RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Riverside, California

WILDOMAR MASTER DRAINAGE PLAN LATERAL C REVISION

Zone 7

Original Plan - August 1980 Revision No. 1 - October 2016 JASON E. UHLEY General Manager-Chief Engineer

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SECTION I - PURPOSE

The Wildomar Master Drainage Plan (MDP) was adopted in August 1980 and included Lateral C as a concrete-lined trapezoidal channel from its confluence with Wildomar Channel to its upstream terminus at I-15. Lateral C, Stage 1, from Wildomar Channel to Palomar Street, was constructed in 1987, and Stage 2, from Palomar Street to Pasadena Street, was constructed in 1992. The remaining portion of the proposed Lateral C system has not been constructed. However, the Wildomar area has continued to grow significantly over the past three decades resulting in significant changes in land use that would not be supported by Lateral C, as originally proposed.

The purpose of this report is to identify a feasible drainage system needed to alleviate currently known and anticipated drainage problems within the city of Wildomar along Bundy Canyon Wash, upstream of the existing Lateral C, Stage 2 channel.

Readers should bear in mind that the drainage network presented herein is conceptual in nature. Simply stated, the MDP provides a conceptual solution that addresses the known and anticipated drainage problems in the Wildomar area based on various engineering, environmental, and economic considerations. By no means does the proposed facility represent the only feasible solution.

The alignment and location of the facility proposed as part of this revision is approximate. Precise location will be dictated by site specific conditions and other factors existing at the time of detailed design. Similarly, the facility sizing information shown on the enclosed map is preliminary. More detailed analysis performed at the facility design stage will determine the final facility sizing.

SECTION II - SCOPE

Tasks involved in the development of the Lateral C revision include:

- 1. Determination of quantity of stormwater runoff produced at various locations during the 100year storm event.
- 2. Investigation of alternative drainage facility alignments and sizes as a basis for selecting the most economical, environmental, and soundly engineered plan.
- 3. Selection of a preferred alternative.
- 4. Preparation of a drainage facility map.
- 5. Preparation of preliminary plan and profile sheets.
- 6. Preparation of facility cost estimates

SECTION III - GENERAL DISCUSSION

The Lateral C system was first conceptualized as a concrete-lined trapezoidal channel during the development of the Wildomar MDP, adopted in 1980. As proposed in the adopted plan, Lateral C would be aligned along Bundy Canyon Wash, and would capture storm runoff at the downstream end of the existing double 10-ft. W x 6-ft. H reinforced concrete box (RCB) culvert under the I-15, approximately half a mile south of Bundy Canyon Road, and convey it to Wildomar Channel, just northeasterly of McVicar Street (**Figure 1**).

This revision was initiated as a result of environmental constraints that precluded the construction of the remaining portion of the proposed concrete-lined channel, and also due to significant land use changes within the Lateral C watershed that would impact the hydraulic capacity of the existing channel and the hydraulic sizing required for the remaining portion of the ultimate facility.



Figure 1: Wildomar MDP Lateral C Unbuilt Portion Per Adopted Plan

SECTION IV - OBJECTIVES

The following objectives were established for the Wildomar MDP Lateral C revision:

- 1. Revise the Wildomar MDP Lateral C system, such that, it supports the existing and proposed land use as set forth in the "Riverside County General Plan" adopted in 2003, and the City of Wildomar's 2015 "Draft. General Plan Update".
- 2. Reduce the level of risk from flooding to existing/future development and infrastructure (located between the I-15 and existing Lateral C channel) to below the "100-year" level.
- 3. Reduce 100-year storm runoff in the Lateral C system, such that, the hydraulic capacity of the existing Lateral C channel is not exceeded.
- 4. Identify a drainage system which, when implemented, will result in the elimination of FEMA designated Special Flood Hazard Areas for the community within the Lateral C watershed.

- 5. Identify the most economical combination of facilities, considering right-of-way acquisition, construction, and maintenance costs.
- 6. Minimize impacts to private property owners.
- 7. Minimize environmental impacts to the maximum extent practicable.
- 8. Develop a drainage system that facilitates phased construction while maximizing flood protection.
- 9. Develop a drainage system that avoids conflicts with existing and proposed subdivisions within the watershed.
- 10. Enhance recreational opportunities within the watershed by incorporating flood protection facilities that would accommodate future public trails and/or park.

SECTION V - HYDROLOGY

Existing Condition

The Wildomar MDP Lateral C system has a tributary watershed of approximately 2,310 acres and is mostly comprised of residential properties and rural mountainous areas with sparse commercial development along the I-15 corridor. The majority of the natural reaches of Bundy Canyon Wash meander through private residential properties. In past years there have been several complaints regarding erosion submitted by property owners located along the unimproved sections of Bundy Canyon Wash.

Runoff from the uppermost sub-watershed (Subarea A) drains westerly through natural reaches of Bundy Canyon Wash to the existing District facility, Bundy Canyon Channel Lateral A, just west of the intersection of Oak Canyon Drive and Bundy Canyon Road, see **Figure 2**. From the downstream terminus of this facility runoff drains along the natural watercourse southwesterly toward Monte Vista Street until it is intercepted by a concrete-lined trapezoidal channel owned by Caltrans, which drains to the double 10-ft. W x 6-ft. H RCB culvert under I-15. Downstream of the I-15 culvert, runoff is conveyed southerly in the natural watercourse to Central Street; along this reach the only improvements along the wash are two sets of corrugated metal pipe (CMP) culverts located at Walnut Street and at Grove Street, respectively. Due to the limited capacity of these culverts, runoff overtops the road at these locations during large storm events.



Figure 2: Lateral C Existing Hydrology Map

Once runoff reaches Central Street, it drains through the existing 12-ft. W x 6-ft. H RCB culvert under the road and continues southeasterly in Bundy Canyon Wash until draining into the existing Wildomar Lateral C, Stage 2 facilities at Pasadena Street. During large storm events, runoff overtops the road and drains south along Central Street toward Wildomar Channel, as depicted in **Figure 2** as a FEMA Special Flood Hazard Area.

Previous Studies

The most recent hydrology study for the Wildomar MDP Lateral C system (prior to this revision) was prepared by the District in September 1988. District files show that the 1988 study assumed natural (undeveloped condition) land use with no imperious cover for the entire Lateral C watershed.

2016 Hydrology Study

This section outlines the assumptions, rainfall values and methodology for this revision. Future land use assumptions for the Lateral C watershed were based on the City of Wildomar's 2015 "Draft. General Plan Update".

The rainfall frequencies examined were the 2-year (50% annual chance) and the 100-year (1% annual chance) recurrence intervals with 1, 3, 6, and 24 hour durations. The slope of the intensity-duration-frequency (IDF) curve is 0.48.

NOAA Atlas 2^1 and NOAA Atlas 14 Version 4^2 precipitation values were compared and are shown below in **Table 1**. However, NOAA Atlas 2 values were higher than NOAA 14 values for all storm durations and frequencies. Also, the existing Lateral C system was designed using these values. Therefore, NOAA Atlas 2 rainfall values were used in the hydrology calculations since they were more conservative compared to NOAA 14 and to match the methodology used for sizing the existing system.

