and acre-ft of runoff. "Inches" as a volume is interpreted as equivalent to inches of water over the tributary drainage area. When there are large changes between the pre- and post-development tributary areas, the comparison using watershed-inches can be misleading and acre-ft should be used.

The following describes the water balance results by planning area.

North Central San Juan (PA 3). The proposed drainage infrastructure for North Central San Juan would result in a direct discharge to San Juan Creek. On average (based on all years), precipitation is about 15 inches per year and current irrigation, associated primarily with the 150 acres of irrigated nurseries, is estimated to increase the net applied water to about 17.1 inches per year. With development, the additional irrigation is estimated to increase the net applied water to about 23.6 inches per year for an increase of about 38 percent (Table D-44). Runoff to San Juan Creek is projected to increase from about 228 acre-ft/yr to about 232 acre-ft/yr for an increase by about two percent. During dry years, the increase in runoff to San Juan Creek would be less than one percent (Table D-46). In summary, the level of control provided by the combined control system in this planning area is such that changes in surface water hydrology are minimal.

East Central San Juan (PA 4). The proposed drainage infrastructure for East Central San Juan also would result in a direct discharge to San Juan Creek. On average (based on all years), precipitation is about 16 inches per year with only a small contribution from irrigation. There are approximately 15 acres of nurseries in this area. With development, the additional irrigation is estimated to increase the net applied water to about 17.0 inches per year for an increase of about six percent (Table D-46). The relatively small increase in irrigation is because the planned development in PA 4 is low density estate residences. Runoff to San Juan Creek is projected to increase from about 268 acre-ft/yr to about 273 acre-ft/yr for an increase of about two percent. During dry years, the increase in runoff to San Juan Creek would be about six percent and the decrease in groundwater outflow would be about seven percent (Table D-46). So during dry years, the effects on surface runoff are more pronounced. In summary, the level of development in this planning area is such that changes in surface water hydrology are quite modest.

South Central San Juan/Trampas Canyon (PA5). The proposed development in Trampas Canyon will eliminate the sand mining operation so the water balance analysis was conducted for the following two scenarios:

- Scenario 1: "With Mine Scenario" – Pre-development with mine, post-development without mine
    - All years - Table D-44
    - Dry years - Table D-46
    - Wet years - Table D-48
- Scenario 2: "Without Mine Scenario" – Pre- and post-development without mine
    - All years - Table D-45
    - Dry years - Table D-47
    - Wet years - Table D-49

The baseline condition is selected as the "with-mine" alternative consistent with the NCCP Guidelines that require flows to be maintained at levels comparable to existing conditions. For the "with-mine" condition, the water balance results indicate that surface runoff to San Juan Creek will increase from the present condition of about 12 acre-ft/yr to about 14 acre-ft/yr for an increase of about 14 percent (Table D-44). During wet years, the surface runoff would be decreased from 29 acre-ft/yr under the existing condition to about 26 acre-ft/yr with the proposed development. This decrease of 3 acre-ft/yr is about a 10 percent reduction (Table D-48). During dry years, there is very little runoff projected for either existing or proposed conditions (Table D-46).

The proposed development in the remaining portion of PA 5 would discharge into an unnamed tributary west of Trampas Creek. The water balance for this area is given in the tables as South CSJ/PA5. For all years, the water balance indicates that the runoff to San Juan Creek would go from about 100 acre-ft/yr for the pre-developed condition to about 109 acre-ft/yr under post development, for an increase of about nine percent (Table D-44). A similar percent increase is indicated for dry conditions. The higher pre-development runoff from this area (100 acre-ft/yr) compared to Trampas is caused by the presence of clay deposits, in contrast to the sandy conditions that prevail in the Trampas catchments.

Hydrologic Condition of Concern #2: Decreased Infiltration and Groundwater Recharge

North Central San Juan (PA 3). The water balance results for North Central San Juan indicate that for all years, groundwater infiltration would increase from about 937 acre-ft/yr to about 1,614 acre-ft/yr or by approximately 73 percent. For dry years, groundwater infiltration and outflow would increase from about 674 acre-ft/yr to about 1,333 acre-ft/yr or about 98 percent (Table D-46). Thus, development is projected to increase infiltration and groundwater recharge and, similar to surface runoff, the effect is more pronounced during dry years.

East Central San Juan (PA 4). Infiltration in East Central San Juan is projected to decrease from about 972 acre-ft/yr to about 911 acre-ft/yr or approximately seven percent (Table D-44). This decrease is associated in part with a projected increase in ET caused by the elimination of the nurseries. During dry weather conditions the decrease is about 52 acre-ft/yr or about seven percent (Table D-46). These are fairly modest changes and would be more than compensated by increases in other planning areas tributary to San Juan Creek.

South Central San Juan/Trampas Canyon (PA5). In Trampas Canyon, the "with mine" water balance analysis indicates that infiltration and groundwater outflow would increase from 391 acre-ft/yr under the existing condition with the mine to about 1,085 acre-ft/yr with the proposed development (Table D-44). This corresponds to an increase of about 700 acre-ft or about 180 percent. Thus the discontinuation of the mining operation is projected to increase groundwater infiltration and outflow to Trampas Creek.

Hydrologic Condition of Concern #3: Changed Base Flows

North Central San Juan (PA 3). The water balance analysis discussed above indicates that post-development groundwater outflow will increase by about 677 acre-ft or 73 percent for all years (Table D-44) and about 659 acre-ft (98 percent) during dry years (Table D-46). This groundwater outflow would ultimately increase base flows in San Juan Creek, which would be utilized to support riparian vegetation, increase levels of the water table, or infiltrate into the channel bottom. Increased base flows in San Juan Creek will further support NCCP Guidelines recommendations addressing downstream aquatic habitat needs.

East Central San Juan (PA 4). Infiltration in East Central San Juan is projected to decrease about 61 acre-ft/yr or approximately seven percent for all years (Table D-44) and about 52 acre-ft/yr (seven percent) during dry years (Table D-46). These are fairly modest changes and would be more than compensated by increases in base flows from other planning areas tributary to San Juan Creek.

South Central San Juan/Trampas Canyon (PA5). In Trampas Canyon, the "with mine" water balance analysis indicates that groundwater outflow would increase approximately 700 acre-ft or 180 percent. Thus the discontinuation of the mining operation is projected to increase groundwater infiltration and outflow to Trampas Creek. This groundwater outflow would ultimately increase base flows in Trampas Creek, which would be utilized to support riparian vegetation, increase levels of the water table, or infiltrate into the channel bottom.

Table D-44: Central San Juan & Trampas Sub-basin, With Sand Mine, Average Annual Water Balance, All Years (inches (acre-ft))

Tributary Area	Pre-Development								Post-Development with PDFs						
	INFLOW			OUTFLOW					INFLOW			OUTFLOW			
	Precipitation	Irrigation	Total	Quarry Runoff Recirculation	Surface Runoff to Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Surface Runoff to Creek	GW Outflow	ET	Total
Lake Area[1]	16.7 (585)	0.0 (0)	16.7 (585)	2.3 (81)	0.0 (0)	7.8 (274)	6.5 (229)	16.6 (583)	-	-	-	-	-	-	-
Trampas Creek/PA5[2]	16.3 (883)	0.0 (0)	16.3 (883)	0.0 (0)	0.2 (12)	7.2 (391)	8.9 (480)	16.3 (883)	16.2 (1366)	7.7 (649)	23.9 (2015)	0.2 (14)	12.8 (1085)	10.8 (912)	23.8 (2010)
South CSJ/PA5[3]	16.1 (798)	0.0 (0)	16.1 (798)	0.0 (0)	2.0 (100)	7.4 (368)	7.0 (350)	16.5 (818)	16.3 (1005)	6.4 (392)	22.6 (1397)	1.8 (109)	11.2 (694)	9.8 (602)	22.8 (1406)
North CSJ/PA3[4]	15.0 (2005)	2.1 (284)	17.1 (2289)	0.0 (0)	1.7 (228)	7.0 (937)	8.7 (1164)	17.4 (2330)	15.4 (2177)	8.2 (1151)	23.6 (3328)	1.6 (232)	11.4 (1614)	10.6 (1492)	23.7 (3338)
East CSJ/PA4[5]	15.8 (2028)	0.2 (28)	16.0 (2056)	0.0 (0)	2.1 (268)	7.6 (972)	6.7 (859)	16.4 (2099)	15.9 (1941)	1.2 (146)	17.0 (2087)	2.2 (273)	7.4 (911)	7.6 (934)	17.3 (2118)
Total Sub-basin[6]	**15.7 (6299)**	**0.8 (312)**	**16.5 (6612)**	**2.3 (81)**	**1.7 (608)**	**7.3 (2941)**	**7.7 (3082)**	**16.7 (6713)**	**15.8 (6489)**	**5.7 (2338)**	**21.5 (8827)**	**1.5 (628)**	**10.5 (4304)**	**9.6 (3940)**	**21.7 (8872)**

[1]Pre-development sand mine area = 421acres; post-development area = 0 acres.
[2]Pre-development tributary area (Trampas Creek) = 638 acres (excluding mine area); post-development tributary area = 1013 acres.
[3]Pre-development tributary area (South Central San Juan in Planning Area 5) = 597 acres (excluding quarry area); post-development tributary area = 735 acres.
[4]Pre-development tributary area (North Central San Juan in Planning Area 3) = 1605 acres; post-development tributary area = 1693 acres.
[5]Pre-development tributary area (East Central San Juan in Planning Area 4) = 1539 acres; post-development tributary area = 1470 acres.
[6]Pre-development tributary area (total Central San Juan and Trampas Sub-basin) = 4800 acres; post-development tributary area = 4911 acres.

Table D-45: Planning Area 5 in Central San Juan & Trampas Sub-basin, Without Sand Mine[1], Average Annual Water Balance, All Years (inches (acre-ft))

Tributary Area	Pre-Development					Post-Development with PDFs						
	INFLOW	OUTFLOW				INFLOW			OUTFLOW			
	Precipitation	Surface Runoff to Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Surface Runoff to Creek	GW Outflow	ET	Total
Trampas Creek/PA5[2]	16.4 (1452)	0.2 (19)	7.4 (656)	8.8 (775)	16.4 (1450)	16.2 (1366)	7.7 (649)	23.9 (2015)	0.2 (14)	12.8 (1085)	10.8 (912)	23.8 (2010)
South CSJ/PA5[3]	16.1 (798)	2.0 (100)	7.4 (368)	7.0 (350)	16.5 (818)	16.3 (996)	6.1 (371)	22.3 (1367)	1.9 (115)	11.1 (681)	9.5 (580)	22.5 (1376)

[1]Results are shown for Planning Area 5 with the pre-development condition, before the mine, represented as open space.
[2]Pre-development, pre-mine tributary area (Trampas Creek) = 1059 acres; post-development tributary area = 1,013 acres.
[3]Pre-development, pre-mine tributary area (South Central San Juan in Planning Area 5) = 596 acres; post-development tributary area = 735 acres.

Table D-46: Central San Juan & Trampas Sub-basin, With Sand Mine, Average Annual Water Balance, Dry Years (inches (acre-ft))

Tributary Area	Pre-Development								Post-Development with PDFs						
	INFLOW			OUTFLOW					INFLOW			OUTFLOW			
	Precipitation	Irrigation	Total	Quarry Runoff Recirculation	Surface Runoff to Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Surface Runoff to Creek	GW Outflow	ET	Total
Lake Area[1]	14.0 (490)	0.0 (0)	14.0 (490)	1.8 (64)	0.0 (0)	5.5 (193)	6.6 (233)	14.0 (490)	-	-	-	-	-	-	-
Trampas Creek/PA5[2]	13.7 (740)	0.0 (0)	13.7 (740)	0.0 (0)	0.1 (4)	4.6 (251)	9.1 (491)	13.8 (745)	13.6 (1145)	7.7 (648)	21.2 (1792)	0.1 (8)	10.3 (867)	10.8 (912)	21.2 (1787)
South CSJ/PA5[3]	13.5 (669)	0.0 (0)	13.5 (669)	0.0 (0)	1.2 (61)	5.5 (273)	7.2 (357)	13.9 (691)	13.7 (843)	6.3 (392)	20.0 (1235)	1.1 (66)	9.2 (571)	9.8 (605)	20.1 (1242)
North CSJ/PA3[4]	12.6 (1679)	2.1 (284)	14.7 (1963)	0.0 (0)	1.1 (148)	5.0 (674)	8.8 (1182)	15.0 (2005)	12.9 (1823)	8.2 (1150)	21.1 (2973)	1.1 (149)	9.5 (1333)	10.6 (1490)	21.1 (2973)
East CSJ/PA4[5]	13.3 (1699)	0.2 (28)	13.5 (1727)	0.0 (0)	1.4 (178)	5.6 (718)	6.8 (873)	13.8 (1769)	13.3 (1626)	1.2 (146)	14.5 (1772)	1.5 (188)	5.4 (666)	7.7 (948)	14.7 (1803)
Total Sub-basin[6]	**13.2 (5277)**	**0.8 (312)**	**13.9 (5589)**	**1.8 (64)**	**1.1 (391)**	**5.3 (2109)**	**7.8 (3136)**	**14.2 (5700)**	**13.3 (5437)**	**5.7 (2336)**	**19.0 (7773)**	**1.0 (412)**	**8.4 (3437)**	**9.7 (3956)**	**19.0 (7804)**

[1]Pre-development with sand mine area = 421acres; post-development sand mine area = 0 acres.
[2]Pre-development tributary area (Trampas Creek) = 638 acres (excluding mine area); post-development tributary area = 1013 acres.
[3]Pre-development tributary area (South Central San Juan in Planning Area 5) = 597 acres (excluding quarry area); post-development tributary area = 735 acres.
[4]Pre-development tributary area (North Central San Juan in Planning Area 3) = 1605 acres; post-development tributary area = 1693 acres.
[5]Pre-development tributary area (East Central San Juan in Planning Area 4) = 1539 acres; post-development tributary area = 1470 acres.
[6]Pre-development tributary area (total Central San Juan and Trampas Sub-basin) = 4800 acres; post-development tributary area = 4911 acres.

Table D-47: Planning Area 5 in Central San Juan & Trampas Sub-basin, Without Sand Mine[1], Average Annual Water Balance, Dry Years (inches (acre-ft))

Tributary Area	Pre-Development					Post-Development with PDFs						
	INFLOW	OUTFLOW				INFLOW			OUTFLOW			
	Precipitation	Surface Runoff to Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Surface Runoff to Creek	GW Outflow	ET	Total
Trampas Creek/PA5[2]	13.8 (1216)	0.1 (6)	4.8 (425)	9.0 (792)	13.9 (1223)	13.6 (1145)	7.7 (648)	21.2 (1792)	0.1 (8)	10.3 (867)	10.8 (912)	21.2 (1787)
South CSJ/PA5[3]	13.5 (669)	1.2 (61)	5.5 (273)	7.2 (357)	13.9 (691)	13.7 (836)	6.0 (370)	19.7 (1206)	1.2 (70)	9.2 (561)	9.5 (582)	19.8 (1213)

[1]Results are shown for Planning Area 5 with the pre-development condition, before the mine, represented as open space.
[2]Pre-development, pre-mine tributary area (Trampas Creek) = 1059 acres; post-development tributary area = 1,013 acres.
[3]Pre-development, pre-mine tributary area (South Central San Juan in Planning Area 5) = 596 acres; post-development tributary area = 735 acres.

