ALBERT A. WEBB ASSOCIATES

San Jacinto River Stage 3

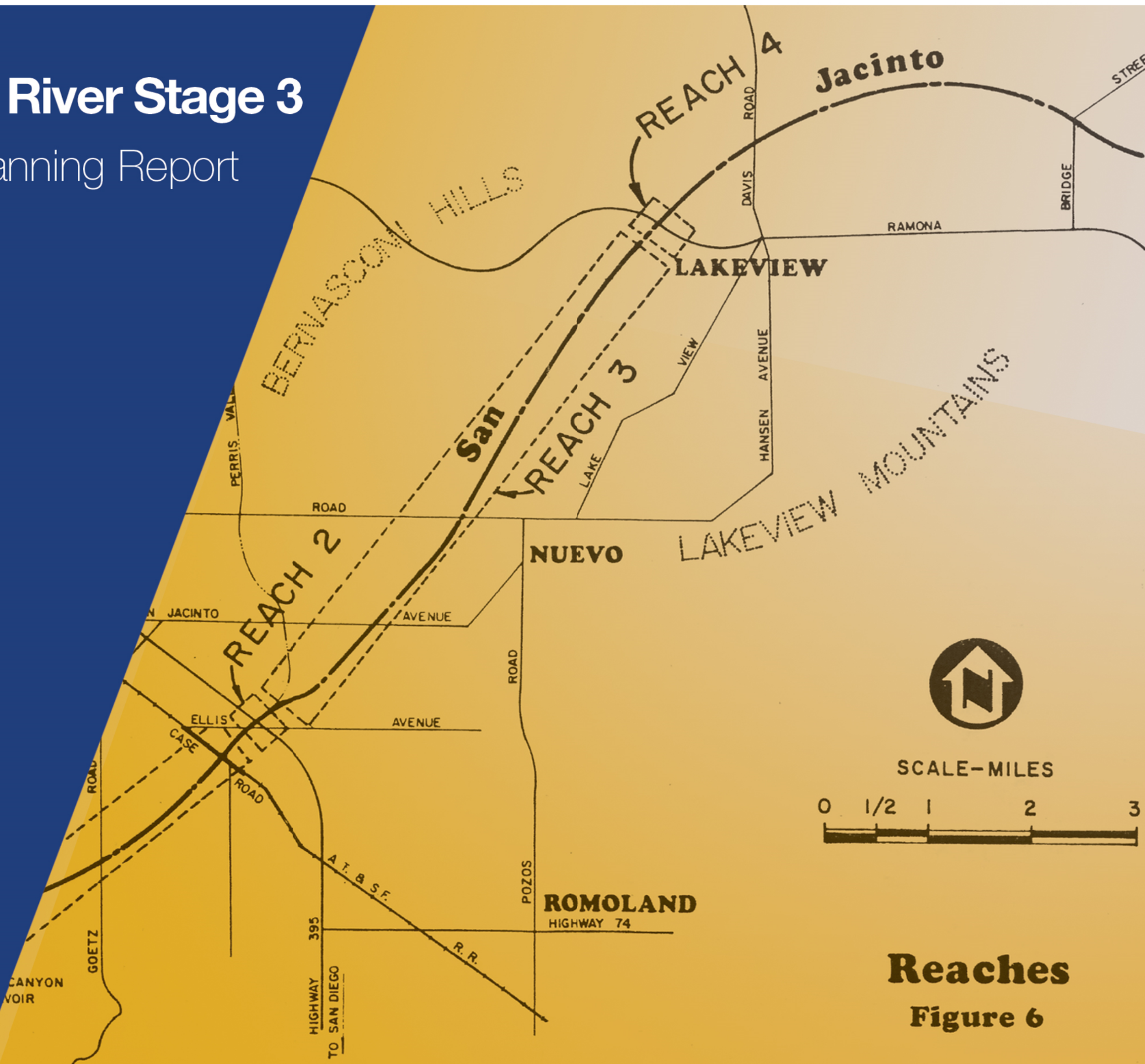
Conceptual Planning Report

Prepared for

Riverside County Flood Control Water Conservation District

March 28, 2017

www.webbassociates.com



Reaches
Figure 6

San Jacinto River Stage 3 Conceptual Planning Report

Prepared by:

ALBERT A. WEBB ASSOCIATES

March 28, 2017

Participating Agencies and Organizations

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Acronyms and Units of Measurement

Acronyms and units of measurement used throughout the report are defined below.