	Point Rainfall Data Comparison									
Duration	Storm Frequency	NOAA 2 (inches)	NOAA 14 Ver. 4 (inches)							
hr	2-year	1.0	0.84							
3-]	100-year	2.6	2.13							
hr	2-year	1.5	1.19							
[- 9	100-year	3.8	2.96							
.hr	2-year	2.8	2.21							
24-	100-year	7.5	5.87							

 Table 1: Rainfall Comparison between NOAA Atlas 2 and NOAA Atlas 14 Version 4

¹ NOAA Atlas 2 Volume 11, Precipitation Frequency Atlas of the Western United States, California (1973)

² NOAA Atlas 14 Volume 1 Version 4.0, Precipitation Frequency Atlas of the Western United States, Semiarid Southwest (Arizona, Southeast California, Nevada, New Mexico, Utah) (2006)

Two methods were used to develop the hydrology for this revision: (1) the Rational Method; and (2) the Synthetic Unit Hydrograph (SUH) Method. The Rational Method was used to determine the peak discharges (cubic feet per second) generated from smaller watersheds less than 300 to 500 acres in size, such as those watersheds tributary to proposed sub-laterals (e.g., Laterals C-2, C-3) connecting to the Lateral C mainline facility.

The SUH Method was used to develop the hydrology for the Lateral C mainline facility due to a watershed size of 2,310 acres. The watershed was initially subdivided into three subareas: A, B, and C, for the development of individual synthetic unit hydrographs, which were then routed downstream and combined (**Figure 2**). This allowed for a more versatile hydrologic model to be used in the alternatives analysis (**Appendix A**) in which detention basins could be proposed at various concentration points within the watershed without having to generate additional hydrographs and routing models.

Based on the preferred alternative (Alternative 2A), a refined hydrology study was developed to estimate runoff rates at various concentration points within the proposed system and adjust pipe sizes, if needed. New subareas, designated Y and Z, were substituted for subareas B and C, respectively, to represent changes in flow paths and contributing tributary areas for this system (**Figure 3**).

SUH Method results and parameters for individual sub-watersheds are shown in **Table 2**. Hydrograph routing results are summarized on **Table 3**.

To account for the attenuating effects of channel and basin storage, the Convex Routing Method and Modified Puls Methods were used, respectively. Methodology and supportive data for the SUH Method may be found in the *Riverside County Flood Control and Water Conservation District Hydrology Manual*, dated April 1978.

Sub-watershed Parameters									
Description of	Existir	ng Hydrolo	Pref	erred					
Hydrology Study	Alter	natives An	alysis	Alterna	tive (2A)				
Subarea Name	Α	В	С	Y	Z				
Area (acres)	1759	301	247	375	111				
L (ft.)	17550	6810	7650	6850	3880				
L _{CA} (ft.)	9010	3380	3790	3670	1530				
Upstream Elevation (ft.)	2150	1490	1710	1496	1333				
Downstream Elevation (ft.)	1390	1290	1260	1292	1253				
Elevation Difference	760	200	450	204	80				
Natural Area (acres) n = 0.040	679	0	0	46	0				
Urban Area (acres) n = 0.020	1080	301	247	329	111				
Weighted 'n' Value	0.028	0.020	0.020	0.022	0.020				
% Valley S-Graph	0%	85%	80%	88%	100%				
% Foothill S-Graph	100%	15%	20%	12%	0%				
Individual Sub-wa	atershed P	eak Flow	Rates (cfs)						
3 Hour, 100-Year	2400	530	460	645	220				
6 Hour, 100-Year	2320	500	445	640	210				
24 Hour, 100-Year	1270	380	210	300	95				

Table	2:	Summary	of Sub-	-watershed	Parameters	and P	eak I	Flow	Rates
		Stilling	01040						

Description of Routing Run	Subar without p	Subareas A, B, and C, thout peak flow attenuation (Figure 2)Subareas A, Y, and Z (Alter includes detention basin for (Figure 3)							
Storm Duration	Node 1	Node 2	Node 3	Node 1Node 2Node					
3 Hour, 100-Year	2400	2590	2810	1020	1430	1600			
6 Hour, 100-Year	2320	2600	2950	1080	1510	1700			
24 Hour, 100-Year	1270	1470	1660	930 1140 1200					

Table 3: Summary of Routing Results (Peak Flow Rates in cfs)

SECTION VI - FACILITY SIZING CRITERIA

Facility sizing criteria and assumptions used for developing the proposed Lateral C system alternatives are described below:

Underground Storm Drains

Proposed underground facilities are located within existing or assumed future right-of-way, whenever possible, and consist of reinforced concrete pipes (RCP) ranging in size from 36 inches to 60 inches in diameter and RCB ranging in dimensions from 10-ft. W x 6-ft. (H) to 14-ft. W x 8-ft. H. Underground pipes were sized based on their full flow capacity and underground boxes were sized flowing open with 1-ft. freeboard from the soffit.

Open Channel

An open channel facility is proposed to provide an outlet for the underground facilities described above, and to serve as a conveyance system connecting to the existing concrete-lined channel (Wildomar MDP Lateral C, Stage 2). The proposed open channel facility is located along an existing wash, and will have an earthen bottom with rock-lined sideslopes. The hydraulic sizing of the open channel was verified using the standard step method. The right-of-way requirements for the open channel segment includes the full channel width, two maintenance access roads, as well as a 5 foot buffer on either side for anticipated cut and fill.

Detention Basin

A detention basin is proposed to attenuate peak flow rates to match the capacity of the existing channel downstream through the use of temporary detention storage. It should be noted that the proposed detention basin is sized for the 1% annual chance ("100-year" storm) event. Flows exceeding the design capacity of the basin would pass over an emergency spillway in flow patterns approximating present conditions.

SECTION VII - ALTERNATIVES ANALYSIS

Eleven (11) different alternatives were formulated for the proposed Lateral C system. The main differences between alternatives can be attributed to the following:

- 1. Proposed detention basin location (north or south of I-15).
- 2. Mainline facility type (underground storm drain versus open channel).
- 3. Mainline facility alignment (within street rights of way as opposed to private property).

The alternatives were first screened to determine if the proposed system would provide 100-year flood protection and would be free of any potential design or constructability issues based on known constraints. Aft.er the initial screening, six (6) alternatives were dismissed from further consideration. The remaining five (5) alternatives were further evaluated and scored against established criteria representing the project objectives to determine which alternative ranked the highest. Once this was completed, the alternatives were discussed with City of Wildomar staff and the preferred alternative (Alternative 2A) was selected.

For a detailed description of the alternatives and corresponding analysis, see Appendix A and B.

SECTION VIII - PROPOSED IMPROVEMENTS

The improvements proposed as part of this revision are shown on the enclosed map found in the back of this report (Appendix D). Supporting data for proposed facilities is available at the Riverside County Flood Control and Water Conservation District's office.

The design engineer should be aware that a detailed utility search was not completed. This means that, while the major known facilities were considered during the preparation of this study, a more thorough search may reveal additional or newly placed utilities that may necessitate minor alignment and size changes, or utility relocations during final design.