Table D-48: South Central San Juan (PA5) & Trampas Tributary Areas, With Mine, Average Annual Water Balance, Wet Years (inches (acre-ft))

Tributary Area	Pre-Development								Post-Development with PDFs						
	INFLOW			OUTFLOW					INFLOW			OUTFLOW			
	Precipitation	Irrigation	Total	Quarry Runoff Recirculation	Surface Runoff to Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Surface Runoff to Creek	GW Outflow	ET	Total
Quarry Area[1]	22.4 (786)	0.0 (0)	22.4 (786)	3.3 (116)	0.0 (0)	12.7 (444)	6.3 (220)	22.2 (781)	-	-	-	-	-	-	-
Trampas Creek/PA5[2]	21.9 (1187)	0.0 (0)	21.9 (1187)	0.0 (0)	0.5 (29)	12.7 (687)	8.5 (459)	21.7 (1174)	21.7 (1835)	7.7 (650)	29.4 (2486)	0.3 (26)	18.3 (1546)	10.8 (911)	29.4 (2483)
South CSJ/PA5[3]	21.6 (1073)	0.0 (0)	21.6 (1073)	0.0 (0)	3.7 (184)	11.4 (568)	6.7 (335)	21.9 (1087)	21.8 (1347)	6.4 (393)	28.2 (1740)	3.3 (201)	15.5 (955)	9.7 (597)	28.4 (1753)
North CSJ/PA3[4]	20.1 (2695)	2.1 (285)	22.3 (2979)	0.0 (0)	3.0 (397)	11.2 (1494)	8.4 (1126)	22.6 (3018)	20.7 (2925)	8.2 (1154)	28.9 (4079)	2.9 (407)	15.7 (2210)	10.6 (1496)	29.2 (4113)
East CSJ/PA4[5]	21.3 (2725)	0.2 (28)	21.5 (2753)	0.0 (0)	3.6 (459)	11.8 (1509)	6.5 (829)	21.8 (2798)	21.3 (2609)	1.2 (146)	22.5 (2755)	3.7 (452)	11.7 (1429)	7.4 (904)	22.7 (2785)
Total Sub-basin[6]	**21.1 (8465)**	**0.8 (313)**	**21.9 (8778)**	**3.3 (116)**	**2.9 (1068)**	**11.7 (4703)**	**7.4 (2969)**	**22.1 (8858)**	**21.3 (8716)**	**5.7 (2344)**	**27.0 (11059)**	**2.7 (1086)**	**15.0 (6140)**	**9.5 (3908)**	**27.2 (11134)**

[1]Pre-development mine area = 421acres; post-development mine area = 0 acres.
[2]Pre-development tributary area (Trampas Creek) = 638 acres (excluding mine area); post-development tributary area = 1013 acres.
[3]Pre-development tributary area (South Central San Juan in Planning Area 5) = 597 acres (excluding quarry area); post-development tributary area = 735 acres.
[4]Pre-development tributary area (North Central San Juan in Planning Area 3) = 1605 acres; post-development tributary area = 1693 acres.
[5]Pre-development tributary area (East Central San Juan in Planning Area 4) = 1539 acres; post-development tributary area = 1470 acres.
[6]Pre-development tributary area (total Central San Juan and Trampas Sub-basin) = 4800 acres; post-development tributary area = 4911 acres.

Table D-49: Planning Area 5 in Central San Juan & Trampas Sub-basin, Pre-Mine[1], Average Annual Water Balance, Wet Years (inches (acre-ft))

Tributary Area	Pre-Development					Post-Development with PDFs						
	INFLOW	OUTFLOW				INFLOW			OUTFLOW			
	Precipitation	Surface Runoff to Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Surface Runoff to Creek	GW Outflow	ET	Total
Trampas Creek/PA5[2]	22.1 (1950)	0.5 (45)	13.0 (1146)	8.4 (739)	21.9 (1930)	21.7 (1835)	7.7 (650)	29.4 (2486)	0.3 (26)	18.3 (1546)	10.8 (911)	29.4 (2483)
South CSJ/PA5[3]	21.6 (1073)	3.7 (184)	11.4 (568)	6.7 (335)	21.9 (1087)	21.8 (1335)	6.1 (371)	27.9 (1707)	3.4 (210)	15.3 (936)	9.4 (575)	28.1 (1720)

[1]Results are shown for Planning Area 5 with the pre-development condition, before the mine, represented as open space.
[2]Pre-development, pre-mine tributary area (Trampas Creek) = 1059 acres; post-development tributary area = 1,013 acres.
[3]Pre-development, pre-mine tributary area (South Central San Juan in Planning Area 5) = 596 acres; post-development tributary area = 735 acres.

D-2.3.2 Impacts on Pollutants of Concern

The section presents the water quality modeling results used to address impacts of stormwater runoff on sediments, nutrients, and trace metals for Alternative B-4. For this sub-basin, the mean annual loads and mean annual concentrations are provided separately for each planning area and, in PA5, also distinguish between Trampas Canyon and the unnamed tributary west of Trampas. The water quality analysis for PA5 includes, as part of the pre-development condition, the Trampas Canyon sand mining operation.

TSS Loads and Concentrations

Table D-50 summarizes TSS loads and concentrations and shows the percent change associated with the proposed development for each planning area and the total sub-basin area. Considering all three planning areas, TSS loads are predicted to decrease by about 35 percent and TSS concentrations are predicted to decrease by about 35 to 42 percent. Pre-development loads in Trampas Canyon are low because of the sediment trapping associated with the Trampas Canyon mining operation. Table D-51 shows that the predicted post-development runoff TSS concentration is approximately 164 mg/L, which is much lower than in-stream data collected by Wildermuth in the San Juan watershed.

Table D-50: Predicted Average Annual TSS Loads and Concentrations for the Central San Juan and Trampas Sub-basin

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
South CSJ/PA5	Pre-Developed	24	14	46	198	189	205
	Developed	55	39	88	140	128	152
	Dev w/ PDFs	24	14	45	171	168	174
	Percent Change	-1	2	-3	-14	-11	-15
Trampas Creek/PA5	Pre-Developed[1]	3	1	7	200	165	211
	Developed	60	49	82	117	116	118
	Dev w/ PDFs	2	1	4	123	130	119
	Percent Change	-29	54	-47	-39	-21	-44
North CSJ/PA3	Pre-Developed	96	69	154	342	376	315
	Developed	106	83	154	118	116	122
	Dev w/ PDFs	36	22	66	126	118	131
	Percent Change	-63	-68	-57	-63	-69	-58
East CSJ/PA4	Pre-Developed	71	47	122	215	212	216
	Developed	66	46	110	179	175	183
	Dev w/ PDFs	63	43	105	187	185	189
	Percent Change	-11	-8	-14	-13	-13	-13

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Total Sub-basin Area	Pre-Developed	194	130	330	259	270	251
	Developed	287	217	434	132	127	138
	Dev w/ PDFs	125	80	221	161	157	164
	Percent Change	-35	-38	-33	-38	-42	-35

[1]This condition reflects sand mining and processing operation including Trampas Dam and a large quarry pit which limits runoff to Trampas Creek.

Table D-51: Comparison of Predicted TSS Concentration with Water Quality Objectives and Observed In-Stream Concentrations for the Central San Juan and Trampas Sub-basin

Predicted Average Annual TSS Concentration[1] (mg/L)	San Diego Basin Plan Water Quality Objectives	Range of Observed In-stream Concentrations[2] (mg/L)
164	TSS levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors	None Detected – 3,100

[1]Modeled concentration for total sub-basin area developed conditions with PDFs in wet years.
[2]Range of means observed at four San Juan watershed stations during the wet years.
NA – not applicable

Nutrient Loads and Concentrations

Table D-52 summarizes nutrient loads and shows percent changes for all years, dry years, and wet years respectively, for each planning area. This and other tables showing nutrients include the approximately 150 acres of nurseries in PA 3 and approximately 15 acres of nurseries in PA 4. For all three planning areas, the net change in loads for nitrate nitrogen is projected to decrease by about 41 percent whereas TKN loads are projected to increase by approximately 35 percent. Nitrate-nitrogen is inorganic nitrogen and is considered more bio-available than TKN, which contains both organic and inorganic forms of nitrogen. Projected loads are generally the largest during wet years and the lowest during dry years. Load increases dramatically in the Trampas Canyon portion of PA 5 in the post-developed case because the effect of the mine is removed. Much of this runoff is then infiltrated in the post-development with PDF case, causing a substantial reduction in loads entering Trampas Creek. Table D-52 shows that total phosphorus loads are predicted to decrease slightly in all years and by approximately 12 percent in dry years, and is predicted to increase by 9 percent in wet years. The major source of phosphorous is PA3.

Table D-53 summarizes nutrient concentrations. The concentrations of nitrate-nitrogen are projected to decrease by about 38 to 48 percent, whereas TKN concentrations are projected to increase by about 20 to 39 percent. Total phosphorous concentrations are projected to decrease by as much as 17 percent during dry years and increase by about six percent during wet years.

Table D-54 compares the predicted average annual runoff concentrations of nutrients with observed in-stream data from Wildermuth. The water quality impact of concern here is excessive algal growth. The Basin Plan narrative objective is "Concentrations of nitrogen and phosphorous, by themselves or in combination with other nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth." The results in the table indicate the predicted post-development runoff concentration for total phosphorous is less than that observed, where the observed data reflects the contribution from open areas and existing land uses. The higher observed nutrient data is consistent with the geologic information that indicates underlying bedrock may contribute high levels of phosphorous from open areas. Nitrate-nitrogen concentrations tend to be in the lower range of the observed data, and this is important, as mentioned above, as nitrate-nitrogen is more bioavailable than TKN. These projections would indicate that projected nutrient concentrations in runoff are comparable to or less than in-stream observations and therefore should not result in an increase in algae growth.

Table D-52: Predicted Average Annual Nutrient Loads for the Central San Juan and Trampas Sub-basin (lbs)

Modeled Area	Site Condition	Nitrate-N Loads			TKN Loads			Total P Loads		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
South CSJ/PA5	Pre-Developed	286	167	538	269	164	491	40	26	70
	Developed	738	547	1141	2013	1701	2675	283	240	375
	Dev w/ PDFs	300	180	555	541	333	983	76	47	136
	Percent Change	5	8	3	101	103	100	88	81	94
Trampas Creek	Pre-Developed[1]	33	9	84	31	10	75	5	2	10
	Developed	871	717	1197	3228	2686	4377	448	373	607
	Dev w/ PDFs	25	17	44	48	53	37	6	7	5
	Percent Change	-24	78	-48	55	414	-50	42	298	-55
North CSJ/PA3	Pre-Developed	1495	1114	2300	1374	1033	2094	304	239	440
	Developed	1536	1219	2207	5579	4553	7753	775	633	1075
	Dev w/ PDFs	508	317	914	1715	1159	2892	237	161	399
	Percent Change	-66	-72	-60	25	12	38	-22	-33	-9

Modeled Area	Site Condition	Nitrate-N Loads			TKN Loads			Total P Loads		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
East CSJ/PA4	Pre-Developed	870	581	1481	791	539	1326	124	88	201
	Developed	805	560	1323	1190	851	1908	171	124	270
	Dev w/ PDFs	752	513	1257	992	676	1661	142	98	234
	Percent Change	-14	-12	-15	25	25	25	14	11	17
Total Sub-basin Area	Pre-Developed	2683	1871	4403	2465	1746	3986	473	355	722
	Developed	3950	3044	5868	12011	9790	16713	1676	1369	2327
	Dev w/ PDFs	1594	1026	2796	3327	2220	5671	465	313	788
	Percent Change	-41	-45	-36	35	27	42	-2	-12	9

[1]This condition reflects sand mining and processing operation including Trampas Dam and a large quarry pit which limits runoff to Trampas Creek.

Table D-53: Predicted Average Annual Nutrient Concentrations for the Central San Juan and Trampas Sub-basin (mg/L)

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			Total P Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
South CSJ/PA5	Pre-Developed	1.0	1.0	1.1	1.0	1.0	1.0	0.1	0.2	0.1
	Developed	0.8	0.8	0.9	2.3	2.5	2.1	0.3	0.4	0.3
	Dev w/ PDFs	1.0	0.9	1.0	1.7	1.8	1.7	0.2	0.2	0.2
	Percent Change	-8	-6	-10	76	77	75	64	58	69
Trampas Creek	Pre-Developed[1]	1.1	0.9	1.1	1.0	1.0	1.0	0.1	0.2	0.1
	Developed	0.8	0.8	0.8	2.9	2.9	2.8	0.4	0.4	0.4
	Dev w/ PDFs	0.7	0.8	0.6	1.3	2.6	0.5	0.2	0.4	0.1
	Percent Change	-34	-8	-44	33	164	-47	22	105	-52
North CSJ/PA3	Pre-Developed	2.4	2.8	2.1	2.2	2.6	1.9	0.5	0.6	0.4
	Developed	0.8	0.8	0.8	2.8	2.9	2.8	0.4	0.4	0.4
	Dev w/ PDFs	0.8	0.8	0.8	2.7	2.9	2.6	0.4	0.4	0.4
	Percent Change	-67	-72	-61	23	11	35	-23	-33	-11
East CSJ/PA4	Pre-Developed	1.19	1.20	1.19	1.09	1.11	1.06	0.17	0.18	0.16
	Developed	0.98	0.97	1.00	1.45	1.47	1.44	0.21	0.21	0.20
	Dev w/ PDFs	1.01	1.00	1.02	1.34	1.32	1.35	0.19	0.19	0.19
	Percent Change	-15	-17	-14	23	19	27	12	5	18

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			Total P Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Total Sub-basin Area	Pre-Developed	1.62	1.76	1.52	1.49	1.64	1.37	0.29	0.33	0.25
	Developed	0.83	0.81	0.85	2.51	2.60	2.41	0.35	0.36	0.34
	Dev w/ PDFs	0.93	0.91	0.94	1.93	1.97	1.90	0.27	0.28	0.26
	Percent Change	-43	-48	-38	30	20	39	-6	-17	6

[1]This condition reflects sand mining and processing operation including Trampas Dam and a large quarry pit which limits runoff to Trampas Creek.

Table D-54: Comparison of Predicted Nutrient Concentrations with Observed In-Stream Concentrations for the Central San Juan and Trampas Sub-basin

Nutrient	Predicted Average Annual Concentration[1] (mg/L)			Observed Range of In-Stream Concentrations[2] (mg/L)
	All Years	Dry Years	Wet Years	
Nitrate	0.93	0.91	0.94	0.15 – 1.5
TKN	1.93	1.97	1.90	None Detected – 3.0
Total Phosphorus	0.27	0.28	0.26	None Detected – 2.8

[1]Modeled concentration for total sub-basin area developed conditions with PDFs.
[2]Range of means observed at four San Juan watershed stations during the wet years.
NA – not applicable

Trace Metals

Table D-55 shows the predicted mean annual loads for aluminum, cadmium, copper, lead, and zinc for the three development scenarios and for the three climatic conditions. Except for aluminum, the concentrations are all in the dissolved form, which is the form addressed in the California Toxics Rule. Overall for all 3 planning areas, the aluminum, cadmium, and zinc loads are projected to decrease slightly, while copper and lead loads are predicted to increase between 14 and 35 percent for all years. In general, loads are higher in wet years and lower during dry years, and are higher from PA 3 which is the largest of the three planning areas. The highest loads are associated with aluminum, then in descending order zinc, copper, lead, and cadmium.

Table D-56 presents the predicted runoff trace metal concentrations. Overall, concentrations tend to decrease by about six percent for aluminum, about six to 13 percent for cadmium, and about five percent for zinc. Concentrations of dissolved copper are predicted to increase by about two to 16 percent depending on the climatic condition. Dissolved lead is predicted to increase by about 29 percent in all years. These concentration changes reflect changes associated with urbanization, the effects of bypassing higher flows around the water quality control facilities, and contributions from untreated open areas.