Acronyms

BFE	Base Flood Elevations
BNSF	Burlington-Northern Santa Fe
CDFW or Department	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
EHL	Endangered Habitats League
EMWD	Eastern Municipal Water District
FEMA	Federal Emergency Management Agency
HEC	Hydrologic Engineering Center
HEC-RAS	Hydrologic Engineering Center River Analysis System
GIS	Geographic Information System
LOMR	Letter of Map Revision
MSHCP	Western Riverside County Multiple Species Habitat Conservation Plan
MDP	Master Drainage Plan
NOAA	National Oceanographic and Atmospheric Administration
PFDS	Precipitation Frequency Data Server
PVSD	Perris Valley Storm Drain
RCA	Western Riverside County Regional Conservation Authority
RCFC&WCD	Riverside County Flood Control and Water Conservation District
RCTC	Riverside County Transportation Commission
RCTD	Riverside County Transportation Department
RWQCB or Regional Board	Regional Water Quality Control Board
SFHA	Special Flood Hazard Areas
Service or USFWS	U.S. Fish and Wildlife Service
USACE	U.S. Army Corps of Engineers
WEBB	Albert A. Webb Associates
WSE	Water Surface Elevation

Units of Measurement and Chemical Symbols

AF	acre-feet
CFS	cubic feet per second
ft	feet
in	inch
sq.mi.	square mile

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EXECUTIVE SUMMARY

At the December 15, 2015 meeting of the Riverside County Board of Supervisors, the Riverside County Flood Control and Water Conservation District (District) provided a "Proposed San Jacinto River, Stage 3 Project Plan of Action" that recommended formation of a "Lower San Jacinto River Advisory Committee" (Committee).[1] The recommendation was the result of a June 2015 meeting called by County Supervisor Marion Ashley with individuals and organizations that have vested interests in the planning efforts for the lower San Jacinto River floodplain. The District's Plan of Action recommended that the Committee be formed to assist the District with establishing a vision for a future master plan of the San Jacinto River Floodplain between the Ramona Expressway and Railroad Canyon ("Stage 3"). The District recommended that the Committee membership consist of representatives from the County, District, City of Perris, regional transportation and conservation authorities, and environmental and land development interests. This report summarizes the recommendations of that Committee.

To establish a vision, the Committee, chaired by Dusty Williams and Jason Uhley of the District and facilitated by Scott Hildebrandt of Albert A. Webb Associates under contract to the District, engaged in a collaborative process. Over the course of five meetings, from April 2016 through October 2016, the Committee was asked to:

- Recommend and rank public health and safety, transportation, environmental and economic development goals;
- To evaluate conceptual management plan alternatives against the ranked goals; and
- Endorse a preferred alternative that could serve as the basis for a tentative Project Description for the purposes of California Environmental Quality Act (CEQA) analysis and development of a lower San Jacinto River Master Drainage Plan.

The Committee considered the evolving nature of the San Jacinto Valley communities including Lakeview, Nuevo, Perris, and Romoland, as well as the benefits of better managing flood hazards that have historically impacted agricultural lands, isolated communities from critical services, and damaged critical environmental resources. The Committee reviewed the impact of flooding on major transportation corridors, including the Interstate 215 freeway and the Ramona Expressway, as well as local and regional development proposals, and future water supply and sewerage projects. It also considered the critical role the floodplain plays in implementing the goals of the Western Riverside County Multiple Species Habitat Conservation Plan, including sustaining the unique local ecology, nourishment of alkali soils that support endangered salt bush species and the San Jacinto River's function as a critical species movement corridor.

[1] Proposal was received and filed by the County Board of Supervisors, see agenda item 11-1 (Dec. 15, 2015 Board Minutes available at http://www.rivcocob.org/2015-agendas/).

After considering various alternatives, the Committee chose to endorse a "preferred alternative" that first focuses on addressing the most critical transportation, public safety and environmental needs; while accommodating ancillary development within the floodplain fringe. The preferred alternative includes the following components, referred to as "Phase 1" that are considered essential for public safety and would be led by the District (refer to **Figure ES-1**):

1. Armoring[2] of the Ramona Expressway as necessary to ensure it will not wash-out during a 100-year storm event;

2. Embankment protection along the east side of Interstate 215 at the San Jacinto River to provide 100-year flood protection for this critical transportation corridor;[3]

3. Certain drainage improvements intended to: i) prevent habitat conversion of the alkali playas due to changes in hydrology associated with urbanization, and ii) alleviate existing lateral drainage problems in Perris and Romoland, including:

    a. Construction of wide berms to direct non-storm related urban runoff from above Interstate 215 into existing culverts beneath the freeway;

    b. A deepened low-flow channel from the Perris Valley Storm Drain to Ethanac Road; and

    c. Utilization of an underground storm drain (in lieu of a deepened low-flow channel) as a method to convey low flows between Ethanac Road and Railroad Canyon.