The proposed Lateral C system (Alternative 2A) includes the following:

- 1. Bundy Canyon Basin The proposed basin is located at the northeast corner of Bundy Canyon Road and Monte Vista Drive, just upstream of the I-15. The basin has a right-of-way footprint of approximately 19.1 acres and a storage volume of 143 acre-ft.. The basin outlet is proposed as a double 6-ft. W x 5-ft. H RCB and connects to a proposed 14-ft. W x 8-ft. H RCB that connects to the existing double 10-ft. W x 6-ft. H RCB culvert at I-15.
- 2. Lateral C (mainline) Proposed underground facility downstream of the I-15, aligned along White Street, Central Street and Como Street, ranging in size from a double 10-ft. W by 6-ft. H RCB to a single 14-ft. W x 8-ft. H RCB. The storm drain is proposed along White Street, southwesterly in Central Avenue, and southeasterly in Como Street to Bundy Canyon Wash. The proposed facility also includes a segment of open channel, approximately 680 linear feet of 24-ft. earthen bottom trapezoidal channel with rock-lined sideslopes (2:1), and a depth ranging from 10.65 to 9 ft.
- 3. Lateral C-2 Approximately 1,180 linear feet of 60-inch diameter RCP in Baxter Road.
- 4. Lateral C-3 Approximately 720 linear feet of 60-inch RCP in Grove Street.

Approximate 100-year, peak storm flows for the proposed system are shown on **Figure 3** (note removal of FEMA Flood Zone A in the Lateral C watershed). A detailed exhibit showing sizes and flows for the entire Alternative 2A system is attached in Appendix D.



Figure 3: Lateral C Proposed System (Alternative 2A) Hydrology Map

SECTION IX - ESTIMATED COST

A cost summary for the proposed Lateral C system (Alternative 2A) is shown in **Table 4**. Cost estimates were based on 2016 Planning Unit Cost Sheets and include construction, engineering, administration, environmental mitigation, and contingencies and right-of-way.

The cost estimates for the proposed facilities include the cost of manholes, catch basins and pipe installations. Manholes are located as necessary with a maximum spacing of 500 feet. Catch basins are not specifically located but the total number of lineal feet is included in the cost estimate. The cost for the open channel facilities includes the cost of access roads and right-of-way requirements. Channel access roads are assumed to be 15 feet wide and two (2) access roads were included where channel top widths exceed 20 feet. Detention basin costs include the cost of a 15-foot wide access road around the perimeter.

Facility/Limits	Construction Cost ¹	Engineering, Administration, & Mitigation Costs ²	Right-of-Way Cost	Total Cost
Bundy Canyon Basin and outlet facility to I-15 culvert	\$6,080,000	\$1,420,000	\$1,290,000	\$8,790,000
I-15 Culvert to Grove Street	\$2,250,000	\$530,000	None	\$2,780,000
Grove Street to Baxter Road, and Lateral C-3	\$1,950,000	\$455,000	None	\$2,405,000
Baxter Road to Central Street, and Lateral C-2	\$2,785,000	\$650,000	None	\$3,435,000
Central Street to upstream terminus of Stage 2	\$3,060,000	\$720,000	\$70,000	\$3,850,000
TOTAL COST	\$16,125,000	\$3,775,000	\$1,360,000	\$21,260,000

Table 4: Lateral C Cost Summary (Alternative 2A)

¹ Cost includes 22% for Lump Sum items, and 12% for Contingencies

² Includes 25% Engineering & Administration, 3% Mitigation

SECTION X - CONCLUSIONS

Based on the studies and investigations made for this report, it is concluded that:

- 1. The Wildomar area has experienced serious drainage related problems along Bundy Canyon Wash, and will continue to experience these problems until the Lateral C system is constructed.
- 2. The existing Wildomar Lateral C, Stage 2 channel does not have the capacity to convey the 100-year runoff from the tributary watershed due to significant changes in land use since the facility was constructed.
- 3. The revised Lateral C system (Alternative 2A) addresses the changes in land use anticipated within the watershed and provides a drainage system which, when implemented, will provide flood protection against a one percent (1%) annual chance flood to existing and future development downstream of the I-15.
- 4. The proposed drainage system, when fully implemented, will result in the elimination Special Flood Hazard Areas designated by FEMA within the Lateral C watershed.
- 5. The revised Lateral C system lends itself to a phased construction as funds become available.
- 6. The total cost of the recommended improvements, including right-of-way, engineering, environmental mitigation, administration, and contingencies is estimated to be \$21,260,000.

SECTION XI - RECOMMENDATIONS

It is recommended that:

- 1. The Lateral C Revision (Alternative 2A), as set herein, be adopted by the City of Wildomar and the District's Board of Supervisors.
- 2. The proposed revision, as set forth herein, replaces the portions of the Wildomar MDP Lateral C system adopted in August 1980.
- 3. The proposed revision, as set forth herein, be used as a guide for all future developments within the Lateral C watershed and that such developments be required to conform to the Plan insofar as possible.
- 4. Right-of-way necessary for the implementation of the Lateral C system be protected from encroachment.

Appendix A

Alternatives Analysis

ALTERNATIVES ANALYSIS

The alternatives selection processes consisted of formulating, screening, evaluating and scoring alternatives against the project objectives established by the District in cooperation with the City of Wildomar.

A total of eleven (11) alternatives were formulated for the proposed Lateral C system. The main differences between alternatives can be attributed to the following:

- 1. Proposed detention basin location (north or south of I-15);
- 2. Mainline facility type (underground storm drain versus open channel); and
- 3. Mainline facility alignment (within street rights-of-way as opposed to private property).

The alternatives were first screened by determining if the proposed system would provide 100-year flood protection and would be free of any potential design and/or constructability issues based on known constraints. Aft.er the initial screening, six (6) alternatives were dismissed from further consideration. The remaining five (5) alternatives were further evaluated and scored against established criteria based on the project objectives. Once this was completed, the alternatives decision matrix was discussed with the City of Wildomar, whereby, the highest scoring alternative (Alternative 2A) was selected as the preferred alternative.

Conceptual Design Objectives

The following list briefly describes several objectives that were determined to be necessary of any alternative that was formulated. These aspects were incorporated into all alternatives that were considered and scored in the decision matrix described later in this section.

- Capture 100-year runoff at the downstream end of Bundy Canyon Channel Lateral A.
- Include a detention basin to attenuate 100-year runoff to match the hydraulic capacity of the existing Wildomar MDP Lateral C, Stage 2 channel (Stage 2 Channel).
- Utilize the existing double 10-ft. H by 6-ft. W RCB culvert under the I-15.
- Convey the runoff to the existing Stage 2 Channel.
- Provide facilities in Grove Street and Baxter Street, extending to the east, to collect runoff from existing Caltrans culverts and convey it to the proposed Lateral C mainline.

Alternatives Development: Considerations and Discussion

- 1. **Detention Basin:** The incorporation of a detention basin was the key component for the development of alternatives. The purpose of the detention basin is to capture and attenuate 100-year storm runoff such that the design capacity of the existing Stage 2 Channel is not exceeded. In order to accomplish this and perpetuate existing drainage patterns, potential basin sites were limited to vacant parcels along or adjacent to Bundy Canyon Wash.
- 2. Existing I-15 Double 10-ft. W x 6-ft. H RCB Culvert (Caltrans culvert): It was assumed that the existing Caltrans culvert underneath the I-15 is not likely to be modified in the foreseeable future. Therefore, the invert elevation at the upstream end of the existing culvert was assumed as the controlling elevation for any proposed detention basin sites upstream of the I-15, specifically for maximum basin depth and slope of outlet facility. These two elements of the basin design are inversely related as a deeper basin (more storage) equates to less slope available for the downstream facilities (reduced capacity) to convey flows to the culvert and a shallower basin (less storage) equates to more slope available for the downstream facilities (more capacity). The optimum balance between these constraints will be further examined at the time of design.