Table D-57 compares the predicted mean annual concentrations with CTR criteria and observed in stream data. The CTR criteria apply to acute aquatic toxicity and assume a hardness of 120 mg/L, which was the minimum observed hardness. As criteria increase with hardness, applying the minimum observed hardness is conservative, that is, would result in the minimum criteria. The table indicates that the projected mean runoff concentrations are well below the CTR criteria. The predicted runoff values tend to be higher than the observed in-stream data and this may reflect the fact that we are comparing dissolved forms. The partitioning between dissolved and particulate forms of metals is influenced by the availability of solids and the organic content of the solids. Where solids concentrations are high, such as in the streams, partitioning will tend to reduce the dissolved fraction, and where solids concentrations tend to be low, such as in the runoff, partitioning will tend to increase the dissolved fraction. Consequently the low observed dissolved concentration in the stream may be a consequence of the higher TSS values in the stream.

Table D-55: Predicted Average Annual Trace Metal Loads for the Central San Juan and Trampas Sub-basin (lbs)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
South CSJ/PA5	Pre-Developed	169	99	317	0.2	0.1	0.3	2.1	1.4	3.5	0.3	0.2	0.6	13	9	23
	Developed	497	378	748	0.5	0.4	0.8	8.3	6.9	11.4	3.3	2.8	4.3	35	27	51
	Dev w/ PDFs	189	114	349	0.2	0.1	0.3	2.5	1.6	4.5	0.8	0.5	1.5	13	8	23
	Percent Change	12	15	10	-1	-8	5	21	11	30	164	175	156	-5	-11	0
Trampas Creek	Pre-Developed[1]	20	6	50	0.02	0.01	0.05	0.2	0.1	0.5	0.04	0.01	0.09	2	1	3
	Developed	626	517	858	0.64	0.53	0.88	11.5	9.5	15.6	5.46	4.55	7.40	40	33	55
	Dev w/ PDFs	16	12	26	0.01	0.01	0.02	0.2	0.2	0.2	0.08	0.09	0.05	1	1	1
	Percent Change	-18	105	-48	-36	13	-59	-19	66	-61	107	745	-48	-39	4	-58
North CSJ/PA3	Pre-Developed	394	251	698	0.41	0.29	0.68	5.4	3.9	8.5	2.5	2.0	3.7	22	14	39
	Developed	1098	878	1566	1.13	0.91	1.59	20.0	16.3	27.8	9.4	7.7	13.1	71	57	100
	Dev w/ PDFs	357	227	634	0.36	0.23	0.62	6.1	4.1	10.5	2.9	2.0	4.8	22	14	39
	Percent Change	-9	-10	-9	-14	-20	-9	13	4	23	15	0	31	1	1	2
East CSJ/PA4	Pre-Developed	460	299	800	0.48	0.33	0.77	5.2	3.7	8.4	1.0	0.7	1.7	33	23	55
	Developed	496	347	813	0.54	0.40	0.84	6.7	5.0	10.3	1.7	1.2	2.7	37	27	58
	Dev w/ PDFs	457	312	765	0.48	0.34	0.77	5.8	4.1	9.2	1.4	0.9	2.3	33	24	54
	Percent Change	0	4	-4	1	3	-1	10	11	10	36	34	37	0	3	-2
Total Sub-basin Area	Pre-Developed	1043	655	1864	1.1	0.8	1.8	13.0	9.2	20.9	3.9	2.8	6.1	70	47	120
	Developed	2717	2119	3984	2.9	2.3	4.1	46.4	37.6	65.1	19.8	16.3	27.5	183	144	264
	Dev w/ PDFs	1026	665	1792	1.0	0.7	1.8	14.7	10.0	24.7	5.2	3.5	8.9	70	47	119
	Percent Change	-2	1	-4	-5	-7	-3	14	8	19	35	23	46	-1	0	-1

[1]This condition reflects sand mining and processing operation including Trampas Dam and a large quarry pit which limits runoff to Trampas Creek.

Table D-56: Predicted Average Annual Trace Metal Concentrations for the Central San Juan and Trampas Sub-basin (µg/L)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
South CSJ/PA5	Pre-Developed	620	598	635	0.7	0.8	0.6	8	9	7	1.1	1.1	1.2	49	54	46
	Developed	572	559	586	0.6	0.6	0.6	10	10	9	3.8	4.1	3.3	40	40	40
	Dev w/ PDFs	607	601	612	0.6	0.6	0.6	8	8	8	2.7	2.7	2.6	41	42	40
	Percent Change	-2	0	-4	-13	-19	-8	6	-3	13	131	141	124	-17	-22	-13
Trampas Creek	Pre-Developed[1]	625	543	648	0.7	1.0	0.6	7	11	6	1.2	1.0	1.2	48	66	43
	Developed	556	555	558	0.6	0.6	0.6	10	10	10	4.9	4.9	4.8	35	35	35
	Dev w/ PDFs	439	573	360	0.4	0.6	0.3	5	9	3	2.1	4.4	0.7	25	35	19
	Percent Change	-30	5	-44	-45	-42	-56	-30	-15	-58	78	334	-45	-48	-47	-55
North CSJ/PA3	Pre-Developed	636	624	646	0.67	0.71	0.63	8.7	9.8	7.9	4.05	4.85	3.43	35.6	35.3	35.9
	Developed	557	554	561	0.57	0.58	0.57	10.1	10.3	10.0	4.78	4.86	4.68	35.8	35.8	35.7
	Dev w/ PDFs	566	558	573	0.56	0.57	0.56	9.7	10.1	9.5	4.57	4.82	4.37	35.4	35.3	35.6
	Percent Change	-11	-11	-11	-15	-21	-11	11	3	20	13	0	28	0	0	-1
East CSJ/PA4	Pre-Developed	631	618	641	0.65	0.69	0.62	7.15	7.70	6.70	1.39	1.43	1.36	45.8	48.1	43.9
	Developed	606	597	615	0.66	0.69	0.63	8.18	8.58	7.80	2.08	2.08	2.07	45.4	47.2	43.8
	Dev w/ PDFs	616	610	622	0.65	0.67	0.63	7.75	8.04	7.50	1.86	1.81	1.90	45.0	46.6	43.6
	Percent Change	-2	-1	-3	-1	-3	1	8	4	12	33	27	39	-2	-3	-1
Total Sub-basin Area	Pre-Developed	631	616	642	0.67	0.71	0.63	7.83	8.67	7.18	2.35	2.67	2.09	42.61	44.36	41.26
	Developed	568	562	575	0.60	0.60	0.59	9.71	9.97	9.40	4.15	4.31	3.96	38.17	38.27	38.05
	Dev w/ PDFs	596	589	602	0.61	0.62	0.59	8.55	8.86	8.31	3.03	3.09	2.98	40.61	41.59	39.82
	Percent Change	-6	-4	-6	-9	-13	-6	9	2	16	29	16	42	-5	-6	-3

[1]This condition reflects sand mining and processing operation including Trampas Dam and a large quarry pit which limits runoff to Trampas Creek.

Table D-57: Comparison of Predicted Trace Metals Concentrations with Water Quality Criteria and Observed In-Stream Concentrations for the Central San Juan and Trampas Sub-basin

Trace Metals	Predicted Average Annual Concentration[1] (µg/L)			California Toxics Rule Criteria[2] (µg/L)	Observed Range of In-Stream Concentrations[3] (µg/L)
	All Years	Dry Years	Wet Years		
Total Aluminum	596	589	602	750[4]	Not Monitored
Dissolved Cadmium	0.61	0.62	0.59	5.2	None Detected – 0.09
Dissolved Copper	8.6	8.9	8.3	15.9	2.1 – 4.0
Dissolved Lead	3.0	3.1	3.0	78.7	None Detected – 3.9
Dissolved Zinc	40.6	41.6	39.8	137	None Detected – 15.0

[1]Modeled concentration for total sub-basin area developed conditions with PDFs.
[2]Hardness = 120 mg/L, minimum value of monitoring data.
[3]Range of means observed at four San Juan watershed stations during the wet years.
[4] NAWQC criteria for pH 6.5 – 9.0.

D-2.3.3 Findings of Significance

Hydrologic Conditions of Concern and Significance Thresholds

The following discusses the implications of the water balance results on the hydrologic conditions of concern.

1. Increased Stormwater Runoff Flowrate, Volume and Flow Duration

Significance Threshold A: Substantially alter the existing drainage pattern of the site or area, including alteration of the course of a stream or river, in a manner that would cause substantial erosion or siltation.

The WQMP was designed specifically to preserve and protect the existing drainage patterns, and sediment transport regime. Drainage patterns within the development bubbles will be modified by the installation of drainage infrastructure, but to the extent feasible (for example, in low density development areas) more natural swale-type drainage will be considered. Drainage patterns will be modified in the Trampas Creek drainage by virtue of removing the sand mining operation; however, flow management is designed to mimic natural hydrologic conditions in Trampas Creek.

Significance Threshold B: Substantially increase the frequencies and duration of channel adjusting flows.

Changes in the frequency and duration of flows were analyzed for all of the catchments that would be affected by the proposed development. The combined control system for these catchments was sized and configured to match, to the extent possible, the flow durations over the entire range of channel adjusting flows, including the 2 ands 10 year peak flows. A water balance also was conducted that took into account the effects of anticipated irrigation and the operation of the BMPs. The results of the water balance indicated that surface water runoff volume to Trampas Creek, to the unnamed creek west of Trampas Creek, and to San Juan Creek would effectively match the existing condition.

On this basis, the effect of the proposed development on altering existing drainage or increasing the frequency and duration of channel adjusting flows is determined to be less than significant.

2. Decreased Infiltration and Groundwater Recharge

Significance Threshold A: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge that would cause a net deficit in aquifer volumes or lowering of the local groundwater table.

The water balance indicates that infiltration volumes will likely increase over pre-development conditions, and therefore groundwater levels, particularly in and around San Juan Creek, would increase rather than decrease.

On this basis, the potential effect of the proposed development on infiltration and groundwater recharge are considered less than significant.

Hydrologic Condition of Concern #3: Changed Base Flows

Significance Threshold A: Substantially increase or decrease base flows as to negatively impact riparian habitat.

The projected increase in infiltration and groundwater outflow is likely to lead to increases in base flows in Trampas Creek, the unnamed creek, and San Juan Creek. The magnitude of the increase is estimated to be about 1 cfs, which could potentially benefit arroyo toad habitat, especially during the breeding season when water is a significant factor affecting recruitment.

Significance Threshold B: Substantially increase or decrease low flow estimates where high groundwater elevations are considered important.

To the extent that the projected increase in base flows enter San Juan Creek, the effect could potentially raise the groundwater elevations downstream which would be beneficial to downstream water supply pumping operations.

On this basis, the effect of the proposed development in altering base flows such as to adversely affect habitat or downstream groundwater levels for water supply purposes is considered less than significant.

Pollutants of Concern

The following are the conclusions regarding the significance of impacts for the pollutants of concern under wet and dry weather conditions.

Sediments: Mean total suspended solids concentrations are predicted to be less in the post development condition than in the existing conditions.

Nutrients (Nitrogen and Phosphorous): Despite the predicted increases in TKN and total phosphorus loadings, the post-developed nutrient concentrations are either well below or within the observed range of in-stream concentrations and therefore should not increase algal growth..

Trace Metals: Mean concentrations of total aluminum and dissolved cadmium, copper, lead, and zinc are predicted to increase relative to predicted concentrations under existing conditions. However, mean concentrations of aluminum, cadmium, copper, lead, and zinc are well below benchmark NAWQC and CTR criteria.

On this basis, the impact of the B-4 alternative on sediments, nutrients, and trace metals is considered less than significant.

D-2.4 Impact analysis for the Cristianitos Sub-Basin

This section evaluates the effectiveness of the WQMP for the Cristianitos Sub-basin and evaluates the impacts of the proposed Alternative B-4 on pollutants of concern and hydrologic conditions of concern within that sub-basin. This sub-basin contains Planning Area 6 and 7.

D-2.4.1 Impacts on Hydrologic Conditions of Concern

The analysis of impacts on hydrologic conditions of concern took into account two flow control measures that were selected to limit impacts to Cristianitos Creek, which is considered sensitive to the adverse effects of increased runoff. Those measures consisted of grading a portion of the Planning Area 7 such that runoff would be directed to the Gabino Sub-basin, and routing excess flows from the remaining portion of PA 7 within the Cristianitos Sub-basin to Gabino Creek.

Hydrologic Condition of Concern #1: Increased Stormwater Runoff Volume, Peak Discharge, and Flow Duration

Flow Duration Analysis

The flow duration analysis was conducted for catchments subject to development. Figure D-4 shows an example of the flow duration analysis for the catchment designated PA7-9. The figure shows the effect of the proposed development on increasing the magnitude and duration of flows. The dashed horizontal lines indicate the estimated post-development 2 and 10 year peak flows. With controls (described in Chapter 4), the runoff flows and duration can be managed so as to essentially match the pre-development condition, and, as part of that matching, return the 2 and 10 peak flows to values consistent with the pre-development condition.

Water Balance Analysis

The water balance analysis for the Cristianitos Sub-basin was conducted for each of the two planning areas and for the sub-basin as a whole. The water balance results are shown Tables D-58, D-59, and D-60 for all years, dry years, and wet years respectively. In contrast with areas in the San Juan Creek watershed where sandy soils provide high infiltration rates and storage volumes, most of the areas in the Cristianitos Sub-basin are clay or sandy loam soils and are underlain by clays at relatively shallow depths. Therefore, deep percolation of infiltrated water will be minimal and infiltrated water will tend to flow in shallow zones towards Cristianitos Creek. One of the prominent characteristics of this geology is that it does not support perennial systems. Groundwater outflow is generally high during the wetter months but is insufficient to support perennial flows throughout the year (except in one limited downstream portion of the sub-basin). The model confirmation of intermittent flow conditions is particularly important, as it indicates that the soil infiltration and groundwater storage processes are reasonably approximated by the model.

Because of the sensitivity to erosion in Cristianitos Creek, approximately 200 acres of PA 7 along the divide between the Cristianitos and Gabino sub-basins would be graded so as to divert excess runoff to the Gabino Sub-basin. It was also assumed in the model that infiltration would create a water table that is inclined towards Gabino and that groundwater under the graded area would flow towards Gabino Creek. Also note that the water balance results are provided in terms of inches of runoff and acre-ft of runoff. “Inches” as a volume measure is equivalent to inches of water over the tributary drainage area. When there are large changes between the pre- and post-development tributary areas, the comparison using watershed inches as a volume measure can be misleading and acre-ft should be used.

The following describes the water balance results by planning area and for the sub-basin as a whole.

Planning Area 6

As indicated in the “pre-development inflow” columns, on average (based on all years) precipitation is about 15 in/yr, about 13 in/yr during dry years, and about 20 in/yr during wet years. Runoff to Cristianitos Creek is estimated to be about four percent of the precipitation irrespective of climatic conditions. In the post-development condition, irrigation of the golf course and common areas is predicted to add the equivalent of 10 inches of water for an increase of about a factor of two-thirds (the effect on the sub-basin scale is about 25 percent).

Under all years (Table D-58), excess runoff corresponding to about 39 acre-ft is stored and recycled for golf course irrigation. Consequently, on average predicted runoff to Cristianitos Creek essentially replicates the pre-developed condition. During dry years (Table D-59), the runoff is only about 50 percent of the pre-development runoff, and during wet years post-development runoff is slightly higher than pre-development runoff. It should be pointed out that matching pre-development conditions was conducted for the "average climatic "condition, that is all years. In general, this work indicates that the concept of flow control is feasible in the Cristianitos Sub-basin, and more precise matching for different climatic conditions, such as matching dry years pre-development runoff, can be achieved during a final design phase.