The Committee agreed that, to the extent feasible, the preferred alternative would not preclude approved and/or pending development activities to proceed in the floodplain fringe (subject to separate project-level environmental review and permitting requirements). The following elements, referred to as "Phase 2" have been included as optional components that would be developer-led. Each of the Phase 2 elements could occur independently of one another; however, neither could proceed prior to completion of all Phase 1 elements described previously. Although non-essential for public safety, these secondary elements, as shown on **Figure ES-2**, will be addressed in the forthcoming CEQA analysis of environmental impacts prepared as part of the Master Drainage Plan:

1. The ability to excavate/fill portions of the shallow pond floodplain upstream of Interstate 215 to allow for some additional development within the floodplain fringe; and

2. Modify the low-flow channel from Perris Valley Storm Drain to Ethanac Road to include a 1,000-foot wide terrace that would slightly reduce the total floodplain acreage. The

[2] 'Armoring' refers to a variety of protective coverings designed to prevent erosion of slopes, such as rocks, vegetation, or engineering materials.

[3] The success of the Interstate 215 levee system is dependent on Ramona Expressway acting as an upstream control structure that attenuates storm flows during large events.

terrace would provide sensitive riverine habitat and species movement within the river corridor. By reducing the floodplain, terracing would also allow for some additional development within the floodplain fringe.

The preferred alternative would ultimately support the conservation of more than 4,300 acres of existing floodplain; while allowing incremental development of approximately 2,700 acres. In addition, the preferred alternative (with and without Phase 2) would provide a hydrologic regime that does not hinder or alter the ability of the MSHCP Conservation Goals to be met.

The preferred alternative recommended by the Committee is based on the preliminary environmental, engineering, and construction cost analyses discussed herein. The District will now further develop and refine the preferred alternative into a Master Drainage Plan for the Lower San Jacinto River with accompanying environmental impact documentation and analysis. Some modifications of the preferred alternative presented herein should be expected during development of the Master Drainage Plan. However, the District aims to maintain the Committee's vision to the fullest extent possible.

The balance of this report contains a description of the history, process and recommendations of the Committee. Several preliminary analyses used to assist the Committee with understanding the costs and benefits of various management options are also summarized.

Sincere appreciation is extended to the members of the Advisory Committee who volunteered their time and expertise, as listed below in **Table ES-A.**

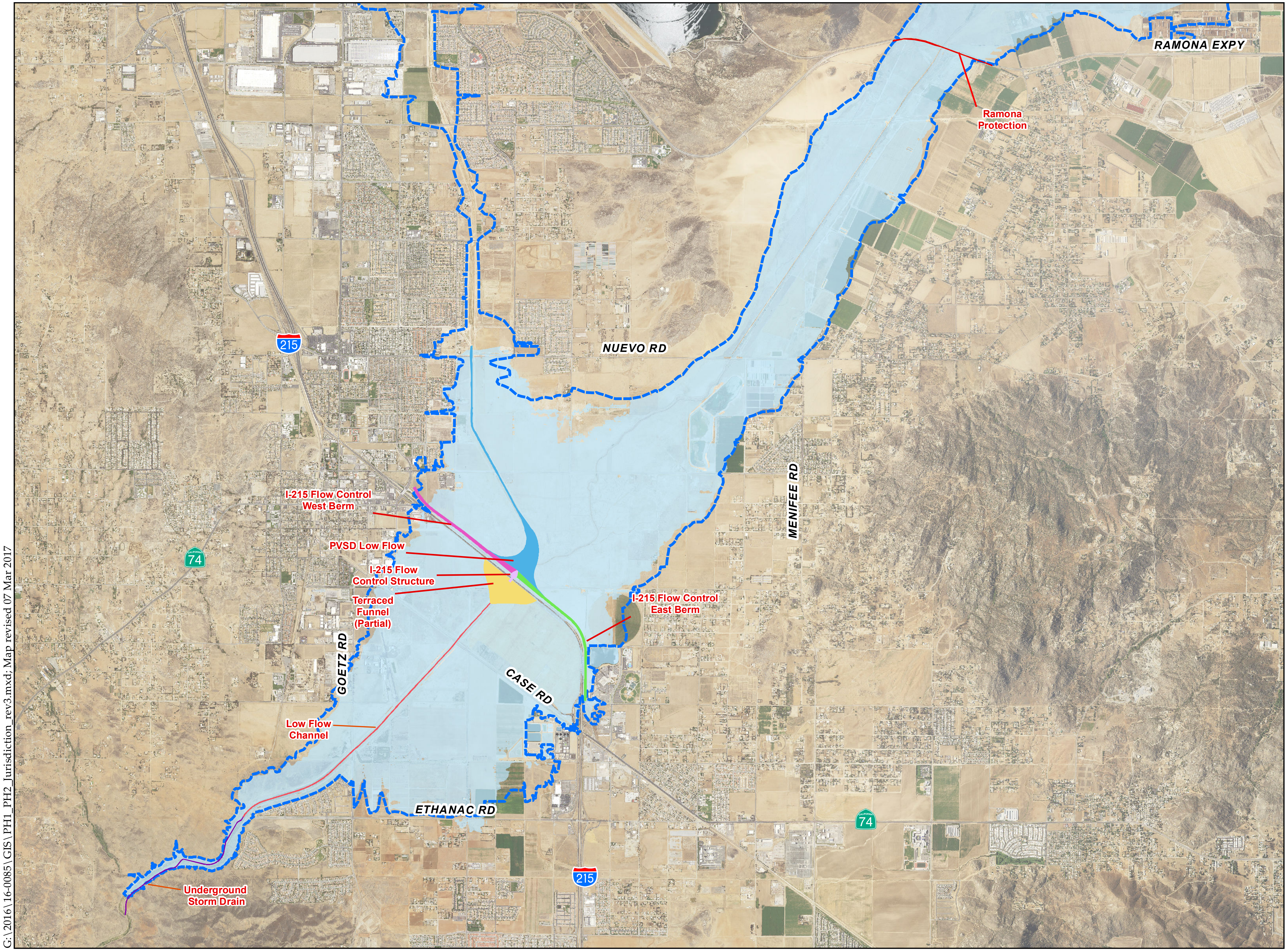
Table ES-A: Members of the Lower San Jacinto River Advisory Committee