For this study the minimum slope of 0.003 was utilized for the basin outlet facilities. It was also assumed that the water released from the basin would not cause the Caltrans culvert to seal, which could potentially cause unwanted backwater effects on the basin outlet. It was determined from preliminary hydraulic models (21 ft. wide rectangular outlet channel with a minimum slope of 0.003 ft./ft.) that 1,050 cfs was the maximum allowable flow able to be conveyed to the Caltrans culvert without potentially sealing the box. This limit was used as a soft. upper limit for the development of the basin outlet. Later configurations and refinements to the downstream system indicated that a slightly higher flow rate can be allowed to outlet from the basin (~1,200 cfs).

3. **Mainline Facility:** Two types of mainline facilities were considered for the alternatives developed as part of this study: 1) rock-lined open channel along the natural wash; and 2) underground storm drain (RCB) within street right-of-way. For the majority of proposed basin sites and configurations studied, both types of mainline facilities were determined to be feasible. Therefore, two alternatives were developed for each proposed basin site. The underground storm drain (denoted by a letter A, i.e., Alternative 2A) was proposed in an attempt to avoid significant alterations to the natural watercourse. The open channel (denoted by a letter B, i.e., Alternative 2B) was proposed to follow the natural alignment of Bundy Canyon Wash and was assumed to require full riprap armoring due to the proximity to existing residential structures, relatively small channel widths, large flow rates, and fast velocities expected along these reaches.

It should be noted that alternatives which share the same letter designation (i.e., Alternative 2A and Alternative 6A), will have near identical mainline facilities and vary primarily in proposed basin location/configuration. It should also be noted that alternatives with the same number designation (i.e., Alternative 2A and Alternative 2B), have identical basin locations/configurations and vary primarily in their mainline facilities as outlined previously. Not all alternatives were able to support the incorporation of above ground *or* underground facilities, in which case no letter designation was assigned and the mainline facilities are unique to that specific alternative (i.e., Alternative 3).

Two locations within the study area were determined to impose specific constraints which were addressed similarly between all alternatives. Those locations are as follows:

- The portion of Bundy Canyon Wash from Como Street upstream to Central Street was identified to have space limitations for an engineered drainage facility due to its proximity to existing structures. It is anticipated that an armored riprap channel section through this reach would not be feasible due to space requirements for the improvements and maintenance roads. This resulted in an underground facility aligned within Central Street and Como Street to be able to convey flows to the existing channel.
- The portion of Bundy Canyon Wash from the upstream terminus of Pasadena Street to Como Street serves as the only viable drainage path to connect to the existing Stage 2 Channel. For this reason all alternatives propose a riprap armored trapezoidal channel along this reach.
- 4. **Low Flow Outlets:** Underground facility alternatives which convey and bypass runoff around the natural wash should be designed to provide low-flow outlets to maintain the existing habitats found in the Bundy Canyon Wash streambed.
- 5. **Facility Sizing:** The hydraulic sizing of facilities was determined using the following:
 - Normal depth calculations were performed for all rock-lined open channel sections with the assumption that the effects of super-elevation would be negligible due to the absence of sharp bends in the proposed alignments.
 - Hydraulic modeling using WSPGW for all underground facilities sections to be able to estimate the water surface profiles and avoid undesirable backwater effects.

Study Constraints

The following constraints were identified during the development and evaluation of project alternatives and need to be considered during the final design of the project:

- The existing Stage 2 Channel has a design capacity of 2,200 cfs at Pasadena Street. Ultimate condition 100-year runoff shall be attenuated to match the design capacity of the channel.
- Proposed detention basins with an embankment height of 6-ft. or more will be subject to the California Department of Water Resources Division of Safety of Dams (DSOD) regulations for small earthen dams.
- Disturbances to the natural wash should be kept to a minimum.
- There is limited funding in Zone 7.
- An Elsinore Valley Municipal Water District (EVMWD) sewer line presently extends westerly across APN 367-110-008, southerly in Monte Vista Street, westerly in Canyon Drive, and under the I-15. Coordination with EVMWD regarding relocation of this facility is expected during the design phase.
- Any modification to Bundy Canyon Wash will require right-of-way acquisition from private property owners.

Study References

The following is a list of various references utilized for the development of project alternatives:

- Basin Requirements:
 - California Department of Water Resources Division of Safety of Dams: "Guidelines for the Design and Construction of Small Embankment Dams" March 1977. Reprinted January 1993
 - DSOD regulation information and spillway requirements
 - 2. RCFC&WCD: "Basic Master Plan Procedures"
 - Spillway freeboard requirements
 - Basin sideslopes
 - 3. Los Angeles County Flood Control District: "Debris Dams and Basins Design Manual"
 - Spillway design: coefficient of discharge
- Open Channel/Rock-Lined Channels
 - 1. RCFC&WCD: "Basic Master Plan Procedures"
 - Freeboard requirements
 - Transition lengths for WSPGW
 - 2. Los Angeles County Flood Control District: "Hydraulic Design Manual" March 1982
 - Used for riprap armoring thickness, see levee armoring on Page F-31
 - 3. Quinonez, Edwin: "Miscellaneous Notes; Moreno MDP Revision No. 2"
 - Freeboard requirements for sub/supercritical flow
 - Max unarmored channel velocities
 - Freeboard requirements
 - 4. RCFC&WCD: "Standard Design Manual"
 - Maintenance road widths and aggregate base fill for open channels

Alternatives Overview

This section provides a brief description of the major components of each alternative and indicates the preferred alternative. Each description is supplemented with an exhibit displaying the layout of facilities and basin locations in Appendix B.

No Project¹: This alternative represents the existing condition in the project area. No improvements were proposed and FEMA Zone A Special Flood Hazard Area within study area would remain as is.

¹ This alternative was dismissed from further consideration. See Table 2 - Decision Matrix.

Adopted 1980 MDP Alignment¹: The currently adopted 1980 Wildomar MDP proposes the unbuilt portions of Lateral C as a concrete-lined trapezoidal channel (base varies 8-ft. to 18-ft.; depth varies 7ft. to 8.5-ft.) from the Caltrans culvert just north of the intersection of Walnut Street and White Street extending southerly, following the natural alignment of Bundy Canyon Wash, to Central Street and then southerly to the existing Stage 2 Channel at Pasadena Street.

Alternative 1¹: This alternative proposed an incised detention basin with a 2.2 acre footprint at the intersection of Central Street and Bundy Canyon Wash. The proposed downstream facilities are comprised of an open channel along Bundy Canyon Wash from the basin outlet to the existing Stage 2 Channel and a section of RCB, for excess flows too great for the basin, extending southwest in Central Avenue and southeast in Como Street until it outlets into Bundy Canyon Wash.

Alternative 2A - Preferred Alternative: This alternative includes an incised flow-through detention basin with a 19.1 acre footprint located southeast of the intersection of Bundy Canyon Road and Monte Vista Street. The basin drains into a 14-ft. W x 8-ft. H RCB extending southerly, adjacent to Monte Vista Drive, and connecting to the existing Caltrans culvert at the I-15.