Planning Area 7

The water balance for that portion of PA 7 that is located in the Cristianitos Sub-basin is shown in Table D-58 for all years, Table D-59 for dry years, and Table D-60 for wet years. Proposed grading would reduce the post-development area tributary to Cristianitos Creek by about 200 acres as a means of redirecting some of the excess runoff to the Gabino Sub-basin. In addition, the excess runoff from the remaining development in the Cristianitos Sub-basin would be diverted south (bypassing upper Cristianitos Creek) to discharge into the less sensitive Gabino Creek just upstream of the confluence with lower Cristianitos Creek. This dual routing of runoff is captured in the water balance which indicates that the net increase in runoff to upper Cristianitos Creek for all years is projected to be about 5 acre-ft or about a 10 percent increase. During wet years this percentage is about 20 percent. During dry years the increase is negligible. In all cases the changes in absolute values are quite low (less than 16 acre-ft/yr).

Total Sub-basin

Total sub-basin runoff to Cristianitos Creek is estimated to remain essentially the same as current conditions on average (for all water years). During wet years, the runoff is estimated to increase by about 10 percent. During dry years, surface runoff to Cristianitos Creek is projected to decrease by about 10 percent (Table D-58); however, the absolute runoff is quite low (50 acre-ft/yr) suggesting that there is limited runoff to Cristianitos Creek in dry years.

Hydrologic Condition of Concern #2: Decreased Infiltration and Groundwater Recharge

Planning Area 6

In general, the water balance results indicate relatively modest amounts of infiltration and groundwater outflow compared to the sub-basins analyzed in the San Juan watershed. The water balance results for PA 6 indicate that for all years, groundwater infiltration would increase from about 170 acre-ft/yr to about 232 acre-ft/yr or about 62 acre-ft/yr (36 percent). For dry years, groundwater infiltration and outflow would increase from about 86 acre-ft/yr to about 146 acre-ft/yr, for about 60 acre-ft/yr or 70 percent (Table D-59). These effects are in part a reflection of the irrigation associated with the golf course. Thus development is projected to increase infiltration and groundwater recharge.

Planning Area 7

The clay soils in PA 7 limit infiltration rates and storage capacity. For all years, the infiltration in PA 7 is projected to decrease from about 76 acre-ft/yr or 24 percent (Table D-58). During dry years, the decrease is about 30 acre-ft/yr or 18 percent (Table D-60).

Total Sub-basin

For the total sub-basin, groundwater infiltration and outflow is projected to remain about the same at 750 acre-ft/yr. During wet years, there is a projected decrease in groundwater infiltration and outflow from about 1,565 acre-ft/yr to about 1,434 acre-ft/yr (less than a 10 percent decrease). The relatively large groundwater outflow during wet years reflects the effects of additional rainfall during the wet years (almost five additional inches per year). During dry years groundwater outflow is projected to increase from about 376 acre-ft/yr under pre-development conditions to about 415 acre-ft/yr for post-development conditions (approximately a 15 percent increase). These changes in groundwater outflow are quite modest overall and indicate that groundwater infiltration is not greatly affected in this sub-basin.

Hydrologic Condition of Concern #3: Changed Base Flows

Planning Area 6

The water balance analysis discussed above indicates that base flows are projected to increase under the post development condition. The mean annual increase in base flows assuming an additional 60 acre-ft/yr translates into an estimated base flow of less than 0.1 cfs. This is a very small increase in base flow which could easily evaporate, infiltrate in the main stem channel, or be utilized by riparian vegetation in the immediate vicinity of PA 6. Cristianitos Creek is an intermittent stream and this minor addition of volume is likely not to change that condition, nor affect the downstream alkaline wetlands.

Planning Area 7

Base flows are projected to decrease slightly in PA 7 in part because of the grading that will redirect surface and groundwater flows to the Gabino Sub-basin. During dry years the decrease is only about 20 acre-ft, which will have little effect on the ephemeral stream. During wet years, the decrease is projected to be about 195 acre-ft which corresponds to a reduction of about 0.25 cfs (Table D-60).

Total Sub-basin

As indicated above, groundwater infiltration for average conditions (all years) will remain unchanged, as will base flows. During wet years, the projected decrease of 130 acre-ft/yr translates into a decrease in base flow of about 0.2 cfs on average. During dry years, the projected increase in base flows is only about 0.05 cfs. These projections would indicate that the effects of the proposed development can be controlled such that base flows will not substantially be altered.

Table D-58: Cristianitos Sub-basin Average Annual Water Balance, All Years (inches (acre-ft))

Tributary Area	Pre-Development					Post-Development with PDFs								
	INFLOW	OUTFLOW				INFLOW			OUTFLOW					
	Precipitation	Runoff to Cristianitos Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Cristianitos Creek	Stored Runoff for GC Irrig	Runoff Diverted to Gabino Creek	GW Outflow	ET	Total
Planning Area 6[1]	15.1 (620)	0.6 (26)	4.2 (171)	10.3 (425)	15.1 (622)	15.0 (643)	10.0 (427)	25.0 (1070)	0.5 (20)	0.9 (39)	0.0 (0)	5.4 (232)	18.2 (780)	25.0 (1070)
Planning Area 7[2]	15.0 (1099)	0.7 (52)	4.2 (310)	10.1 (739)	15.0 (1101)	14.8 (837)	4.4 (252)	19.2 (1089)	1.0 (57)	0.0 (0)	2.1 (121)	4.1 (234)	11.9 (676)	19.2 (1088)
Total Sub-basin[3]	**14.8 (2923)**	**0.4 (79)**	**3.8 (758)**	**10.6 (2094)**	**14.8 (2930)**	**14.7 (2685)**	**3.7 (680)**	**18.4 (3364)**	**0.4 (79)**	**0.2 (39)**	**0.7 (121)**	**4.1 (742)**	**13.1 (2385)**	**18.4 (3366)**

[1]PA6 catchment shapes change from pre-development to post-development; the results presented include some open space outside of PA6. Thus, the total area is greater than the development area of PA6. Pre-development tributary area (Planning Area 6) = 493 acres; post-development tributary area = 515 acres.
[2]PA7 catchment shapes change from pre-development to post-development; the results presented include some open space outside of PA7. Thus, the total area is greater than the development area of PA7. Pre-development tributary area (Planning Area 7) = 881acres; post-development tributary area = 680 acres.
[3]Pre-development tributary area (Total Sub-basin Area) = 2370 acres; post-development tributary area = 2191 acres.

Table D-59: Cristianitos Sub-basin Average Annual Water Balance, Dry Years (inches (acre-ft))

Tributary Area	Pre-Development					Post-Development with PDFs								
	INFLOW	OUTFLOW				INFLOW			OUTFLOW					
	Precipitation	Runoff to Cristianitos Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Cristianitos Creek	Stored Runoff for GC Irrig	Runoff Diverted to Gabino Creek	GW Outflow	ET	Total
Planning Area 6[1]	12.6 (519)	0.5 (21)	2.1 (86)	10.1 (416)	12.7 (523)	12.6 (539)	10.0 (427)	22.5 (966)	0.2 (10)	0.8 (36)	0.0 (0)	3.4 (146)	18.1 (774)	22.5 (966)
Planning Area 7[2]	12.5 (920)	0.5 (36)	2.3 (167)	9.8 (722)	12.6 (926)	12.4 (701)	4.4 (252)	16.8 (952)	0.7 (39)	0.0 (0)	1.8 (102)	2.6 (146)	11.7 (665)	16.8 (953)
Total Sub-basin[3]	**12.4 (2448)**	**0.3 (59)**	**1.9 (376)**	**10.3 (2030)**	**12.5 (2466)**	**12.3 (2248)**	**3.7 (679)**	**16.0 (2928)**	**0.3 (51)**	**0.2 (36)**	**0.6 (102)**	**2.3 (415)**	**12.8 (2331)**	**16.1 (2935)**

[1]PA6 catchment shapes change from pre-development to post-development; the results presented include some open space outside of PA6. Thus, the total area is greater than the development area of PA6. Pre-development tributary area (Planning Area 6) = 493 acres; post-development tributary area = 515 acres.
[2]PA7 catchment shapes change from pre-development to post-development; the results presented include some open space outside of PA7. Thus, the total area is greater than the development area of PA7. Pre-development tributary area (Planning Area 7) = 881acres; post-development tributary area = 680 acres.
[3]Pre-development tributary area (Total Sub-basin Area) = 2370 acres; post-development tributary area = 2191 acres.

Table D-60: Cristianitos Sub-basin Average Annual Water Balance, Wet Years (inches (acre-ft))

Tributary Area	Pre-Development					Post-Development with PDFs								
	INFLOW	OUTFLOW				INFLOW			OUTFLOW					
	Precipitation	Runoff to Cristianitos Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Cristianitos Creek	Stored Runoff for GC Irrig	Runoff Diverted to Gabino Creek	GW Outflow	ET	Total
Planning Area 6[1]	20.3 (833)	0.9 (35)	8.5 (351)	10.8 (444)	20.2 (830)	20.1 (864)	10.0 (428)	30.1 (1292)	1.0 (42)	1.0 (44)	0.0 (0)	9.7 (414)	18.5 (792)	30.1 (1291)
Planning Area 7[2]	20.1 (1478)	1.2 (85)	8.4 (614)	10.6 (775)	20.1 (1473)	19.9 (1126)	4.5 (252)	24.3 (1378)	1.6 (93)	0.0 (0)	2.9 (162)	7.4 (421)	12.3 (699)	24.3 (1375)
Total Sub-basin[3]	**19.9 (3929)**	**0.6 (122)**	**7.9 (1565)**	**11.3 (2228)**	**19.8 (3915)**	**19.8 (3608)**	**3.7 (681)**	**23.5 (4290)**	**0.8 (138)**	**0.2 (44)**	**0.9 (162)**	**7.9 (1434)**	**13.7 (2500)**	**23.4 (4278)**

[1]PA6 catchment shapes change from pre-development to post-development; the results presented include some open space outside of PA6. Thus, the total area is greater than the development area of PA6. Pre-development tributary area (Planning Area 6) = 493 acres; post-development tributary area = 515 acres.
[2]PA7 catchment shapes change from pre-development to post-development; the results presented include some open space outside of PA7. Thus, the total area is greater than the development area of PA7. Pre-development tributary area (Planning Area 7) = 881acres; post-development tributary area = 680 acres.
[3]Pre-development tributary area (Total Sub-basin Area) = 2370 acres; post-development tributary area = 2191 acres.

D-2.4.2 Impacts on Pollutants of Concern

The section presents the water quality modeling results used to address impacts of stormwater runoff on sediments, nutrients, and trace metals. The modeling analysis has been described in Chapter 3. The modeling results are in the form of mean annual loads and mean annual concentrations. Similar to the hydrologic impacts, results are provided for the three development scenarios: pre-development, post-development, and post-development with PDFs; for three climatic conditions: all years in the 53 year rainfall record, dry years, and wet years.

TSS Loads and Concentrations

Table D-61 shows the mean annual loads and concentrations for TSS for each development scenario and climatic period. Mean annual loads are highest during the wet years and lowest during dry years. Loads also increase with development and decrease when controls are taken into account. Concentrations vary depending on the relative contribution of undeveloped areas, which contribute more TSS, compared to urbanized areas where runoff tends to have lower TSS. It is important to note however that the treatment controls are designed to control TSS from developed areas only. Contributions of sediment from undeveloped areas would remain unchanged. Table D-61 shows modest relative reductions in both TSS concentrations and loads which, given that the development would be located on clay soils, would tend to be finer rather than coarser sediments. The reduction in TSS loads is typical of development, which has the effect of stabilizing soils with vegetation and covering soils with impervious surfaces.

Table D-62 shows the mean annual TSS concentration of 126 mg/L for the total sub-basin during wet years and how it compares with water quality criteria and observed concentrations. The criterion for TSS in the San Diego Basin Plan is narrative and states that “levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors”. The range of observed TSS data collected by Wildermuth at two stations in the San Mateo watershed was 3,900 to 9,400 mg/L. Thus the projected effects of the proposed development are not likely to affect in-stream TSS levels.

Table D-61: Predicted Average Annual TSS Loads and Concentrations for the Cristianitos Sub-basin

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Cristianitos Creek	Pre-Developed	14	10	22	143	138	149
	Developed	37	29	55	124	121	127
	Dev w/ PDFs	12	8	21	129	132	126

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
	Percent Change	-14	-21	-8	-10	-4	-16

Table D-62: Comparison of Predicted TSS Concentration with Water Quality Objectives and Observed In-Stream Concentrations for the Cristianitos Sub-basin

Predicted Average Annual TSS Concentration[1] (mg/L)	San Diego Basin Plan Water Quality Objectives	Range of Observed In-stream Concentrations[2] (mg/L)
126	TSS levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors	3,900 – 9,400

[1]Modeled concentration for total sub-basin under developed conditions with PDFs in wet years.
[2]Range of observed concentrations at two San Mateo watershed stations during the wet years.

Nutrient Loads and Concentrations

Tables D-63 and D-64 show the mean annual loads and concentrations for nitrate nitrogen, TKN, and total phosphorus. Nitrate-nitrogen and ammonia-nitrogen (a portion of the TKN measurement) are important bio-available forms of nitrogen that can contribute to algal growth in streams. TKN also includes organic forms of nitrogen that are generally considered less bioavailable. In this respect, nitrate-nitrogen is the more important species of nitrogen to consider when concerned about stimulating algal growth in streams.

Nitrate-nitrogen loads to Cristianitos Creek are projected to decrease by about 20 percent for dry years and remain about the same for wet years. Projected concentrations for all three development scenarios are within 0.05 mg/L. TKN loads and concentrations also are projected to decrease by about 10 to 50 percent compared to pre-development conditions. Total phosphorus loads and concentrations are projected to decrease by about 10 to 50 percent except for wet years when post-development with PDF conditions are projected to be about the same as pre-development.

Table D-65 compares post-development concentrations with observed in-stream data. This table indicates that the predicted concentrations for nitrate-nitrogen and TKN are in the upper portion of the reported measured data. By contrast, the projected mean total phosphorus concentration is in the lower portion of the observed data. This comparison would indicate that runoff could increase concentrations of nitrate-nitrogen and TKN in Cristianitos Creek during storm runoff events. However, given the intermittent nature of the stream, the effect of increased nutrients is unlikely to create algal conditions because algae growth requires a sustained flow of water.

Table D-63: Predicted Average Annual Nutrient Loads for the Cristianitos Sub-basin (lbs)

Modeled Area	Site Condition	Nitrate-N Loads			TKN Loads			Total P Loads		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Cristianitos Creek	Pre-Developed	178	129	283	329	254	487	53	41	79
	Developed	525	414	761	1529	1240	2140	222	181	310
	Dev w/ PDFs	164	106	286	217	118	427	40	22	78
	Percent Change	-8	-18	1	-34	-54	-12	-24	-46	0

Table D-64: Predicted Average Annual Nutrient Concentrations for the Cristianitos Sub-basin (mg/L)

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			Total P Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Cristianitos Creek	Pre-Developed	0.83	0.80	0.85	1.53	1.58	1.47	0.25	0.26	0.24
	Developed	0.79	0.78	0.80	2.30	2.33	2.25	0.33	0.34	0.33
	Dev w/ PDFs	0.79	0.80	0.79	1.05	0.89	1.17	0.20	0.17	0.22
	Percent Change	-4	0	-7	-31	-43	-20	-21	-34	-9

Table D-65: Comparison of Predicted Nutrient Concentrations with Observed In-Stream Concentrations for the Cristianitos Sub-basin

Nutrient	Predicted Average Annual Concentration[1] (mg/L)			Observed Range of In-Stream Concentrations[2] (mg/L)
	All Years	Dry Years	Wet Years	
Nitrate	0.79	0.80	0.79	0.29 – 1.1

TKN	1.05	0.89	1.17	0.39 – 1.2
Total Phosphorus	0.20	0.17	0.22	None Detected – 6.2

[1]Modeled concentration for developed conditions with PDFs in wet years.
[2]Range of means observed at two San Mateo watershed stations during the wet years.
NA – not applicable

Trace Metals

Tables D-66 and D-67 show the predicted mean annual loads and mean annual concentrations for aluminum, cadmium, copper, lead, and zinc for the three development scenarios and for the three climatic conditions. Except for aluminum, the concentrations are all in the dissolved form, which is the form addressed in the California Toxics Rule.