Member	Affiliation
Marion Ashley	Riverside County Supervisor, 5th District
Daryl Busch	Mayor, City of Perris
Dusty Williams (retired) and Jason Uhley	General Manager-Chief Engineer, Riverside County Flood Control and Water Conservation District
Charles Landry	Executive Director, Western Riverside County Regional Conservation Authority
Anne Mayer	Executive Director, Riverside County Transportation Commission
Russell Williams	Environmental/Development Review Division Manager, Riverside County Transportation Department
Paul D. Jones II	General Manager, Eastern Municipal Water District
Dan Silver	CEO, Endangered Habitats League
Brett Feuerstein	New Perris Specific Plan
Patrick Parker	Green Valley Specific Plan (Raintree Investment Corporation)
David Arnold	River Park Mitigation Bank

In addition, the District staff and consulting professionals that supported the effort are listed below in **Table ES-B.**

Table ES-B: Members of the Technical Subcommittee

Member	Affiliation
Jason Uhley	General Manager-Chief Engineer, Riverside County Flood Control and Water Conservation District (RCFC&WCD)
Bob Cullen	Assistant Chief Engineer, RCFC&WCD
Mark Wills	Chief of Planning, RCFC&WCD
Stuart McKibbin	Chief of Watershed Protection, RCFC&WCD
Edwin Quinonez	Engineering Project Manager (Project Planning Section), RCFC&WCD
Scott Hildebrandt	Senior Vice President, Albert A. Webb Associates (WEBB)
Stephanie Standerfer	Vice President and Director of Planning & Environmental Services, WEBB
Joseph Caldwell	Director of Stormwater Engineering, WEBB



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LEGEND

Phase 1 Components

- Ramona Protection
- PVSD Low Flow
- I-215 Flow Control Structure
- I-215 Flow Control West Berm
- I-215 Flow Control East Berm
- Terraced Funnel (Partial)
- Low Flow Channel
- Underground Storm Drain
- Phase 1 Floodplain
- Existing 100-Year Floodplain