Downstream of the Caltrans culvert, the proposed underground facility ranges in size from a double 10-ft. W x 6-ft. H RCB to a single 14-ft. W by 8-ft. H RCB extending southerly in White Street, Central Avenue, and Como Street to Bundy Canyon Wash. In addition, there are two storm drain laterals extending easterly and proposed to drain into the mainline. One lateral is a 60-inch diameter RCP in Grove Street, and the other a 36-inch RCP in Baxter Road (Note: Aft.er Alternative 2A was chosen as the preferred alternative, a refined hydrology study was performed and it was determined a 60-inch RCP would be required in Baxter Road instead). This alternative also includes a segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

Alternative 2B: This alternative includes an incised flow-through detention basin with a 19.1 acre footprint located southeast of the intersection of Bundy Canyon Road and Monte Vista Street. The basin drains into a 14-ft. W x 8-ft. H RCB extending southerly, adjacent to Monte Vista Drive, and connecting to the existing Caltrans culvert at the I-15.

Downstream of the I-15 the double 10-ft. W x 6-ft. H RCB is proposed to be extended along Bundy Canyon Wash to Walnut Street, and then transitions to an earthen bottom trapezoidal rock-lined channel (B varies from 10-ft. to 24-ft.; D varies from 6-ft. to 6.5-ft.), extending southerly to Central Street. In addition, there are two (2) storm drain laterals extending easterly and proposed to drain into the mainline channel. One lateral is a 60-inch diameter RCP in White Street, and the other a 54-inch RCP in Baxter Road. Downstream of Bundy Canyon Wash's confluence with Central Street, the facility is proposed as a 12-ft. W x 8-ft. H RCB along Central Street, then to Como Street, and draining to the proposed segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

Alternative 3: This alternative includes a flow-through detention basin with a 9.45 acre basin footprint located north of Grove Street and west of Bundy Canyon Wash. The proposed basin is partially incised and would require an embankment and a 300-ft. emergency spillway on the east side of the basin to drain

¹ This alternative was dismissed from further consideration. See Table 2 - Decision Matrix.

flow back into Bundy Canyon Wash. The proposed mainline facility includes a rectangular channel (D = 7.5 ft., W = 29 ft.) from Bundy Canyon Lateral A to the existing double 10-ft. W x 6-ft. H RCB under the I-15. Downstream of the I-15 the double 10-ft. W x 6-ft. H RCB is proposed to be extended along Bundy Canyon Wash to Walnut Street and then southerly to the basin site.

Downstream of Grove Street, the basin is proposed to drain to an earthen bottom trapezoidal rock-lined channel (B = 20 ft., D varies from 5 ft. to 6 ft.), extending southerly to Central Street. In addition, there are two storm drain laterals extending easterly and proposed to drain into the mainline channel. One lateral is a 60-inch diameter RCP in White Street, and the other a 48-inch RCP in Baxter Road. Downstream of Bundy Canyon Wash's confluence with Central Street, the facility is proposed as a 12-ft. W x 8-ft. H RCB along Central Street, then to Como Street, and draining to the proposed segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

Alternative $4A^1$: This alternative includes a flow-through detention basin with a 12.9 acre footprint located southeast of the intersection of Bundy Canyon Road and Monte Vista Drive. The proposed basin is partially incised and would require an embankment and a 100-ft. spillway located on the south side of the basin. The basin is proposed to drain flow into a 14-ft. x 8-ft. RCB facility extending southerly, adjacent to Monte Vista Drive and then transitioning to the existing double 10-ft. W x 6-ft. H RCB under the I-15.

Downstream of the Caltrans culvert, the proposed underground facility ranges in size from a double 10-ft. W x 6-ft. H RCB to a single 14-ft. W by 8-ft. H RCB extending southerly in White Street, Central Avenue, and Como Street to Bundy Canyon Wash. In addition, there are two storm drain laterals extending easterly and proposed to drain into the mainline. One lateral is a 60-inch diameter RCP in White Street, and the other a 36-inch RCP in Baxter Road. This alternative also includes a segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

Alternative $4B^1$: This alternative includes a flow-through detention basin with a 12.9 acre footprint located southeast of the intersection of Bundy Canyon Road and Monte Vista Drive. The proposed basin is partially incised and would require an embankment and a 100-ft. spillway located on the south side of the basin. The basin is proposed to drain flow into a 14-ft. x 8-ft. RCB facility extending southerly, adjacent to Monte Vista Drive and then transitioning to the existing double 10-ft. W x 6-ft. H RCB under the I-15.

Downstream of the I-15 the double 10-ft. W x 6-ft. H RCB is proposed to be extended along Bundy Canyon Wash to Walnut Street, and then transitions to an earthen bottom trapezoidal rock-lined channel (B varies from 10-ft. to 24-ft.; D varies from 6-ft. to 6.5-ft.), extending southerly to Central Street. In addition, there are two storm drain laterals extending easterly and proposed to drain into the mainline channel. One lateral is a 60-inch diameter RCP in White Street, and the other a 54-inch RCP in Baxter Road. Downstream of Bundy Canyon Wash's confluence with Central Street, the facility is proposed as a 12-ft. W x 8-ft. H RCB along Central Street, then to Como Street, and draining to the proposed segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

Alternative 5A¹: This alternative includes a flow-through detention basin with a 9.7 acre footprint located southeast of the intersection of Bundy Canyon Road and Monte Vista Drive. The proposed basin is partially incised and would require an embankment and a 100-ft. spillway located on the south side of the basin.

¹ This alternative was dismissed from further consideration. See Table 2 - Decision Matrix.

The basin is proposed to drain flow into a 14-ft. x 8-ft. RCB facility extending southerly, adjacent to Monte Vista Drive and then transitioning to the existing double 10-ft. W x 6-ft. H RCB under the I-15.

Downstream of the Caltrans culvert, the proposed underground facility ranges in size from a double 10-ft. W x 6-ft. H RCB to a single 14-ft. W by 8-ft. H RCB extending southerly in White Street, Central Avenue, and Como Street to Bundy Canyon Wash. In addition, there are two storm drain laterals extending easterly and proposed to drain into the mainline. One lateral is a 60-inch diameter RCP in White Street, and the other a 36-inch RCP in Baxter Road. This alternative also includes a segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

Alternative $5B^1$: This alternative includes a flow-through detention basin with a 9.7 acre footprint located southeast of the intersection of Bundy Canyon Road and Monte Vista Drive. The proposed basin is partially incised and would require an embankment and a 100-ft. spillway located on the south side of the basin. The basin is proposed to drain flow into a 14-ft. x 8-ft. RCB facility extending southerly, adjacent to Monte Vista Drive and then transitioning to the existing double 10-ft. W x 6-ft. H RCB under the I-15.

Downstream of the I-15 the double 10-ft. W x 6-ft. H RCB is proposed to be extended along Bundy Canyon Wash to Walnut Street, and then transitions to an earthen bottom trapezoidal rock-lined channel (B varies from 10-ft. to 24-ft.; D varies from 6-ft. to 6.5-ft.), extending southerly to Central Street. In addition, there are two storm drain laterals extending easterly and proposed to drain into the mainline channel. One lateral is a 60-inch diameter RCP in White Street, and the other a 54-inch RCP in Baxter Road. Downstream of Bundy Canyon Wash's confluence with Central Street, the facility is proposed as a 12-ft. W x 8-ft. H RCB along Central Street, then to Como Street, and draining to the proposed segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

Alternative 6A: This alternative includes a flow-by basin with a 10.2 acre footprint located west of Monte Vista Drive, just north of the existing double 10-ft. W x 6-ft. H RCB under the I-15. The basin is partially incised and would require an embankment and a 300-ft. spillway on the east side of the basin along Monte Vista Drive. The proposed mainline facility includes a rectangular concrete channel (B = 30-ft., D = 7.5-ft.) from the downstream terminus of Bundy Canyon Channel Lateral A extending westerly toward Monte Vista Drive. This section of channel includes a flow-by structure, such as a side weir to transfer flow during larger storm events to the basin. The bypass channel downstream of the weir, located to the east of Monte Vista Drive, is a rectangular concrete channel (B = 15-ft., D = 7.5-ft.) extending southerly to the existing double 10-ft. W x 6-ft. H RCB under the I-15.