Loads and concentrations for all of the metals except aluminum tend are generally projected to decrease. Concentrations of aluminum are projected to increase by a modest amount, ranging from about 5 to 10 percent. Aluminum loads in wet years are projected to increase by about 23 percent, whereas the loads are projected to decrease by about 15 percent during dry years.

The important comparison however is with the CTR criteria. Table D-68 compares the projected mean concentration for wet years with the CTR criteria. A hardness of 140 mg/L has been used to estimate the CTR criteria for those metals whose criteria are hardness dependent. This value of hardness was the minimum hardness observed in the in-stream data collected by Wildermuth. Therefore the criteria may be viewed as a lower bound, and in this respect the comparison is conservative (i.e., more likely to indicate an exceedance). The table indicates that the projected mean concentrations are all less than these minimum CTR criteria, and therefore the effects of metals on acute aquatic toxicity is not likely to be significant. Table D-68 also compares the projected runoff concentrations with observed data. This comparison indicates that dissolved runoff concentrations are projected to be less than dissolved in-stream concentrations. As discussed earlier, this situation may reflect the different dissolved-particulate equilibrium in the more sediment rich streams compared to the low sediment runoff.

Table D-66: Predicted Average Annual Trace Metal Loads for the Cristianitos Sub-basin (lbs)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Cristianitos Creek	Pre-Developed	114	83	179	0.20	0.15	0.30	2.53	1.95	3.76	0.44	0.35	0.65	13	10	20
	Developed	365	290	526	0.48	0.39	0.68	7.08	5.74	9.91	2.29	1.86	3.19	31	25	44
	Dev w/ PDFs	119	71	220	0.08	0.05	0.16	1.21	0.61	2.50	0.43	0.24	0.82	7	4	14
	Percent Change	4	-15	23	-58	-69	-46	-52	-69	-33	-3	-29	26	-48	-63	-31

Table D-67: Predicted Average Annual Trace Metal Concentrations for the Cristianitos Sub-basin (µg/L)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Cristianitos Creek	Pre-Developed	527	518	537	0.91	0.94	0.89	12	12	11	2.06	2.16	1.96	62	63	60
	Developed	549	545	553	0.72	0.73	0.71	11	11	10	3.43	3.49	3.36	47	48	47
	Dev w/ PDFs	575	536	604	0.40	0.35	0.44	6	5	7	2.08	1.85	2.26	34	28	38
	Percent Change	9	4	12	-56	-62	-51	-50	-62	-39	1	-14	15	-45	-55	-37

Table D-68: Comparison of Predicted Trace Metals Concentrations with Water Quality Criteria and Observed In-Stream Concentrations for the Cristianitos Sub-basin

Trace Metals	Predicted Average Annual Concentration[1] (μg/L)			California Toxics Rule Criteria[2] (μg/L)	Observed Range of In-Stream Concentrations[3] (μg/L)
	All Years	Dry Years	Wet Years		
Total Aluminum	527	518	537	750[4]	Not Monitored
Dissolved Cadmium	0.40	0.35	0.44	6.1	None Detected – 0.37
Dissolved Copper	6	5	7	18	1.3 – 4.7
Dissolved Lead	2.08	1.85	2.26	93	None Detected – 0.19
Dissolved Zinc	34	28	38	160	None Detected – 26

[1]Modeled concentration for developed conditions with PDFs.
[2]Hardness = 140 mg/L, minimum value of monitoring data.
[3]Range of means observed at two San Mateo watershed stations during the wet years.
[4] NAWQC criteria for pH 6.5 – 9.0.

D-2.4.3 Findings of Significance

Hydrologic Conditions of Concern and Significance Thresholds

The following discusses the implications of the water balance results on the hydrologic conditions of concern.

1. Increased Stormwater Runoff Flowrate, Volume and Flow Duration

Significance Threshold A: Substantially alter the existing drainage pattern of the site or area, including alteration of the course of a stream or river, in a manner that would cause substantial erosion or siltation.

The WQMP was designed specifically to preserve and protect the existing drainage patterns, and sediment transport regime. Drainage patterns within the development bubbles will be modified by the installation of drainage infrastructure, but to the extent feasible (for example, in low density development areas) more natural swale-like drainage will be considered.

Significance Threshold B: Substantially increase the frequencies and duration of channel adjusting flows.

Changes in the frequency and duration of flows were analyzed for catchments that discharge to Cristianitos Creek. Flow duration and volume runoff controls were selected to manage the frequency and duration of channel adjusting flows. These controls include routing runoff to storage for recycling for golf course irrigation, grading portions of the sub-basin to re-route flows to the Gabino Sub-basin, and routing excess flows from the Cristianitos Sub-basin into Gabino Creek. This combination of measures was modeled and the results indicated that it was possible to match durations over the entire range of channel adjusting flows, including the 2 and 10 year peak flows. A water balance also was conducted that took into account the effects of anticipated irrigation and the operation of the various flow control measures. The results of the water balance indicated that surface water runoff volume to Cristianitos Creek would effectively match the pre-developed condition.

On this basis, the effect of the proposed development on altering existing drainage or increasing the frequency and duration of channel adjusting flows is determined to be less than significant.

2. Decreased Infiltration and Groundwater Recharge

Significance Threshold A: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge that would cause a net deficit in aquifer volumes or lowering of the local groundwater table.

The geology of this sub-basin limits deep groundwater recharge and what infiltration does occur tends to contribute to shallow interflow into the stream. The water balance indicates that infiltration volumes will likely mimic the existing condition.

On this basis, the potential effect of the proposed development on infiltration and groundwater recharge are considered less than significant.

3. Changed Base Flows

Significance Threshold A: Substantially increase or decrease base flows as to negatively impact riparian habitat.

Projected maximum changes to base flows are quite marginal (less than 0.1 cfs) and are insufficient to negatively impact habitat.

Significance Threshold B: Substantially increase or decrease low flow estimates where high groundwater elevations are considered important.

As discussed above, the geology and soils of this sub-basin limit the groundwater resource to shallow interflow. Nonetheless, the projected water balance results indicate the effect of the B-4 alternative is not likely to alter the groundwater balance.

On this basis, the effect of the proposed development in altering base flows such as to adversely affect habitat or downstream groundwater levels for water supply purposes is considered less than significant.

Pollutants of Concern

The following are the conclusions regarding the significance of impacts for the pollutants of concern under wet and dry weather conditions.

Sediments: Mean total suspended solids loads and concentrations are predicted to be less in the post development condition than in the existing conditions.

Nutrients (Nitrogen and Phosphorous): Mean nutrient loads and concentrations are predicted to generally be less in the post-development condition than in the existing conditions. Runoff concentrations are projected to be higher than measured instream data. However, the ephemeral nature of Cristianitos Creek substantially limits the potential for sustained algal growth.

Trace Metals: Mean concentrations of total aluminum and dissolved cadmium, copper, lead, and zinc are predicted to decrease relative to predicted concentrations under existing conditions. More significantly, mean concentrations of aluminum, cadmium, copper, lead, and zinc are well below benchmark NAWQC and CTR criteria.

On this basis, the impact of the B-4 alternative on sediments, nutrients, and trace metals in the Cristianitos Sub-basin is considered less than significant.

D-2.5 Impact analysis for the Gabino Sub-Basin

This section evaluates the effectiveness of the WQMP for the Gabino Sub-basin and evaluates the impacts of the B-4 alternative on pollutants of concern and hydrologic conditions of concern.

In this chapter we evaluate the effects of runoff from PA 7 into lower Gabino Creek, and a portion of PA 8C (about 50 acres) that is graded such that runoff is directed to middle Gabino Creek. Although Blind Canyon was considered along with Gabino in previous work such as the Baseline Conditions Report, we have chosen to discuss the impacts on Blind Canyon with those on Talega Canyon because proposed grading would direct runoff from the Northrop-Grumman area in the Talega Sub-basin into Blind Canyon.

In contrast to previous chapters where entire sub-basins were modeled, the water balance modeling was conducted only for lower Gabino, defined as catchments 68 to 80, and the PA 7 and PA 8 catchments illustrated in Figure A-17. The modeling does not include the proposed development in upper Gabino associated with PA 9, or the hydrologic contributions from existing open areas in middle and upper Gabino. A brief description of the anticipated impacts of the proposed development in upper Gabino is provided at the end of this section.

The decision to focus the analysis in Gabino on lower Gabino is reasonable given that most of the proposed development in located in lower Gabino. The results of the hydrologic and water quality analysis is therefore more of a relative comparison of pre- versus post-development conditions for discharges into lower Gabino, as opposed to an absolute comparison of hydrologic conditions within the stream.

D-2.5.1 Impacts on Hydrologic Conditions of Concern

Hydrologic Condition of Concern #1: Increased Stormwater Runoff Volume, Peak Discharge, and Flow Duration

Water Balance Analysis

The water balance analysis for the Gabino Sub-basin addresses portions of PA 7 and a portion of PA 8C. As discussed in Section 5.5, excess runoff from catchments in PA 7 that would otherwise drain to Cristianitos Creek would be diverted to lower Gabino Creek at a point upstream of the confluence with Cristianitos Creek. In the water balance tables this diversion is referred to as “Runoff Diverted from Cristianitos Creek”.

Runoff from catchments in PA 7 that are currently located in the Gabino Sub-basin, along with additional catchments in PA 7 that are currently located in Cristianitos but would be graded to direct runoff into Gabino, would be stored and treated in the existing quarry pond in lower Gabino (the pond nearest the road). Well data indicate that this pond is connected hydraulically to lower Gabino Creek and water levels can vary by 10 to 20 feet in response to changes in the elevation of the local water table. Based on available aerial photos, the surface area of the pond is approximately two acres, although the surface area would appear to be larger than two acres during high water conditions. The quarry pond currently does not have a surface outlet; however, if used as proposed, an outlet would be required to allow the basin to operate as an extended detention wet pond. Surface water would exit the pond through the outlet into lower Gabino Creek. This water is referred to in the water balance table (Table D-69) as “Runoff to Gabino Creek”. Given the groundwater connection between the pond and Gabino Creek, water from the pond also would enter Gabino Creek through this connection. This is a potential benefit, in that the pond can act as a recharge area when stream flows are low, and seepage through the 150 to 200 feet of alluvium will further cleanse the water moving through the subsurface toward Gabino Creek.

A small 50 acre portion of PA 8C, including part of a golf course, also would drain to middle Gabino Creek. This runoff is also included in the water balance tables as “Runoff to Gabino Creek”. The columns in the water balance tables referred to as “Runoff Stored for GC Irrigation” represent runoff that would be diverted from this 50 acre area to non-domestic water supply reservoirs for use as golf course irrigation.

It is important to note that the pre-development catchments considered in the water balance total approximately 1,491 acres. However, because of the effects of the proposed grading, the total area of the post-development catchments is approximately 1,740 acres, for an increase of about 250 acres.

Because of these factors, surface water runoff into Gabino Creek is projected to increase on average (for all years) from about 45 acre-ft/yr to about 474 acre-ft/yr. This is the sum of the runoff to Gabino Creek from those portions of PA 7 in the Gabino Sub-basin (353 acre-ft/yr) and runoff diverted from Cristianitos Creek to Gabino Creek (121 acre-ft/yr). Increases during wet years would be larger, and increases during dry years would be less. This is considered acceptable because lower Gabino Creek, like San Juan Creek, is a relatively large, braided stream with coarse sized substrate that can accommodate increases in runoff without causing excessive erosion or inducing significant habitat changes. By comparison, increased runoff into Cristianitos Creek is considered likely to cause excessive erosion and possibly modify the existing alkaline wetland habitat.

Hydrologic Condition of Concern #2: Decreased Infiltration and Groundwater Recharge

As discussed earlier for Cristianitos Creek, the groundwater component of the water balance is smaller in these sub-basins in contrast to the sandy alluvial aquifers in the San Juan Creek watershed. This is particularly the case during dry years, when groundwater outflow is estimated to increase from about 356 acre-ft/yr to about 419 acre-ft/yr or about 20 percent. During wet years there is no projected change in groundwater recharge. These projected changes in groundwater outflow indicate that groundwater infiltration is not greatly affected by the proposed development in this sub-basin.

Hydrologic Condition of Concern #3: Changed Base Flow

As indicated above, projected groundwater infiltration and outflow is relatively small in these geologic conditions, resulting in intermittent stream systems, especially during dry years. During such years, the change in groundwater outflow is projected to be about 63 acre-ft which translates into a mean annual increase in base flow of less than 0.1 cfs. These projections would indicate that base flows will not substantially be altered by the proposed development.

D-2.5.2 Impacts on Pollutants of Concern

The section presents the water quality modeling results used to address impacts of stormwater runoff on sediments, nutrients, and trace metals. Results are provided for the three development scenarios, for three climatic conditions.

TSS Loads and Concentrations

Table D-70 shows that TSS concentrations are projected to decrease whereas, because of the increased runoff volume, TSS loads increase. Table D-71 compares the projected mean annual TSS concentration (44 mg/L) to observed in-stream data that range from about 4,000 to 9,000 mg/L. These high in-stream concentration data further support the above conclusion that projected increases in runoff TSS loads are likely to be quite small compared to existing sediment transport in lower Gabino Creek.

Table D-69: Gabino Sub-basin Average Annual Water Balance[1] (inches (acre-ft))

Climatic Period	Pre-Development[2]					Post-Development with PDFs[3]									
	INFLOW	OUTFLOW				INFLOW				OUTFLOW					
	Precipitation	Runoff to Gabino Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Runoff Diverted from Cristianitos Sub-basin[4]	Total	Runoff to Gabino Creek[4]	Runoff Diverted from Cristianitos Sub-basin[5]	Runoff Stored for GC Irrigation[6]	GW Outflow	ET	Total
All Years	17.3 (2148)	0.4 (45)	5.2 (649)	11.8 (1461)	17.3 (2155)	16.5 (2392)	3.9 (560)	0.8 (121)	21.2 (3073)	2.4 (353)	0.8 (121)	0.1 (19)	4.8 (695)	13.2 (1912)	21.4 (3100)
Dry Years	14.5 (1802)	0.3 (35)	2.9 (356)	11.6 (1437)	14.7 (1828)	13.8 (2008)	3.9 (559)	0.7 (102)	18.4 (2669)	1.9 (282)	0.7 (102)	0.1 (16)	2.9 (419)	13.0 (1886)	18.6 (2704)
Wet Years	23.2 (2880)	0.5 (67)	10.2 (1271)	12.2 (1513)	22.9 (2850)	22.1 (3205)	3.9 (561)	1.1 (162)	27.1 (3928)	3.5 (504)	1.1 (162)	0.2 (25)	8.8 (1279)	13.6 (1968)	27.2 (3938)

[1]Water balance results for the lower Gabino Sub-basin; i.e. catchments that are directly tributary to Gabino Creek in PA7 and PA8, and excludes development areas in PA9.
[2]The pre-development catchments are 68-80. Pre-development area = 1491 acres.
[3]The post-development catchments are: 68-80, PA7-7, PA7-12, PA7-13, PA7-15, PA8-12, and PA8-14. Post-development area = 1740 acres.
[4]This is runoff from catchments that are tributary to Gabino Creek.
[5]This is treated runoff diverted from Cristianitos Sub-basin (inches are with respect to area of Lower Gabino).
[6]Assumed golf course storage volume was 10 AF.