Fig ES-1: Preferred Alternative Phase 1 Elements and Footprint

San Jacinto River Stage III Conceptual Planning Report

ALBERT A. WEBB ASSOCIATES

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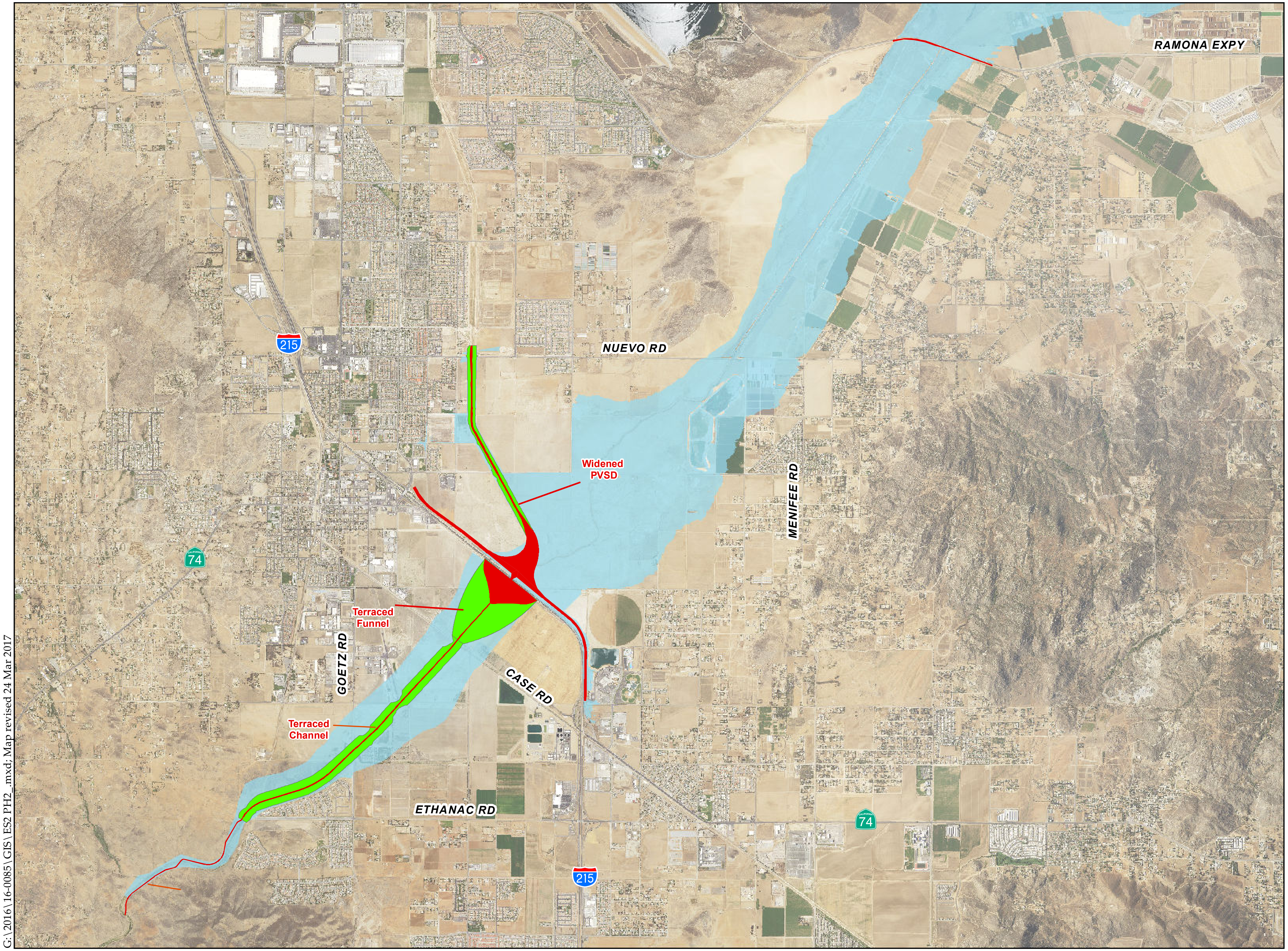
Sources: Riverside Co. GIS, 2016; USDA NAIP, 2014.



LEGEND

- Phase 1 Components
- Phase 2 Components
- Post Project Floodplain
- Existing 100-Year Floodplain

Fig ES-2: Preferred Alternative Phase 2 Elements and Footprint

San Jacinto River Stage III Conceptual Planning Report

ALBERT A. WEBB ASSOCIATES

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Sources: Riverside Co. GIS, 2016; USDA NAIP, 2014.

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SECTION 1: INTRODUCTION

The San Jacinto River flows westerly through the San Jacinto and Perris Valley regions of Western Riverside County. The earliest flood control efforts on the lower San Jacinto River were planned and implemented in the 1930's. Since that time, the communities surrounding the San Jacinto River and the regulatory environment have changed significantly. While much of this region is still dominated by agricultural production and rural open space, the need to improve the flood resiliency of two critical transportation corridors (i.e., Interstate 215 and Ramona Expressway) is of paramount concern. Additionally, the City of Perris and County of Riverside need to accommodate planned land development projects within their respective jurisdictions.

Notably, the population of the San Jacinto Valley nearly doubled between 1995 and 2015.[1] The San Jacinto River and floodplain is an important wildlife corridor and contains several unique habitats that support rare and endemic plant and animal species, including vernal pools, wetlands, grasslands, and alkaline soils. While many of the early planning efforts for the San Jacinto River were strictly focused on floodplain reclamation to support land development, the current understanding of the stakeholders is that any project for the river must achieve not only life, property, and infrastructure protection, but also advance environmental goals and accommodate economic development opportunities.

The focus of this planning effort encompasses the San Jacinto River from the Mystic Lake area to Railroad Canyon (**Figure 1-1**). This region is referred to as the "lower" San Jacinto River. Within the overall river system, the lower San Jacinto River is often referred to as "Stage 3." The lower San Jacinto River is characterized as a wide, shallow and very flat floodplain. Although the 100-year floodplain can reach widths of over two miles, smaller flooding events can still reach widths of over 1,000 feet due to the flat topography of the Perris Valley. Previous planning efforts have been led by various entities and while a wealth of knowledge has been gained by these efforts, an updated planning document has not been finalized. Seeking a renewed focus on the lower San Jacinto River, the Riverside County Flood Control and Water Conservation District (District) has taken the lead to assemble an advisory committee for the lower San Jacinto River in order to create a comprehensive planning document that considers the engineering, environmental, and economic aspects of a master plan for the lower San Jacinto River.