Downstream of the Caltrans culvert, the proposed underground facility ranges in size from a double 10-ft. W x 6-ft. H RCB to a single 14-ft. W by 8-ft. H RCB extending southerly in White Street, Central Avenue, and Como Street to Bundy Canyon Wash. In addition, there are two storm drain laterals extending easterly and proposed to drain into the mainline. One lateral is a 60-inch diameter RCP in White Street, and the other a 36-inch RCP in Baxter Road. This alternative also includes a segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

Alternative 6B: This alternative includes a flow-by basin with a 10.2 acre footprint located west of Monte Vista Drive, just north of the existing double 10-ft. W x 6-ft. H RCB under the I-15. The basin is partially

¹ This alternative was dismissed from further consideration. See Table 2 - Decision Matrix.

incised, would require embankment and a 300-ft. spillway on the east side of the basin along Monte Vista Drive. The proposed mainline facility includes a rectangular concrete channel (B = 30-ft., D = 7.5-ft.) from the downstream terminus of Bundy Canyon Channel Lateral A extending westerly toward Monte Vista Drive. This section of channel includes a flow-by structure, such as a side weir to transfer flow during larger storm events to the basin. The bypass channel downstream of the weir, located to the east of Monte Vista Drive, is a rectangular concrete channel (B = 15-ft., D = 7.5-ft.) extending southerly to the existing double 10-ft. W x 6-ft. H RCB under the I-15.

Downstream of the I-15 the double 10-ft. W x 6-ft. H RCB is proposed to be extended along Bundy Canyon Wash to Walnut Street, and then transitions to an earthen bottom trapezoidal rock-lined channel (B varies from 10-ft. to 24-ft.; D varies from 6-ft. to 6.5-ft.), extending southerly to Central Street. In addition, there are two storm drain laterals extending easterly and proposed to drain into the mainline channel. One lateral is a 60-inch diameter RCP in White Street, and the other a 54-inch RCP in Baxter Road. Downstream of Bundy Canyon Wash's confluence with Central Street, the facility is proposed as a 12-ft. W x 8-ft. H RCB along Central Street, then to Como Street, and draining to the proposed segment of trapezoidal rock-lined channel in Bundy Canyon Wash from Como Street to the existing Stage 2 Channel.

								Cost Breakdow	/N st Breakdowns ex	clude engineering and	administration co	**All
Alternative Name	Description of Mainline Facilities	Description of Mainline Facilities Basin Type Basin Location Site (acres) Required Spillway Uncised		Fully Incised?	Basin Construction Cost (No R/W)	Basin R/W Costs	Facility Construction Cost (No R/W)	Facilities R/W Cost	Total Cost			
No Project	No Improvements	None	N/A	N/A	N/A	N/A	N/A	Not Availiable	Not Availiable	Not Availiable	Not Availiable	Not Availiable
Adopted 1980 MDP Alignment	Concrete lined Trapezoidal Channels following the natural alignement of Bundy Canyon Wash	None	N/A	N/A	N/A	N/A	N/A	Not Availiable	Not Availiable	Not Availiable	Not Availiable	Not Availiable
Alternative 1	Combination of reinforced concrete box (RCB) and open channel downstream of the basin	Flow-through basin	Bundy Canyon Wash and Central Ave.	2.2	NO	NO	YES	Not Availiable	Not Availiable	Not Availiable	Not Availiable	Not Availiable
Alternative 2A	Majority of facilities are RCBs primarily within street R/W. Also includes shorter sections of rectangular channel and a trapezoidal, rock-lined channel section	Flow-through basin	Southeast of the intersection between Bundy Canyon Rd. and Monte Vista St.	19.1	NO	NO	YES	\$7,956,000	\$1,290,000	\$10,790,000	\$70,000	\$20,100,000
Alternative 2B	Majority of facilities are trapezoidal, rock-lined channels following the natural alignment of Bundy Canyon Wash. Also includes shorter sections of rectangular channel and underground RCB sections	Flow-through basin	Southeast of the intersection between Bundy Canyon Rd. and Monte Vista St.	19.1	NO	No	YES	\$7,956,000	\$1,290,000	\$10,900,000	\$450,000	\$20,600,000
Alternative 3	Majority of facilities are trapezoidal, rock-lined channels following the natural alignment of Bundy Canyon Wash. Also includes sections of rectangular channel and underground RCB	Flow-through basin	North of Grove St. to the west of Bundy Canyon Wash	9.5	YES	YES	NO	\$5,275,000	\$575,000	\$10,967,000	\$487,000	\$17,300,000
Alternative 4A	Majority of facilities are RCBs primarily within street R/W. Also includes shorter sections of rectangular channel and a trapezoidal, rock-lined channel section	Flow-through basin	Southeast of the intersection between Bundy Canyon Rd. and Monte Vista St.	12.9	YES	YES	NO	\$5,903,000	\$938,000	\$10,790,000	\$70,000	\$17,700,000
Alternative 4B	Majority of facilities are trapezoidal, rock-lined channels following the natural alignment of Bundy Canyon Wash. Also includes shorter sections of rectangular channel and underground RCB sections	Flow-through basin	Southeast of the intersection between Bundy Canyon Rd. and Monte Vista St.	12.9	YES	YES	NO	\$5,903,000	\$938,000	\$10,900,000	\$450,000	\$18,200,000
Alternative 5A	Majority of facilities are RCBs primarily within street R/W. Also includes shorter sections of rectangular channel and a trapezoidal, rock-lined channel section	Flow-by basin	Southeast of the intersection between Bundy Canyon Rd. and Monte Vista St.	9.7	YES	YES	NO	\$5,461,000	\$724,000	\$10,790,000	\$70,000	\$17,000,000
Alternative 5B	Majority of facilities are trapezoidal, rock-lined channels following the natural alignment of Bundy Canyon Wash. Also includes shorter sections of rectangular channel and underground RCB sections	Flow-by basin	Southeast of the intersection between Bundy Canyon Rd. and Monte Vista St.	9.7	YES	YES	NO	\$5,461,000	\$724,000	\$10,900,000	\$450,000	\$17,500,000
Alternative 6A	Majority of facilities are RCBs primarily within street R/W. Also includes shorter sections of rectangular channel and a trapezoidal, rock-lined channel section	Flow-by basin	East of Monte Vista St., just north of where Monte Vista St. Parallels the I-15 freeway	10.2	YES	YES	NO	\$4,458,000	\$1,707,000	\$10,790,000	\$70,000	\$17,000,000
Alternative 6B	Majority of facilities are trapezoidal, rock-lined channels following the natural alignment of Bundy Canyon Wash. Also includes shorter sections of rectangular channel and underground RCB sections	Flow-by basin	East of Monte Vista St., just north of where Monte Vista St. Parallels the I-15 freeway	10.2	YES	YES	NO	\$4,458,000	\$1,707,000	\$10,900,000	\$450,000	\$17,500,000

Alternative Analysis: Criteria and Scoring

A decision matrix was developed to evaluate the alternatives against the project objectives established by the District and the City of Wildomar. Criteria for the matrix were developed to represent aspects of the project objectives which could be qualitatively and quantitatively evaluated for each alternative. The decision matrix is shown in **Table 2**.