Table D-70: Predicted Average Annual TSS Loads and Concentrations for the Gabino Sub-basin

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
*Gabino	Pre-Developed	11	8	16	189	187	191
	Developed	76	61	107	123	122	124
	Dev w/ PDFs	29	22	44	53	49	58
	Percent Change	177	173	183	-72	-74	-69

Total loads draining into Gabino Creek. These include loads from Gabino Sub-basin and partially diverted loads from Cristianitos Sub-basin.

Table D-71: Comparison of Predicted TSS Concentration with Water Quality Objectives and Observed In-Stream Concentrations for the Gabino Sub-basin

Predicted Average Annual TSS Concentration[1] (mg/L)	San Diego Basin Plan Water Quality Objectives	Range of Observed In-stream Concentrations[2] (mg/L)
44	TSS levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors	3,900 – 9,400

[1]Modeled concentration for total project developed conditions with PDFs in wet years.
[2]Range of concentrations observed at two San Mateo watershed stations during the wet years.
NA – not applicable

Nutrient Loads and Concentrations

Tables D-72 and D-73 show the mean annual loads and concentrations for nitrate-nitrogen, TKN, and total phosphorus. Nitrate-nitrogen and ammonia-nitrogen (a portion of the TKN measurement) are inorganic and more bio-available forms of nitrogen that can contribute to algal growth in streams. TKN also includes organic forms of nitrogen that are generally considered less bioavailable. In this respect, nitrate-nitrogen is the more important species of nitrogen to consider when concerned about stimulating algal growth in streams.

Nitrate-nitrogen concentrations are projected to decrease slightly with development, but the additional projected runoff volume causes loads to increase by a factor of about three. TKN loads and concentrations are projected to increase, with order of magnitude increases in loads projected. Total phosphorus loads and concentrations are also projected to increase.

Table D-74 compares post-development concentrations with observed in-stream data. This table indicates that the predicted concentrations for nitrate-nitrogen are within the range of observed data, whereas the projected TKN concentrations are somewhat higher than in-stream concentrations. Given that these systems appear to be nitrogen limited and that nitrate-nitrogen is more bioavailable than TKN, changes in nitrate-nitrogen are the more important measure of the potential for discharges to stimulate algal growth. Table D-73 indicates that nitrate-nitrogen concentrations would decrease slightly with development, and Table D-74 indicates that projected runoff concentrations would fall within the range of observed in-stream data. Moreover, as discussed earlier for Cristianitos Creek, intermittent streams run during the wet winter season when environmental conditions of light and temperature are less supportive of algal growth.

Lastly, as discussed earlier, the combined control system includes constructed wetlands for treating dry weather flows and small storm flows. Constructed wetlands have been shown to be effective in reducing nitrate-nitrogen. Regional examples of successful applications of wetland technology include the Irvine Ranch Water District's San Joaquin Marsh and the Prado Reservoir wetlands. Based on the success achieved in the San Joaquin Marsh, the Irvine Ranch Water District has recently developed a "Natural Treatment System" Master Plan calling for constructing a number of wetlands throughout the 122 square mile San Diego Creek watershed (IRWD, 2003). Modeling of this system has indicated that it will result in substantially achieving the nutrient TMDL targets for that watershed.

Table D-72: Predicted Average Annual Nutrient Loads for the Gabino Sub-basin (lbs)

Modeled Area	Site Condition	Nitrate-N Loads			TKN Loads			Total P Loads		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gabino	Pre-Developed	118	91	177	143	112	209	21	17	31
	Developed	1093	883	1535	3672	2998	5100	510	416	707
	Dev w/ PDFs	481	372	712	2115	1689	3016	337	272	475
	Percent Change	306	309	303	1377	1403	1346	1470	1504	1430

Table D-73: Predicted Average Annual Nutrient Concentrations for the Gabino Sub-basin (mg/L)

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			Total P Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gabino	Pre-Develop	0.96	0.95	0.97	1.16	1.17	1.15	0.17	0.18	0.17
	Developed	0.80	0.80	0.80	2.68	2.70	2.67	0.37	0.37	0.37
	Dev w/ PDFs	0.40	0.38	0.43	1.75	1.71	1.80	0.28	0.28	0.28
	Percent Change	-59	-60	-56	51	46	57	60	56	66

Table D-74: Comparison of Predicted Nutrient Concentrations with Observed In-Stream Concentrations for the Gabino Sub-basin

Nutrient	Predicted Average Annual Concentration[1] (mg/L)			Observed Range of In-Stream Concentrations[2] (mg/L)
	All Years	Dry Years	Wet Years	
Nitrate-nitrogen	0.40	0.38	0.43	0.29 – 1.1
TKN	1.75	1.71	1.80	0.39 – 1.2
Total Phosphorus	0.28	0.28	0.28	None Detected – 6.2

[1]Modeled concentration for developed conditions with PDFs in wet years.
[2]Range of concentrations observed at two San Mateo watershed stations during the wet years.
NA – not applicable

Trace Metals

Tables D-75 and D-76 show the predicted mean annual loads and mean annual concentrations for aluminum, cadmium, copper, lead, and zinc for the three development scenarios and for the three climatic conditions. Except for aluminum, the concentrations are all in the dissolved form, which is the form addressed in the California Toxics Rule.

Concentrations for aluminum, cadmium and zinc are projected to decrease. Concentrations for dissolved copper are projected to essentially remain unchanged, and dissolved lead concentrations are projected to increase. Loads for all metals are projected to increase because of the increased runoff volumes.

Table D-75: Predicted Average Annual Trace Metal Loads for the Gabino Sub-basin (lbs)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gabino	Pre-Developed	77	60	115	0.09	0.07	0.12	1.16	0.93	1.66	0.25	0.20	0.36	10	8	14
	Developed	774	627	1085	0.79	0.64	1.10	13.29	10.87	18.43	5.96	4.87	8.26	51	41	71
	Dev w/ PDFs	674	550	937	0.63	0.52	0.88	12.11	9.96	16.67	3.46	2.76	4.95	45	37	62
	Percent Change	770	816	718	638	665	607	940	973	902	1287	1290	1283	357	367	344

Table D-76: Predicted Average Annual Trace Metal Concentrations for the Gabino Sub-basin (µg/L)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Gabino	Pre-Develop	629	627	632	0.70	0.71	0.68	9.45	9.70	9.18	2.03	2.08	1.98	80	82	77
	Developed	566	564	568	0.58	0.58	0.57	9.72	9.78	9.64	4.35	4.38	4.32	37	37	37
	Dev w/ PDFs	559	557	560	0.52	0.52	0.52	10.03	10.09	9.97	2.87	2.80	2.96	37	37	37
	Percent Change	-11	-11	-11	-25	-26	-23	6	4	9	41	35	50	-53	-55	-52

The important comparison with respect to potential effects on aquatic species is with the benchmark CTR criteria, and in the case of aluminum, the NAWQA criteria. Table D-77 compares the projected mean concentration for wet years with the CTR and NAWQA benchmark criteria. A hardness of 140 mg/L has been used to estimate the CTR criteria of those metals whose criteria are hardness dependent. This value of hardness was the minimum hardness observed in the in-stream data collected at the two monitoring stations in the San Mateo watershed by Wildermuth. Therefore the criteria may be viewed as a lower bound, and in this respect the comparison is conservative (i.e., more likely to indicate an exceedance). The table indicates that the projected mean concentrations of all the metals are well below the minimum criteria. In conclusion, concentrations of all trace metals are projected to be at lower concentrations than the benchmark criteria.

Table D-77: Comparison of Predicted Trace Metals Concentrations with Water Quality Criteria and Observed In-Stream Concentrations for the Gabino Sub-basin

Trace Metals	Predicted Average Annual Concentration[1] (µg/L)			California Toxics Rule Criteria[2] (µg/L)	Observed Range of In-Stream Concentrations[3] (µg/L)
	All Years	Dry Years	Wet Years		
Total Aluminum	559	557	560	750[4]	Not Monitored
Dissolved Cadmium	0.52	0.52	0.52	6.1	None Detected – 0.37
Dissolved Copper	10.0	10.1	10	18	1.3 – 4.7
Dissolved Lead	2.87	2.80	2.96	93	None Detected – 0.19
Dissolved Zinc	37	37	37	160	None Detected – 26

[1]Modeled concentration for developed conditions with PDFs.
[2]Hardness = 140 mg/L, minimum value of monitoring data.
[3]Range of means observed at two San Mateo watershed stations during the wet years.
[4] NAWQC criteria for pH 6.5 – 9.0.

D-2.5.3 Findings of Significance

Hydrologic Conditions of Concern and Significance Thresholds

The following discusses the implications of the water balance results on the hydrologic conditions of concern.

1. Increased Stormwater Runoff Flowrate, Volume and Flow Duration

Significance Threshold A: Substantially alter the existing drainage pattern of the site or area, including alteration of the course of a stream or river, in a manner that would cause substantial erosion or siltation.

The WQMP was designed specifically to preserve and protect the existing drainage patterns, and sediment transport regime. Development will alter existing drainage patterns in the side canyon above lower Gabino Creek in areas previously altered by prior mining activities and thus will not modify natural drainage patterns in these altered areas. Drainage patterns within the development bubbles will be modified by the grading and installation of drainage infrastructure. Some of the grading is specifically designed to divert runoff from approximately 200 acres in the more runoff sensitive neighboring Cristianitos Sub-basin to the Gabino Sub-basin, where stream conditions are considered more stable and resistant to the anticipated increase in flows.

Significance Threshold B: Substantially increase the frequencies and duration of channel adjusting flows.

Runoff volume in lower Gabino is projected to increase substantially with the proposed development, in large part because of the grading in the Cristianitos Sub-basin which will redirect flows from the Cristianitos Sub-basin into the Gabino Sub-basin. This and other runoff from PA 7 will be discharged into the large quarry pond in Lower Gabino, which is connected through the alluvial aquifer to nearby Gabino Creek. Gabino Creek is considered far more resistant to erosion than Cristianitos Creek.

On this basis, the effect of the proposed development on altering existing drainage or increasing the frequency and duration of channel adjusting flows is determined to be less than significant.

2. Decreased Infiltration and Groundwater Recharge

Significance Threshold A: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge that would cause a net deficit in aquifer volumes or lowering of the local groundwater table.

As discussed earlier for Cristianitos Creek, the groundwater component of the water balance is smaller in these sub-basins in contrast to the sandy alluvial aquifers in the San Juan Creek watershed. According to an evaluation of the Gabino alluvial/terrace groundwater basin conducted by Balance Hydrologics, the potential holding capacity of the Gabino groundwater basin is about 400 acre-ft primarily in the lower portion of the Gabino Sub-basin. The water balance during dry years projects that groundwater outflow will increase from about 356 acre-ft/yr to about 419 acre-ft/yr or about 20 percent. During wet years there is no projected change in groundwater recharge. These projected changes in groundwater outflow indicate that groundwater recharge is not likely to decrease, but rather substantially fill the groundwater basin.

On this basis, the potential effect of the proposed development on infiltration and groundwater recharge are considered less than significant.

3. Changed Base Flows

Significance Threshold A: Substantially increase or decrease base flows as to negatively impact riparian habitat.

The increased availability of groundwater could encourage non-native vegetation or additional vegetation that could adversely affect aquatic species. However it is likely that riparian vegetation in lower Gabino is influenced more by channel scour than by groundwater level. If elevated groundwater conditions in lower Gabino were to adversely affect habitat, adaptive management options could include pumping the aquifer down each year in order to manage base flows for the maximum habitat value.

Significance Threshold B: Substantially increase or decrease low flow estimates where high groundwater elevations are considered important.

With the exception of the alluvial/terrace aquifers of Gabino, which are a part of this unit, the geology and soils of this sub-basin limit the groundwater resource to shallow interflow. Nonetheless the projected water balance results indicate the effect of the B-4 alternative is not likely to alter the groundwater balance and water table levels. If anything there may be a modest increase in groundwater levels during dry years.

On this basis, the effect of the proposed development in altering base flows such as to adversely affect habitat or groundwater levels is considered less than significant.

Pollutants of Concern

The following are the conclusions regarding the significance of impacts for the pollutants of concern under wet and dry weather conditions.

Sediments: Mean total suspended solids concentrations are predicted to be less in the post-development condition, but because of the increased runoff volume, loads are projected to increase. Because development will be located in areas with clay soils that are currently disturbed and eroding, the generation of fine sediments that originate from erosion of these clay soils will be reduced; whereas the transport of coarser sediment and cobbles generated in middle Gabino and La Paz Canyon will be maintained to and through lower Gabino Creek.

Nutrients (Nitrogen and Phosphorous): Nitrate-nitrogen concentrations are projected to decrease with development; however, TKN and total phosphorus concentrations are projected to increase. Loads of all three nutrient species are projected to increase. Comparisons with observed in-stream data indicate runoff nitrate-nitrogen concentrations will be comparable to observed in-stream concentrations. Also, as discussed earlier, the utilization of constructed wetlands for treatment has been shown to be effective in reducing nutrient concentrations. Given that nitrate-nitrogen is the more important nutrient of concern, this comparison would suggest that runoff would not increase algal growth in Gabino Creek or impact arroyo toad habitat. Moreover, as discussed earlier for Cristianitos Creek, intermittent streams run during the wet winter and spring season when environmental conditions of light and temperature are less supportive of algal growth.

Trace Metals: Although trace metal loads are projected to increase, mean concentrations of cadmium, copper, lead, and zinc are well below the benchmark CTR criteria. Total aluminum is also less than the benchmark NAWQA criterion for all climatic conditions.

On this basis, the impact of the B-4 alternative on sediments, nutrients, and trace metals in the Gabino Sub-basin is considered less than significant.

D-2.5.4 Impacts Associated with Proposed Development in Upper Gabino

The above discussion described the potential impacts associated with PA 6 and PA 7 on middle and lower Gabino. The B-4 alternative also includes development in Upper Gabino consisting of estate housing, casitas, and a golf course. The effects of this proposed low density development were not modeled, but rather are addressed here qualitatively.

Impacts to Hydrologic Conditions of Concern

The golf course and casitas would be located in an area that has experienced extensive erosion because of natural erosive conditions coupled with past agricultural practices. Because of a combination of erodible clays and sands, Upper Gabino is a source of fine as well as coarse sediment. The Gabino sub-basin is underlain by clayey and crystalline terrains that generally produce high runoff volumes. So in this case, urbanization, especially the low density urbanization that is proposed, may not substantially increase post-development runoff. With development, grading, landscaping, and the incorporation of flow control facilities including recycling of stormwater for golf course irrigation are all factors that would reduce runoff volumes and rates into middle and lower Gabino Creek.

Impacts to Pollutants of Concern

By siting the majority of the proposed development in an area that has suffered from past land use practices, the post-development sediment loads should decrease as a result of the landscaping associated with the golf course, and other urban landscaping that will tend to stabilize the soils. Low density development also will provide the opportunity to incorporate site design techniques that can provide for hydrologic as well as water quality control. Such techniques include directing roof and road runoff to bioinfiltration areas or swales. Given the clay conditions, soil amendments and underdrains could be employed to encourage infiltration. Runoff from low density development also exhibits better water quality than runoff from more dense development.

Based on these considerations, the impacts of the proposed development in upper Gabino on water quality are considered less than significant.

D-2.6 <u>Impact analysis for the Blind and Talega sub-basins</u>

This section evaluates the effectiveness of the WQMP for the Blind Canyon and Talega Canyon Sub-basins and evaluates the impacts of the proposed development on pollutants of concern and hydrologic conditions of concern.

In this section we evaluate the effects of runoff from PA 8 as it affects Talega and Blind Canyons. This area includes the Northrop-Grumman (formerly TRW) facilities. Because of concerns for arroyo toad habitat in Talega Creek, the proposed development plan is to grade PA 8 such that all excess runoff from PA 8 would discharge into either Blind Canyon to the north or lower Cristianitos to the west. The area of that portion of PA 8 that would be graded to discharge to Blind Canyon is approximately 473 acres. It is for this reason that the Blind and Talega Sub-basins are addressed in this section together.