This committee, which is led by the District, includes both public and private stakeholders with an interest in this area of San Jacinto River (see **Table ES-1**). The committee was tasked to generate planning objectives, project elements, compare models/alternatives, and finally endorse a preferred alternative for further detailed study, which would be in the form of an updated master drainage plan and accompanying environmental impact analyses pursuant to the California Environmental Quality Act (CEQA).

[1] County of Riverside. *San Jacinto Valley Area Plan*. December 8, 2015, p. 2.

It is the aim of this report and the culmination of the committee's efforts, to provide the foundation on which a comprehensive master plan can be developed that gives clarity to the engineering possibilities and physical improvements, environmental constraints, and land development opportunities for the lower San Jacinto River.

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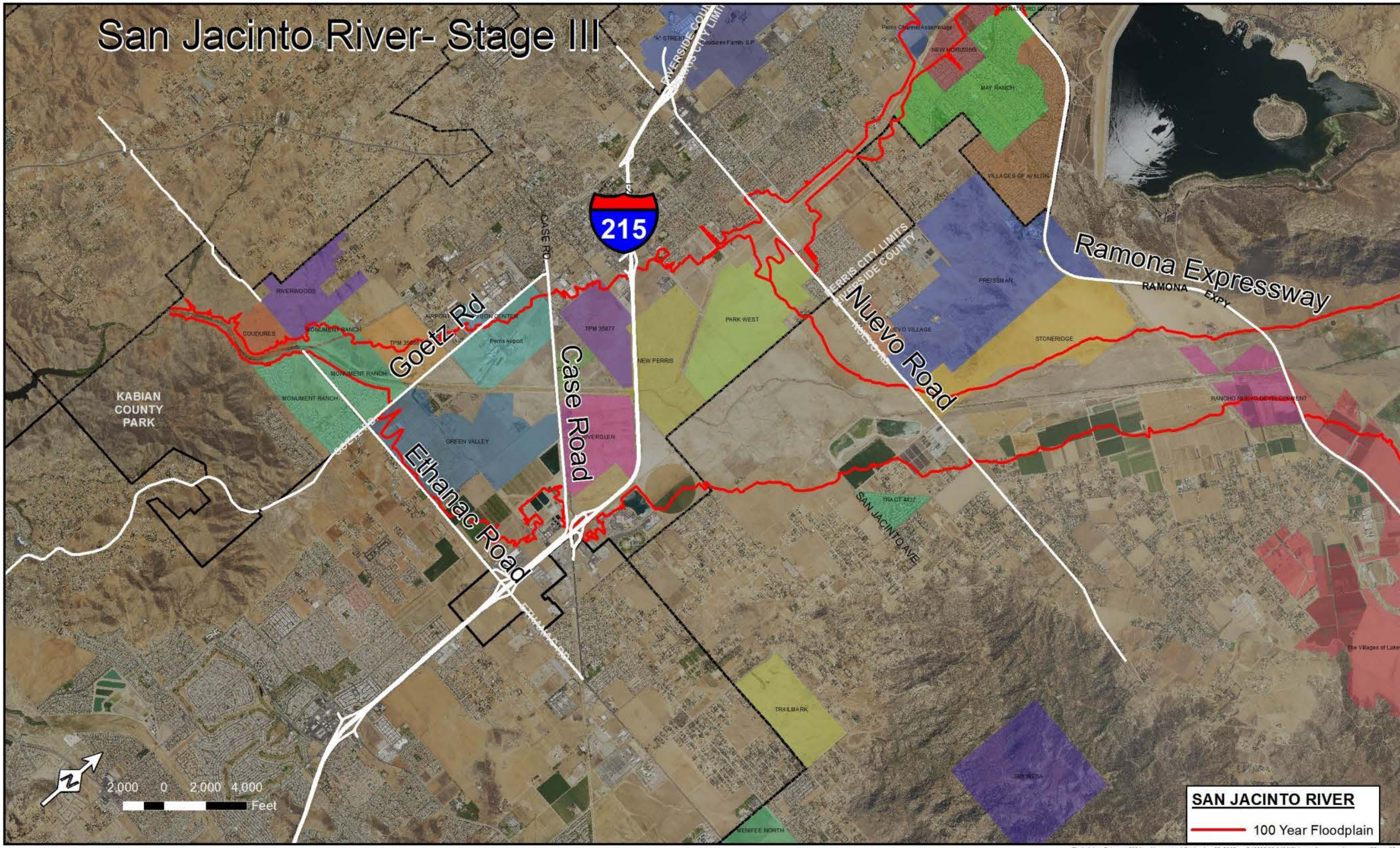
Figure 1-1: Project Study Area



This map contains Geographic Information owned by the County of Riverside. © 2004

Photo taken February 2004. Map revised September 29, 2005. G:\2003\03-0461\Gis\overall conservatopm area 29 sep 05.mxd