There are a total of 12 different criterions used to evaluate each alternative, which were divided into four distinct categories as follows:

- **Pass/Fail Criteria:** These criterions are those essential to the project and were part of the initial alternatives screening. If an alternative did not fulfill one of these criterions it was excluded from further consideration. Each alternative was required to pass all of these criterions in order to receive further consideration.
- **True/False Criteria:** These criterions define desirable project characteristics to which, if satisfied, alternative would receive full points and vice versa.
- **Quantitative Criteria:** These criterions rank each alternative based upon a quantifiable aspect (acreage, cost, percentage, etc.) of the project. The scoring system used to determine the points awarded to each alternative is defined in the following section.
- **Qualitative Criteria:** These criterions rank alternatives based upon an aspect of each alternative that cannot be easily quantified. The score awarded to each alternative is relative to the other alternatives evaluated and was based on staff discussions, considerations of project specifics, and engineering judgement.

Each criterion was also assigned a weighting factor used to highlight the perceived importance of each criterion in relation to each other. The assignment of weights was determined by the District based on discussions regarding project objectives with the City of Wildomar. These weights are displayed in the decision matrix shown in **Table 2**.

Pass/Fail Criterions

- 1. **Provide 100-Year Flood Protection:** This criterion represents the ability of an alternative to provide 100-year flood protection within the study area.
- 2. **Removal of FEMA mapped Special Flood Hazard Areas:** This criterion represents the ability of an alternative to remove FEMA mapped Special Flood Hazard Areas within the study area.
- 3. **Presence of Known Major Construction Issues:** This criterion considers known constraints and potential complications which could prevent or significantly complicate the successful design or construction of an alternative.

True/False Criterions

- 4. **No DSOD Involvement Required:** This criterion represents whether DSOD review and approval of the design is likely to be required.
 - Point Range: 0 pts. or 3 pts.

- If the alternative does not require DSOD involvement (True) 3 points are to be awarded.
- If the alternative requires DSOD involvement (False) 0 points are to be awarded.

Quantitative Criterion Descriptions

- 5. **Project Cost:** This criterion considers the total construction and right-of-way costs for the detention basin and mainline facilities proposed in the alternative. Project costs do not include engineering and administration costs.
 - Point Range: 5 pts = \$15 to \$16 million; 4 pts = \$16 to \$17 million; 3 pts = \$17 to \$18 million; 2 pts = \$18 to \$19 million; and 5 pts = \$19 million and above
- 6. **Water Quality/Conservation Opportunities:** This criterion represents the extent to which an alternative is able to promote infiltration of runoff back into the ground, mainly through the proposed detention basins and earthen bottom rock-lined channels.
 - This criterion will be quantified by summing the pervious surface footprint of the basin as well as any earthen bottom rock-lined channel area (base width x reach length) in acres. It is assumed that alternatives with a greater pervious area would increase the chance of runoff infiltrating back into the ground.
 - Point Range: 1 pt = 0 to 5 acres; 2 pts = 5 to 10 acres; 3 pts = 10 to 15 acres; 4 pts = 15 to 20 acres; and 5 pts = 20 to 25 acres
- 7. **Minimizing Environmental Impacts:** This criterion represents the extent to which proposed facilities within each alternative would disturb the existing Bundy Canyon Wash.
 - This criterion will be quantified as the approximate percentage of the currently unimproved Bundy Canyon Wash that would require modification/grading.
 - Point Range: 1 pt = 80 to 100%; 2 pts = 60 to 80%; 3 pts = 40 to 60%; 4 pts = 20 to 40%; and 5 pts= 0 to 20%
- 8. **Minimizing the Number of Property Owners Included in Right-of-Way Acquisition:** This criterion addresses the potential difficulty in acquiring the right-of-way required for facilities proposed in each alternative.
 - This criterion will be quantified by the number of different property owners whose property would require full or partial right-of-way acquisition for implementation of the alternative.
 - Point Range: 1 pt = 32 to 40 owners; 2 pts = 24 to 32 owners; 3 pts = 16 to 24 owners; 4 pts = 8 to 16 owners; and 5 pts = 0 to 8 owners

Qualitative Criterion Descriptions

9. Allowance for Economic Development: This criterion represents how well an alternative supports the economic development goals established by the City of Wildomar General Plan. For example, does an alternative conflict with proposed land development projects within the study area?

- Point Range: 1 to 5; a score of 1 represents an alternative which significantly conflicts with the City of Wildomar's economic development goals, whereas, a score of 5 represents an alternative which best fits with the City's economic development goals.
- 10. **Phasing Plan:** This criterion addresses the feasibility of an alternative to be effectively constructed in phases.
 - Point Range: 1 to 5; a score of 1 represents a system which would require the completion of a significant portion of the proposed project to be able to provide some flood protection to the community; and 5 represents a system that can easily be constructed in phases while providing significant flood protection.
- 11. **Ease of Maintenance:** This criterion addresses the expected level of maintenance for each of the completed alternatives.
 - Point Range: 1 to 5; a score of 1 represents an alternative which requires the most maintenance; and 5 represents the alternative with the least required maintenance.
- 12. **Enhance Recreational Opportunities:** This criterion evaluates whether an alternative would lend itself for the incorporation of recreational features (e.g., trails, open space, park) for the surrounding community.
 - Point Range: 1 to 5; a score of 1 represents the alternative with the least opportunity for recreational use; and 5 represents the alternative with the most opportunity for recreational use.

Table 2: Decision Matrix Table and Results

Decision Matrix

Wildomar MDP Lateral C Alternatives

		Pass/Fail Crite	eria	True/False Criteria Qualitative Criteria Qualitative Criter			ative Criteria						
	1) Provides							8) Minimizing the					Totals
Name	100 Year Flood Protection	2) Removes the FEMA Floodplain	3) Free of Major Construction Issues	4) No DSOD Involvement Required	5) Project Cost	6) Water Quality/ Conservation Opportunities	7) Minimizing Environmental Impacts	Number of Property Owners Included in R/W Acquisition	9) Economic Development	10) Phasing Plan	11) Ease of Maintenance	12) Enhance Recreational Opportunities	(Max)
Score Range	N/A	N/A	N/A	If True, scored as a 3 If False, scored as a 0	Best= 5 Worst= 1	Best= 5 Worst= 1	Best= 5 Worst= 1	Best= 5 Worst= 1	Best= 5 Worst= 1	Best= 5 Worst= 1	Best= 5 Worst= 1	Best= 5 Worst= 1	
Weighting Factor	N/A	N/A	N/A	1	3	2	3	3	3	3	1	1	98
Alternative 2A	YES	YES	YES	3	1	4	5	5	5	4	5	4	80
Alternative 2B	YES	YES	YES	3	1	5	1	2	5	5	1	5	61
Alternative 6A	YES	YES	YES	0	3	3	5	5	1	3	5	2	64
Alternative 6B	YES	YES	YES	0	3	3	1	1	1	5	1	3	43
Alternative 3	YES	YES	YES	0	3	3	2	2	5	4	1	3	58
Alternative 4A	YES	YES	NO	Dismissed from further con	sideration du	ie to anticipated	construction co	mplexities					N/A
Alternative 4B	YES	YES	NO	Dismissed from further con	sideration du	ie to anticipated	construction co	mplexities					N/A
Alternative 5A	YES	YES	NO	Dismissed from further con	sideration du	ie to anticipated	construction co	mplexities					N/A
Alternative 5B	YES	YES	NO	Dismissed from further con	sideration du	ie to anticipated	construction co	mplexities					N/A
Alternative 1	NO	NO	YES	Dismissed from further con	missed from further consideration due to a lack of necessary storage volume							N/A	
Adopted 1980 MDP Alignment	NO	NO	YES	Dismissed from further con	sideration du	e to a failure to	provide adequa	te flood protection					N/A
No Project	NO	NO	YES	Dismissed from further con	sideration du	e to a failure to	provide adequa	te flood protection					N/A

Results:

The results of the decision matrix highlight Alternative 2A as the highest scoring alternative with a score of 80. This alternative was selected as the Preferred Alternative with support from the City of Wildomar.