In contrast to previous sections where entire sub-basins were modeled, the water balance and water quality modeling in these sub-basins were conducted for all the catchments in Blind Canyon and only for developed catchments in Talega Canyon. The decision to only model the developed portion of the Talega is reasonable given the grading plan.

D-2.6.1 Impacts on Hydrologic Conditions of Concern

Hydrologic Condition of Concern #1: Increased Stormwater Runoff Volume, Peak Discharge, and Flow Duration

Flow Duration Analysis

The flow duration analysis was conducted for catchments subject to development. Figure D-5 shows an example of the flow duration analysis for the 145 acre catchment designated PA8-6 (Figure A-19). The figure shows the effect of the proposed development on increasing the magnitude and duration of flows. The dashed horizontal lines indicate the estimated post-development 2 and 10 year peak flows. With controls, the runoff flows and durations can be managed so as to essentially match the pre-development condition, and, as part of that matching, the 2 and 10 peak flows are reduced to values consistent with the pre-development condition.

Water Balance Analysis

Tables D-78 and D-79 show the water balance results for the three climatic conditions for Blind Canyon and for the Talega development area, respectively. As indicated in Table D-79, the only outflow from the graded area to Talega is some surface runoff (approximately 25 acre-ft) to approximately mimic existing conditions.

The column titled “Runoff to Blind Canyon” is the projected total surface runoff (70 acre-ft) generated in the sub-basin consisting primarily of that portion of PA 8 that is located in Blind Canyon. These results indicate that runoff to Blind Canyon Creek would increase from about 48 acre-ft/yr under the pre-development case to about 70 acre-ft/yr, an increase of 22 acre-ft or 45 percent. Approximately 42 acre-ft/yr of runoff from the golf course and the estate housing located upgradient of the golf course would be stored in non-domestic water supply reservoirs and used for irrigating the course and common areas.

Hydrologic Condition of Concern #2: Decreased Infiltration and Groundwater Recharge

Because of the heavy reliance on groundwater infiltration to manage potentially erosive flows, groundwater outflow to Blind Canyon increases substantially. The total groundwater outflow consists of three components: (1) surface runoff from Talega Canyon that is being directed into the infiltration basins located in an alluvium area near the confluence of Blind Creek and Gabino Creek, (2) groundwater diverted from Talega by the grading, and (3) groundwater from within Blind Canyon. The total projected post-development groundwater outflow to Blind Creek, the sum of these three components, is about 902 acre-ft/yr. This is an increase of about 591 acre-ft over pre-development conditions. The effects of this infiltration would be to increase local groundwater table elevations, primarily in the lower portion of Blind Canyon.

Note that in this analysis we are assuming that groundwater flows in the graded portion of Talega Canyon will be redirected to Blind Canyon. The assumption is that the water table elevations will adjust to conform approximately to the land surface. However the direction of groundwater flows could be influenced by subsurface geologic formations such as clay lenses.

Hydrologic Condition of Concern #3: Changed Base Flow

The projected increase in groundwater infiltration and outflow into Blind Canyon is approximately 591 acre-ft/yr, which translates into an annual mean change in base flow of about 0.8 cfs. This increase would occur near the mouth of Blind Creek and the effect could extend into lower Cristianitos Creek.

Table D-78: Blind Sub-basin Average Annual Water Balance (inches (acre-ft))

Climatic Period	Pre-Development[1]					Post-Development with PDFs[2]							
	INFLOW	OUTFLOW				INFLOW			OUTFLOW				
	Precipitation	Runoff to Blind Canyon Creek	GW Outflow	ET	Total	Precipitation	Irrigation	Total	Runoff to Blind Canyon Creek	Runoff Stored for GC Irrigation[4]	GW Outflow[4]	ET	Total
All Years	16.8 (1026)	0.8 (48)	5.1 (311)	11.0 (672)	16.9 (1031)	15.7 (1654)	8.9 (937)	24.5 (2591)	0.7 (70)	0.4 (42)	8.5 (902)	15.4 (1626)	25.0 (2641)
Dry Years	14.1 (862)	0.6 (37)	2.8 (171)	10.8 (662)	14.2 (870)	13.1 (1387)	8.9 (936)	22.0 (2323)	0.4 (45)	0.4 (40)	6.3 (661)	15.3 (1617)	22.4 (2363)
Wet Years	22.5 (1375)	1.1 (70)	10.0 (609)	11.3 (693)	22.4 (1372)	21.0 (2218)	8.9 (939)	29.9 (3157)	1.2 (123)	0.4 (47)	13.4 (1412)	15.6 (1647)	30.6 (3229)

[1]The pre-development catchments are: 64,65,66,67. Pre-development area = 734 acres.
[2]The post-development catchments are: 64, 65, 66, PA8-3, PA8-4, PA8-5, PA8-6, PA8-7, PA8-8, PA8-9, PA8-10, PA8-11, and PA8-13. Post-development area = 1173 acres.
[3]Assumed golf course storage volume was 15 AF.
[4]Includes GW flows from Blind Cyn, GW flows from development areas in Talega Cyn, and treated surface runoff discharged to infiltration facilities.

Table D-79: Talega Sub-basin Average Annual Water Balance (inches (acre-ft))

Climatic Period	Pre-Development[1]					Post-Development with PDFs[2]			
	INFLOW	OUTFLOW				INFLOW			OUTFLOW
	Precipitation	Runoff to Talega Creek[3]	GW Outflow[4]	ET	Total	Precipitation	Irrigation	Total	Runoff to Talega Creek[5]
All Years	14.9 (586)	0.9 (35)	4.4 (172)	9.7 (383)	14.9 (589)	15.1 (801)	9.7 (517)	24.8 (1317)	0.5 (25)
Dry Years	12.5 (491)	0.7 (28)	2.3 (91)	9.5 (376)	12.6 (496)	12.6 (671)	9.7 (516)	22.3 (1187)	0.3 (18)
Wet Years	20.0 (788)	1.2 (47)	8.7 (343)	10.0 (396)	19.9 (786)	20.2 (1075)	9.7 (518)	30.0 (1593)	0.8 (42)

[1]The predevelopment catchments are 3, 4, 5, 6, 7, 8, 9a, and 9b. Pre-development area = 473 acres.
[2]Post-development area = 0 acres.
[3]Because only the development areas are modeled, runoff may not represent actual volumes that reach the stream. Surface runoff could infiltrate in open space areas between the development area and the stream.
[4]Because only the development areas are modeled, groundwater flows may not represent actual volumes that reach the stream. Some groundwater flows could be lost to ET, or groundwater flows could be greater if there is significant infiltration in the open space areas.
[5]Assumes that all flows from the developed catchments (PA8-3 to PA8-9) are collected in a pipe. There would be a flow splitter to divert some flows to Talega Creek (via a swale), and the remaining flows are diverted to Blind Canyon Creek.

D-2.6.2 Impacts on Pollutants of Concern

The section presents the water quality modeling results used to address impacts of stormwater runoff on sediments, nutrients, and trace metals for Alternative B-4. The results are provided for the three development scenarios, for three climatic conditions, and for Blind Canyon and the development area in Talega Canyon.

TSS Loads and Concentrations

Table D-80 shows the mean annual loads and concentrations for TSS for the Blind and Talega sub-basins. The "developed condition" row for Talega is assumed to be zero because of grading. However, it is assumed under the post-development with PDF scenario that some water will be directed from the graded area back into Talega Creek to maintain the existing water balance.

Table D-80 indicates that concentrations and loads are projected to be quite low in both Blind Canyon and Talega Canyon. This effect reflects the relatively small areas proposed for development, soil stabilization achieved with urban landscaping, the increase in impervious cover, and the effect of treatment, and in particular, treatment by infiltration.

Table D-81 shows the mean annual TSS concentration of 34 mg/L for runoff into Blind Canyon during wet years and how it compares with water quality criteria and observed in-stream concentrations. The criterion for TSS in the San Diego Basin Plan is narrative and states that "levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors". Observed concentrations reported by Wildermuth for two stations in the San Mateo Creek watershed range between about 4,000 to 9,000 mg/L. Consequently runoff will not adversely affect TSS levels in receiving streams.

Table D-80: Predicted Average Annual TSS Loads and Concentrations for the Blind and Talega Sub-basins

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Blind	Pre-Developed	11	9	17	190	188	192
	Developed	53	44	74	120	120	120
	Dev w/ PDFs	1.08	0.54	2.22	34	34	34
	Percent Change	-90	-94	-87	-82	-82	-82

Modeled Area	Site Condition	TSS Load (metric tons)			TSS Concentration (mg/L)		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Talega	Pre-Developed	8	6	10	178	144	144
	Developed*	0	0	0	-	-	-
	Dev w/ PDFs	0.74	0.51	1.22	24	24	24
	Percent Change	-90	-92	-88	-87	-84	-84

*For the Talega developed without PDFs condition, no flows will occur to Talega Creek from the development bubble.

Table D-81: Comparison of Predicted TSS Concentration with Water Quality Objectives and Observed In-Stream Concentrations for the Blind Sub-basin

Predicted Average Annual TSS Concentration[1] (mg/L)	San Diego Basin Plan Water Quality Objectives	Range of Observed In-stream Concentrations[2] (mg/L)
34	TSS levels shall not cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors	3,900 – 9,400

[1]Modeled concentration for developed conditions with PDFs in wet years.
[2]Range of concentrations observed at two San Mateo Creek watershed stations during the wet years.
NA – not applicable

Nutrient Loads and Concentrations

Tables D-82 and D-83 show the mean annual loads and concentrations for nitrate-nitrogen, TKN, and total phosphorus. Nitrate-nitrogen and ammonia-nitrogen (a portion of the TKN measurement) are important bio-available forms of nitrogen that can cause excessive algal growth in streams. TKN also contains organic nitrogen which is considered less bioavailable, and in this respect nitrate-nitrogen is the more important nitrogen species when considering effects on algal growth. Overall loads for nutrients will decrease in both Talega Canyon and Blind Canyon. Nitrogen concentrations will mostly decrease in both sub-basins. Total phosphorus concentrations will increase slightly in Talega Canyon. The substantial load reductions in Blind Canyon between “developed” and “developed with PDFs” reflect the effectiveness of infiltration.

Table D-84 shows a comparison of the average annual concentrations of nutrients in runoff into Blind Canyon Creek with observed in-stream data from Wildermuth. Nitrate and total phosphorus are within the lower portion of the observed range, whereas TKN concentrations are somewhat higher than the observed range. Given that TKN is less bioavailable, combined with the ephemeral nature of Blind Canyon Creek, it is unlikely that these concentrations would lead to excessive algal growth.

Table D-82: Predicted Average Annual Nutrient Loads for the Blind and Talega Sub-basins (lbs)

Modeled Area	Site Condition	Nitrate-N Loads			TKN Loads			TP Loads		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Blind	Pre-Developed	99	74	150	251	202	357	34	27	48
	Developed	801	656	1109	2623	2155	3614	363	298	500
	Dev w/ PDFs	21	10	43	112	56	230	19	9	39
	Percent Change	-79	-86	-71	-56	-72	-36	-44	-65	-19
Talega	Pre-Developed	57	47	79	214	176	294	29	24	40
	Developed*	0	0	0	0	0	0	0	0	0
	Dev w/ PDFs	36	25	59	82	57	136	24	16	39
	Percent Change	-38	-48	-26	-62	-68	-54	-18	-31	-1

*For the Talega developed without PDFs condition, no flows will occur to Talega Creek from the development bubble.

Table D-83: Predicted Average Annual Nutrient Concentrations for the Blind and Talega Sub-basins (mg/L)

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			TP Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Blind	Pre-Developed	0.76	0.73	0.79	1.94	1.99	1.87	0.26	0.27	0.25
	Developed	0.82	0.82	0.82	2.68	2.68	2.67	0.37	0.37	0.37
	Dev w/ PDFs	0.29	0.29	0.29	1.58	1.58	1.58	0.26	0.26	0.26
	Percent Change	-61	-60	-63	-18	-21	-16	2	-1	6

Modeled Area	Site Condition	Nitrate-N Concentration			TKN Concentration			TP Concentration		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Talega	Pre-Developed	0.61	0.49	0.50	2.28	1.84	1.84	0.31	0.25	0.25
	Developed*	-	-	-	-	-	-	-	-	-
	Dev w/ PDFs	0.52	0.52	0.52	1.19	1.19	1.19	0.35	0.35	0.35
	Percent Change	-16	4	4	-48	-36	-36	12	39	39

*For the Talega developed without PDFs condition, no flows will occur to Talega Creek from the development bubble.

Table D-84: Comparison of Predicted Nutrient Concentrations with Observed In-Stream Concentrations for the Blind Sub-basin

Nutrient	Predicted Average Annual Concentration[1] (mg/L)			Observed Range of In-Stream Concentrations[2] (mg/L)
	All Years	Dry Years	Wet Years	
Nitrate	0.29	0.29	0.29	0.29 – 1.1
TKN	1.58	1.58	1.58	0.39 – 1.2
Total Phosphorus	0.26	0.26	0.26	None Detected – 6.2

[1]Modeled concentration for developed conditions with PDFs.
[2]Range of concentrations observed at two San Mateo watershed stations during the wet years.
NA – not applicable

Trace Metals

Tables D-85 and D-86 show the predicted mean annual loads and mean annual concentrations for aluminum, cadmium, copper, lead, and zinc for the three development scenarios and for the three climatic conditions. Except for aluminum, the concentrations are all in the dissolved form, which is the form addressed in the California Toxics Rule.

Overall concentrations and loads are projected to decrease in Blind Canyon and in the runoff to Talega Canyon. The only exception is a small increase in the concentration of cadmium in runoff into Blind Canyon.

The important comparison with respect to potential effects on aquatic species is with the CTR criteria, and in the case of aluminum, the NAWQA criteria. Table D-87 compares the projected mean concentrations with the benchmark CTR and NAWQA criteria. A hardness of 140 mg/L has been used to estimate the CTR criteria of those metals whose criteria are hardness dependent. This value of hardness was the minimum hardness observed in the in-stream data collected at the two monitoring stations in the San Mateo Creek watershed by Wildermuth. Therefore the criteria may be viewed as a lower bound, and in this respect the comparison is conservative (i.e., more likely to indicate an exceedance). The table indicates that the projected mean concentrations of all the metals are well below the benchmark criteria.

Table D-85: Predicted Average Annual Trace Metal Loads for the Blind and Talega Sub-basins (lbs)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Blind	Pre-Developed	103	81	150	0.05	0.04	0.08	1.80	1.46	2.53	0.84	0.69	1.17	27	22	37
	Developed	548	449	757	0.56	0.46	0.77	9.40	7.72	12.96	4.21	3.46	5.79	36	30	50
	Dev w/ PDFs	43	21	89	0.04	0.02	0.08	0.57	0.29	1.16	0.18	0.09	0.38	3	1	6
	Percent Change	-58	-74	-41	-28	-53	-1	-68	-80	-54	-78	-87	-68	-89	-93	-84
Talega	Pre-Develop	78	65	108	0.03	0.03	0.05	1.60	1.32	2.20	0.79	0.65	1.08	25	21	34
	Developed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Dev w/ PDFs	38	27	63	0.02	0.01	0.03	0.42	0.29	0.70	0.27	0.19	0.45	2	1	3
	Percent Change	-51	-59	-41	-50	-58	-39	-74	-78	-68	-65	-71	-58	-93	-94	-91

*For the Talega developed without PDFs condition, no flows will occur to Talega Creek from the development bubble.