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SECTION 2: PROJECT HISTORY

2.1 Geographic Setting

The San Jacinto River is a 42-mile-long river with headwaters beginning at the west base of the San Jacinto Mountains above Lake Hemet. Downstream of the Lake Hemet Dam, the main stem of the San Jacinto River continues northwest where it historically discharged into Mystic Lake, located a couple miles east of Lake Perris. The lake was formed as a result of active earthquake faulting leading to subsidence, which created the depression of the lake. In the early twentieth century, a levee system was constructed to take San Jacinto River low flows away from Mystic Lake. However, due to ongoing fault activity, subsidence, and flood flows, the levees have been breached in multiple areas. When inundated, Mystic Lake is relatively shallow with a large surface area of up to 4,000 acres. Refer to **Figure 2-1, "Geographic Setting"** located at the end of this section.

Overflow from Mystic Lake flows southwest in a wide, ephemeral floodplain, passing under Ramona Expressway and Interstate 215, and through Railroad Canyon to Canyon Lake. Downstream of Canyon Lake Dam, the San Jacinto River continues flowing west through the Temescal Mountains until it drains into Lake Elsinore. In years of heavy rainfall, Lake Elsinore may overflow into Temescal Creek which flows north to outlet into the Santa Ana River in Corona.

The study area for this report, deemed "Stage 3," encompasses a segment of the San Jacinto River from just north of Ramona Expressway (and just below Mystic Lake) to the mouth of Railroad Canyon.

Of the many tributaries to the San Jacinto River, two man-made channels within the study area are notable; the Perris Valley Storm Drain and Romoland Channel. The Perris Valley Storm Drain (or Perris Valley Channel) is a 9-mile earthen trapezoidal channel that provides regional stormwater conveyance beginning at the east side of March Air Reserve Base and discharging to the San Jacinto River just east of the I-215. It is the regional collector facility for the Perris Valley Master Drainage Plan, which has a tributary drainage area of approximately 80 square miles. The Romoland Channel ("Line A") provides regional collection and conveyance for a tributary area of 11.1 square miles and outlets into the San Jacinto River just south of Perris Valley Airport.

Within Stage 3, the existing San Jacinto River floodplain is very flat and wide, with an average slope of 0.02% and variable width from 300 feet to more than two miles. The floodplain generally consists of an alluvial stream system, although it has experienced a variety of human activity including the construction of bridge crossings and agricultural activities that have all affected the fluvial mechanics.

2.2 Ecological Setting

Historically, the lower San Jacinto River floodplain experiences periods of flooding followed by the receding of floodwaters. The soils are generally alkaline; consisting of Chino, Domino, Grangeville, Traver, Waukena, and Willow soil series. These soils are prone to the formation of vernal pools since they are alkaline in nature and relatively impermeable. During periods of flooding, the floodplain will retain water in the micro-depressions of the flat topography resulting in vernal pools formation. Refer to **Figure 2-2, "Alkaline Soils"** located at the end of this section**.**

Given the type of soils and the hydrologic regime of short periods of flooding, standing water, and drying-out periods, various sensitive plants are associated with the San Jacinto River floodplain within the project area. Such plants include the San Jacinto Valley crownscale, Davidson's saltscale, thread-leaved brodiaea, Coulter's goldfields, Wright's trichocoronis, and spreading navarretia. Refer to **Figure 2-3, "Covered Plant Species"** located at the end of this section**.** These plants are all "Covered Species" per the Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP); however, they do require certain protections as a result of MSHCP compliance.

Because of the sensitive plants and rare soil formations found in the lower San Jacinto River floodplain, the MSHCP has identified the stretch of the river in the study area as a "Reserve Feature" to be conserved as part of the MSHCP Conservation Area. Specifically, the project area is within the following Reserve Features: Proposed Extension of Existing Core 4, Proposed Linkage 7 and Proposed Constrained Linkage 19. Refer to **Figure 2-4, "Reserve Features"** located at the end of this section**.** These three Reserve Features contemplate the conservation of not only the alkaline soils, but of the sensitive plants all the while maintaining the hydrology of the San Jacinto River. Connectivity to Conservation Areas is also a key element of the three Reserve Features within the project area. The connectivity will be maintained by ensuring a large enough area is set aside where animals can traverse even during high storm events (i.e. leaving lands outside the floodplain conserved).

2.3 Recent Human Activities

Activities that have impacted the hydrology of the San Jacinto River include agriculture, development and transportation projects. Agricultural activities in the floodplain have modified the hydrology of the river through channelization as well as the construction of levees to constrain the flows into smaller areas and prevent the wide-spread flooding that historically has occurred.

Because the San Jacinto River floodplain is wide and flat it is also attractive to land development interests. Therefore a number of significant private land development proposals are either currently approved or pending approval.

Transportation corridors such as Interstate 215 and Ramona Expressway currently transect the lower San Jacinto River floodplain, along with other arterial and circulation infrastructure.