It is worth mentioning that Alternatives 4A/4B and 5A/5B were initially included and scored in the decision matrix, however, due to several uncertainties regarding potential utility relocation, spillway design and excavation, and the importance of selecting adequate space for the proposed basin site (at a planning level), it was determined that the scoring of these alternatives would be left. out of the final decision matrix.

Preferred Alternative Discussion: Alternative 2A

The following paragraphs detail each criterion in regards to the Preferred Alternative to highlight the identified benefits and discuss potential project drawbacks.

- 1. **Provides 100-Year Flood Protection:** Alternative 2A will provide the community within the study area 100-year flood protection.
- 2. **Removes the FEMA Floodplain:** Alternative 2A will remove the FEMA mapped SFHA within the study area aft.er the implementation of the proposed facilities.
- 3. **Free of Major Construction Issues:** There is an existing EVMWD 8-inch sewer line which conflicts with the proposed basin site (APN 367-110-008) and will need to be relocated. The relocation appears to be feasible based upon a preliminary horizontal and vertical alignment which would reroute the sewer line just south of the basin. It should be noted that the relocation can be accomplished by keeping the sewer line above the basin outlet RCB for maintenance access purposes. Specific relocation details to be determined at the design stage.
- 4. **No DSOD Involvement Required:** Alternative 2A proposes a fully incised basin, such that no embankment is required. This simplifies proposed basin design and it is expected that no DSOD coordination and review will be required.
- 5. **Project Cost:** Alternative 2A scored lower than other alternatives for this criterion since it was determined to be the second most expensive alternative at \$20.1 million (revised to \$21.3 million aft.er a refined hydrology study based on this alternative). The majority of the cost is attributed to the excavation due to the size of the fully incised basin. The proposed basin, being completely incised, requires a site of approximately 19.1 acres to generate the required storage necessary to attenuate the storm flows from the upstream watershed, however, the basin is proposed as a simple design free of embankments, emergency spillway and flow-by structures.

While many basin configurations proposed in other alternatives have a smaller footprint the tradeoff is for a more complicated design with subject to more stringent DSOD design requirements. It should be noted that Alternatives 4A/4B and Alternatives 5A/5B, which have lower costs than Alternatives 2A, are proposed at the same site but have lower costs due to less excavation and the use of excavated material for embankment. However, it is expected that the final basin configuration will be optimized at the design stage by balancing engineering, regulatory constraints and cost.

6. **Water Quality/Conservation Opportunities:** Alternative 2A scored high for this criterion due to the large (19.1 acres) basin footprint which would increase the opportunity for infiltration.

- 7. **Minimizing Environmental Impacts:** Alternative 2A scored well for this criterion due to the minimal impacts proposed to Bundy Canyon Wash. As stated earlier in the report the "regulatory climate" has changed significantly since the adoption of the Wildomar MDP in 1980 and environmental permitting has become increasingly more challenging. This alternative, by utilizing underground RCB facilities within street right-of-way in lieu of open channels along the undisturbed natural wash, avoids disturbance of the natural watercourse to a significant extent. This approach is a great benefit to both the habitats present along the natural watercourse and to the District in regards to simplifying and reducing the regulatory permitting required of the project.
- 8. **Minimizing the Number of Property Owners Included in Right-of-Way Acquisition:** Alternative 2A scored high with this criterion due to the low number of property owners from which property would need to be acquired for implementation of the proposed facilities. By proposing underground RCB facilities within street right-of-way, this alternative significantly reduces the number of individual property acquisitions which would be required with other alternatives proposing open channels along the existing wash alignment.
- 9. Allowance for Economic Development: Alternative 2A scored high against this criterion by not interfering with the economic development goals of the City of Wildomar. This determination was made through discussions and coordination on project updates with the City of Wildomar.
- 10. **Phasing Plan:** Alternative 2A scored well for this criterion. As with several other flowthrough basin configurations proposed in other alternatives, the completion of the basin alone would provide significant flood protection to the community by attenuating flows from all storm recurrences (i.e., 2-year, 5-year, and 10-year). This was seen as a great benefit due to the limited funding in Zone 7 and the overall cost to complete all phases of the project. In addition, construction of proposed segments of the underground facility may be more feasible as part of potential land development projects within the proposed commercial corridor on the west side of the I-15.
- 11. **Ease of Maintenance:** Alternative 2A scored high for this criterion due to the use of underground facilities for the majority of the mainline facilities. These facilities require minimal annual maintenance as opposed to open channels which would require regular mowing and upkeep. It is anticipated that the basin site would still require some annual maintenance for vegetation overgrowth and tracking of sideslopes.
- 12. **Potential for Recreational Opportunities:** The City of Wildomar has expressed interest in the future recreational features within the proposed basin, such as a park and or trails around the basin. However, these features would be designed and analyzed as a separate City project. Alternative 2A scored high in this category due to the large proposed basin site which would be able to accommodate several ball fields.

Appendix B

Alternatives Exhibits







Q(6hr)= 1423 cfs

8'x12' RCB

Node 13 Q(6hr)= 1827 cfs

NOTE: Trap Channels are rock lined

Trap. Channel B=24' D=6.5' SS= 2:1

Existing Lat. C Stg. 2 Design Q= 2200 cfs







Trap. Channel B=24' D=6.5'

Existing Lat. C Stg. 2 Design Q= 2200 cfs

SS= 2:1

Q(6hr)= 1423 cfs

8'x12' RCB

Node 13 Q(6hr)= 1846 cfs

NOTE: Trap Channels are rock lined





Trap. Channel

Existing Lat. C Stg. 2

Design Q= 2200 cfs

SS= 2:1

Q(6hr)= 1581 cfs

8'x12' RCB

Node 13 Q(6hr)= 2022 cfs

NOTE: Trap Channels are rock lined





8'x12' RCB

Node 13 Q(3hr)= 2169 cfs

NOTE: Trap Channels are rock lined



Existing Lat. C Stg. 2 Design Q= 2200 cfs Appendix C

Alternative 2A Mainline Alignment - Plan and Profile





































DATE DRAWN: APRIL 2015

DESCRIPTION



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Don't DigUntil You CollU.S.A. TollFree	BENCH MARK		REVISIONS			RIVERSIDE COUNTY FLOOD CONTROL
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Appendix D

Alternative 2A Exhibit