Table D-86: Predicted Average Annual Trace Metal Concentrations for the Blind and Talega Sub-basins (µg/L)

Modeled Area	Site Condition	Total Aluminum			Dissolved Cadmium			Dissolved Copper			Dissolved Lead			Dissolved Zinc		
		All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years	All Years	Dry Years	Wet Years
Blind	Pre-Developed	795	802	787	0.40	0.39	0.40	14	14	13	6.48	6.79	6.13	206	216	194
	Developed	559	558	559	0.57	0.57	0.57	10	10	10	4.29	4.31	4.28	37	37	37
	Dev w/ PDFs	608	606	609	0.52	0.52	0.52	8	8	8	2.58	2.58	2.58	41	41	40
	Percent Change	-23	-24	-23	32	35	30	-42	-43	-40	-60	-62	-58	-80	-81	-79
Talega	Pre-Developed	837	676	676	0.36	0.29	0.29	17	14	14	8.37	6.77	6.76	267	216	215
	Developed*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Dev w/ PDFs	556	556	556	0.25	0.25	0.25	6	6	6	3.93	3.93	3.93	26	26	26
	Percent Change	-34	-18	-18	-32	-15	-15	-64	-55	-55	-53	-42	-42	-90	-88	-88

*For the Talega developed without PDFs condition, no flows will occur to Talega Creek from the development bubble.

Table D-87: Comparison of Predicted Trace Metals Concentrations with Water Quality Criteria and Observed In-Stream Concentrations for the Blind Sub-basin

Trace Metals	Predicted Average Annual Concentration[1] (μg/L)			California Toxics Rule Criteria[2] (μg/L)	Observed Range of In-Stream Concentrations[3] (μg/L)
	All Years	Dry Years	Wet Years		
Total Aluminum	608	606	609	750[4]	Not Monitored
Dissolved Cadmium	0.52	0.52	0.52	6.1	None Detected – 0.37
Dissolved Copper	8	8	8	18	1.3 – 4.7
Dissolved Lead	2.6	2.6	2.6	93	None Detected – 0.19
Dissolved Zinc	41	41	40	160	None Detected – 26

[1]Modeled concentration for developed conditions with PDFs.
[2]Hardness = 140 mg/L, minimum value of monitoring data.
[3]Range of concentrations observed at two San Mateo watershed stations during the wet years.
[4] NAWQC criteria for pH 6.5 – 9.0.

D-2.6.3 Findings of Significance

Hydrologic Conditions of Concern and Significance Thresholds

The following discusses the implications of the water balance results on the hydrologic conditions of concern.

1. Increased Stormwater Runoff Flowrate, Volume and Flow Duration

Significance Threshold A: Substantially alter the existing drainage pattern of the site or area, including alteration of the course of a stream or river, in a manner that would cause substantial erosion or siltation.

The WQMP was designed specifically to preserve and protect the existing drainage patterns, and sediment transport regime. Drainage patterns within the development bubbles will be modified by the grading and installation of drainage infrastructure. Some of the grading is specifically designed to divert runoff from approximately in the more sensitive Talega Sub-basin to Blind Canyon and ultimately to lower Cristianitos, where stream conditions are considered more stable and resistant to the anticipated increase in flows.

Significance Threshold B: Substantially increase the frequencies and duration of channel adjusting flows.

Runoff volume in lower Blind Canyon is projected to increase on average by about 22 acre-ft, which is unlikely to affect channel stability.

On this basis, the effect of the proposed development on altering existing drainage or increasing the frequency and duration of channel adjusting flows is determined to be less than significant.

2. Decreased Infiltration and Groundwater Recharge

Significance Threshold A: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge that would cause a net deficit in aquifer volumes or lowering of the local groundwater table.

Because of the reliance on infiltration as a volume control measure, groundwater infiltration is projected to increase in Blind Canyon and especially near the confluence with Gabino and lower Cristianitos Creeks. On this basis, the potential effect of the proposed development on infiltration and groundwater recharge are considered less than significant.

3. Changed Base Flows

Significance Threshold A: Substantially increase or decrease base flows as to negatively impact riparian habitat.

Groundwater outflow into lower Blind Canyon Creek is projected to increase by about 591 acre-ft/yr, which translates into a mean increase in base flows of about 0.8 cfs. This effect would be mostly in lower Cristianitos Creek. Because of its size, substrate, and habitat, lower Cristianitos Creek is considered more suitable for accepting additional flows than Talega Creek. The base flow will decrease with distance downstream as some water will infiltrate into the stream bed and some water may be used to support riparian vegetation, especially in Lower Cristianitos Creek which, in certain reaches, is heavily vegetated.

Significance Threshold B: Substantially increase or decrease low flow estimates where high groundwater elevations are considered important.

As discussed above, the projected effect of the development would, if anything, increase base flows and local groundwater elevations. The effect would be most pronounced in lower Cristianitos Creek where existing habitat could potentially benefit from the additional water. On this basis, the effect of the proposed development in altering groundwater levels is considered less than significant.

Pollutants of Concern

The following are the conclusions regarding the significance of impacts for the pollutants of concern under wet and dry weather conditions.

Sediments: Mean total suspended solids loads and concentrations are predicted to be less in the post-development condition.

Nutrients (Nitrogen and Phosphorous): Post-developed nutrient loads are predicted to decrease and post-development concentrations are either well below or within the observed range of in-stream concentrations. Moreover the treatment system will include constructed wetlands to treat dry weather and small storm flows. Wetland systems such as those at the San Joaquin Marsh and Prado Reservoir have been shown to be quite effective in treating nitrate-nitrogen. On this basis, the impact of the B-4 alternative on nutrients is considered less than significant.

Trace Metals: Mean concentrations of total aluminum and dissolved cadmium, copper, lead, and zinc are predicted to decrease relative to predicted concentrations under existing conditions and are well below benchmark NAWQC and CTR criteria. On this basis, the impact of the B-4 alternative on trace metals is less than significant.

D-2.7 Impact analysis for the Verdugo Sub-Basin

This section evaluates the effectiveness of the WQMP for the Verdugo Sub-basin and evaluates the impacts of the proposed development on pollutants of concern and hydrologic conditions of concern.

Planning Area 9 includes 200 acres of estate housing in upper Gabino, Verdugo, and Central San Juan. Of the 240 acres, 54 acres would be in lower Verdugo. Given that estate homes will be widely disbursed with extensive landscaping, low impact site design techniques will be feasible. Such controls would be conducted onsite or in common areas and will include treatment practices such as vegetated swales and planter boxes. Water quality facilities will be designed to meet the MS4 Permit sizing criteria. Hydromodification controls will be designed to match pre-development volume, flow duration, and water balance conditions to the extent feasible.

Effects on Hydrologic Conditions of Concern

The estate homes would be located primarily in lower Verdugo Canyon in the San Juan Creek watershed. This area is characterized by infiltrative and highly erodible silty soils. Upper portions of the canyon contain erodible sands and the canyon is considered an important source of sand and gravel sediments during larger episodic storm events. Lack of subsurface water limits base flows and results in relatively dry upland and riparian plant communities. Given the infiltrative soils and sparse development surrounded by open space, volume control utilizing planter boxes and vegetated swales would be effective in matching pre-development runoff conditions.

Effects on Pollutants of Concern

Pollutant generation will be minimal given the low density of development. Fine sediment production is anticipated to be reduced as a result of urban landscaping. Irrigation controls and pesticide and fertilizer management educational programs would be provided to manage dry weather runoff and pollution. Roof runoff could be directed to planter boxes effectively treating pollutants that could be associated with atmospheric deposition on roof materials. The density of housing is compatible with swales along the arterial roads, in contrast to traditional curb and gutter, which would effectively treat road runoff. The resulting runoff from PA 9 is projected to meet the water quality significance criteria, and the discharges are therefore considered to be less than significant in affecting the water quality of Verdugo Creek.

D-2.8 Impact analysis for the Narrow and Lower Central San Juan Sub-Basin and the Lower Cristianitos Sub-Basin

Hydrologic and water quality modeling was conducted for most of the Planning Areas and the results of this modeling was presented in the sections above. This modeling encompassed the range of terrains and proposed development types in the proposed alternatives, and therefore it was not necessary to model all of the planning areas. The two remaining sub-basins that were not modeled were: (1) the Narrow and Lower Central San Juan Sub-basin (areas affected by PA 1), and lower Cristianitos Sub-basin, which would be affected by proposed development in the extreme western portion of the Northrop-Grumman area development (PA 8).

D-2.8.1 Narrow and Lower San Juan Sub-basin

Planning Area (PA) 1 is located in the western portion of Narrow Canyon within the Chiquita Sub-basin and in what is referred to herein as the Lower Central San Juan Sub-basin. The proposed development in the B-4 alternative would encompass approximately 599 acres and provides a mix of residential, urban activity center, business park, and open space uses. Runoff from PA 1 would discharge into San Juan Creek. The following impact analysis is for both development alternatives.

Impacts on Hydrologic Conditions of Concern

Effects on the hydrologic conditions of concern are associated with increased runoff volumes, peak flows, and durations taking into account the effect of terrains on stream channel characteristics and sediment supply. PA 1 is located in clayey terrain where shallow substrate is classified as less erodible clay. This terrain is also characterized as having lower infiltration capacity and therefore the effects of development on increasing runoff will be less pronounced than comparable development on sandy soils.

The receiving stream is San Juan Creek, a braided stream that drains a large tributary area. The system is braided because coarser sediments that originate in the steeper upland portions of the watershed tend to be deposited in the more gradual reach within PA 1. Given the small size of PA 1 compared to the San Juan Creek watershed, the discharges from PA 1 will in general be small relative to existing flow conditions in San Juan Creek. Also, given the proximity of the planning area to the creek and the tendency of urbanization to decrease the response time of catchments, the discharges from PA 1 will tend to precede peak flows in the larger watershed. For small storms, discharges into San Juan Creek may only originate from urbanized areas; however, such discharges will easily be accommodated within the channel and are not likely to be sufficient to mobilize stream sediments on a large scale.

With respect to significance criteria, discharges from the proposed development are not likely to adversely affect storm flows or base flows to the extent that the geomorphology and habitat values of central San Juan Creek will be adversely affected. Groundwater recharge also will not be significantly affected given the clayey terrain which limits existing infiltration.

Impacts on Pollutants of Concern

Impacts on pollutants for this development area are addressed based on available runoff data from similar land uses and data on BMP effectiveness. Table D-88 shows the anticipated runoff water quality and effectiveness of the treatment BMPs based on literature values. The table is limited to solids, nutrients, and trace metals, as these categories of pollutants are most often measured in stormwater monitoring programs. Project impacts on pathogens, petroleum hydrocarbons, pesticides, trash and debris, and chlorine were addressed qualitatively in Section 5-1. Monitoring data from a nearby station in San Juan Creek are also provided, and, where applicable, available water quality criteria are given.

It is important to note that, as indicated in the table, the runoff data are regional data from LA and Ventura Counties, whereas the treatment data come from the EPA International BMP Database. Given the current availability of data, these are considered the two best sources of information for the project. However, using independent data sets can lead to minor inconsistencies. For example, in some cases effluent quality exceeds runoff water quality. Also within the ASCE/EPA data set, each constituent is not measured at all facilities and for all storms and this may lead to inconsistencies. For example, the dissolved copper concentration exceeds the total copper value in the data set. These inconsistencies reflect the current availability of data, but are minor for our broader purposes here and do not affect our conclusions.

Dissolved metals data are all well below the CTR criteria based on hardness values observed in San Juan Creek. Also, note that dissolved concentrations observed in San Juan Creek are less than the effluent quality predictions. This reflects the much higher

TSS concentrations in San Juan Creek, which tends to increase the fraction of metals adsorbed to particulates and decrease the fraction of metals in the dissolved state.

Although there are no numeric water quality criteria for nutrients, projected effluent concentrations of nutrients are all relatively low when compared to the range of observed concentrations. The projected effluent concentrations for the more biologically available forms of the nutrients, namely dissolved phosphorous and nitrate-nitrogen are below the observed range.

Total suspended solids are projected to be relatively low compared to the range of observed data, which reflects in part the high sediment concentrations that can be observed during large storm events in the San Juan Creek watershed. This comparison does not account for grain size, for which the terrains analysis would indicate that discharges from PA 1 will tend to be finer material such as clays and silts. In contrast, sediment supply and transport energy in the San Juan Creek watershed as a whole indicate that suspended sediments will largely be coarser materials, including sands.

With respect to significance criteria for water quality, these data indicate that, with implementation of the proposed WQMP, projected mean concentrations in the runoff discharged to San Juan Creek will not exceed water quality criteria, and will in general be less than observed in San Juan Creek. On this basis, the effects of discharges from PA 1 on water quality in San Juan Creek are considered less than significant.

Table D-88: Projected Runoff Water Quality for Mixed Residential Land Uses in Planning Area 1

Pollutant of Concern	Units	Predicted Runoff Quality[1]	Predicted Effluent Quality[2]	Range of Observed Concentrations[3]	CTR Criteria[4]
TSS	mg/L	72.9	33.7	13 - 3100	
Nitrate-Nitrogen	mg/L	0.59	0.29	0.46 - 1.5	
Total Kjeldahl Nitrogen	mg/L	2.2	1.6	0.56 – 2.8	
Dissolved Phosphorus	mg/L	0.23	0.15	0.54 - 0.76	
Total Phosphorus	mg/L	0.28	0.26	0.07 - 1.5	
Total Aluminum	µg/L	278	NA	NA	750
Total Cadmium	µg/L	NA	0.93	ND[6] – 9.1	
Dissolved Cadmium	µg/L	0.12	0.52	ND - 0.088	7.6
Total Copper	µg/L	13.5	14.2	ND - 90	

Dissolved Copper	µg/L	8.60	16.2	3.4 - 3.7	22.2
Total Lead	µg/L	5.22	18.8	ND - 22	
Dissolved Lead	µg/L	1.60	2.58	ND	115
Total Zinc	µg/L	134	77.8	36 - 360	
Dissolved Zinc	µg/L	98.2	54.7	ND -13	184

[1]Predicted mean runoff quality based on LA County EMC data for mixed residential land use type. Range of data points for monitored parameters is 49 to 56
[2]Predicted mean effluent quality based on ASCE/EPA International BMP Database for extended detention basin. Range of data points for monitored parameters is 12 to 104
[3]Range of observed concentrations at station SW1 (San Juan at Equestrian Site). Number of data points for monitored parameters is 2 to 5
[4]CTR Criteria were conservatively estimated based on minimum hardness value (170 mg/L as $CaCO_3$) observed at the station SW1 (San Juan at Equestrian Site)
[5]NA – Not Available
[6]ND – Non-Detect

D-2.8.2 Lower Cristianitos Sub-basin

Alternative B-4 proposes 140 acres of general development, five acres of non-reserve open space, and 144 acres of reserve open space within the Lower Cristianitos Sub-basin. The general development land use is associated with Planning Area 8, which overlays the Lower Cristianitos, Gabino, Blind, and Talega sub-basins. Grading plans for the B-4 alternative would redirect approximately 40 acres of the Lower Cristianitos Sub-basin into the Talega Sub-basin and would redirect approximately three acres of the Blind Sub-basin into the Lower Cristianitos Sub-basin, for a net gain of 37 acres in Lower Cristianitos.

The anticipated increase in runoff volumes, especially low flows, would likely infiltrate into Lower Cristianitos Creek, raise groundwater levels, and support riparian vegetation. Runoff volumes and flow rates associated with larger storm events are not likely to adversely affect the stability of Lower Cristianitos Creek given the size of the proposed development relative to the size of the overall San Mateo Creek watershed at the point of discharge. Prior to discharge, runoff would be treated in an extended detention basin following the WEF sizing methodology.

D-3 **References**

GeoSyntec Consultants, 2004. Rancho Mission Viejo Conceptual Water Quality Management Plan. June 7, 2004.