Several bridges currently cross the San Jacinto River, and others will be needed in the future (e.g. Ethanac Road).

2.4 Prior Flood Control Planning and Projects

Balancing these needs along with the maintenance of the hydrology of the San Jacinto River for not only biological resources but as well as for flood hazard mitigation requires the development of a master plan.

In order to address the flood control concerns of the San Jacinto river valley, the San Jacinto Levee District was formed in 1908 by local citizens who built, funded, and maintained a protective levee along the San Jacinto River with aid from the County, State and Federal governments. Flooding events were recorded along the San Jacinto River in 1916, 1927, 1931, 1937, 1938, 1969, 1980 and 1993, with formal flood control planning efforts beginning in the 1930s. The San Jacinto River levee improvements were turned over to the Riverside County Flood Control and Water Conservation District (District) in 1947.

Throughout the years, a number of facilities have been built along the San Jacinto River that provide varying levels of flood protection. The existing facilities within the lower San Jacinto River study area consist of primarily an excavated channel and levee system between Interstate 215 and the entrance to Railroad Canyon.

In the mid-1970's, a flood control master plan was developed for the lower San Jacinto River.[1] This master plan (1975) included recommendations for channelizing the river system and utilizing a series of flood control structures to regulate the floodplain storage upstream of Interstate 215 and in the Mystic Lake area.

In the late 1980's, an Improvement District was formed and bonds were issued for the design of the lower reach of the San Jacinto River as contemplated in the 1975 master plan. However, due to economic recession, the construction of this project was not initiated and efforts to move a project forward stalled until the mid-1990's when a property owners group and the District formed a committee to renew efforts to formulate the lower San Jacinto River project.

Over the course of five years, this committee of property owners and the District developed a series of alternatives that evaluated all reaches of the lower San Jacinto River and emphasized environmental resources and their protection. During this time, the U.S. Fish and Wildlife Service (Service) established biological evaluation criteria that any proposed San Jacinto River project would be measured against. Concurrently, the County of Riverside began the creation of the Western Riverside County MSHCP to preserve and protect environmental resources throughout the County, including the unique habitats and species endemic to the lower San Jacinto Valley.

[1] Riverside County Flood Control and Water Conservation District and Neste, Brudin & Stone, Inc. *Flood Control Master Plan for the Lower San Jacinto River Basin.* March 1975.

In the late 1990's, the Service reviewed the District's then-proposed alternatives for the lower San Jacinto River and determined that there was not enough information provided to support any alternative, and therefore proposed to issue a biological jeopardy opinion[2] unless sufficient backup information could be supplied to support an alternative. In the years that followed the Service's proposed jeopardy opinion, additional planning efforts focused on developing alternatives that could meet the Service's criteria. These efforts focused on balancing the environmental goals and objectives with the flood control aspects needed for the lower San Jacinto River.

In 2003, the San Jacinto River Coalition was formed with the goal of developing a plan for the lower San Jacinto River that met both the Service and the newly-adopted MSHCP criteria. The San Jacinto River Coalition consisted of various property owners along the lower San Jacinto River, the County of Riverside, the District, and the City of Perris.

The efforts of San Jacinto River Coalition continued until 2007 when economic recession once again brought work to a halt. Nevertheless, several significant accomplishments were achieved during the Coalition's tenure, including:

- a jurisdictional delineation for the lower San Jacinto River;
- interim development criteria for properties along the lower San Jacinto River adopted by the City of Perris and the County of Riverside;
- a series of project alternatives were developed for the lower San Jacinto River and submitted to the District for review; and
- The City of Perris formally adopted an alternative as its 'preferred' alternative for the lower San Jacinto River.

Refer to **Appendix B** for copies of the presentations made in 2005 to the Riverside County Board of Supervisors and City Council of the City of Perris that review historical flooding events and planning efforts. The presentations also contain the approved Memorandum of Understanding between the District, Riverside County, City of Perris, and the San Jacinto Property Owners Coalition (dated July 27, 2004). The presentations provided in Appendix B also include the interim development criteria adopted by the County, and how that criteria differs from the interim development criteria adopted by the City of Perris.

In conjunction with a 2009 development proposal, a floodplain study was initiated to update the 100-year floodplain limits for the lower San Jacinto River and Perris Valley Storm Drain based on updated topographic data and new hydraulic modeling techniques. The study was preliminarily approved by FEMA in 2011 and the Flood Insurance Rate Maps for the City of Perris and County of Riverside were officially revised in 2014. As a result, the 100-year

[2] According to the Endangered Species Act, "jeopardy" occurs when an action is reasonably expected, directly or indirectly, to diminish a species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciable reduced. When the Service makes a jeopardy determination, it would provide reasonable and prudent alternative actions that are consistent with the purpose of the project but avoid jeopardy. (www.fws.gov).

flowrates and corresponding floodplain elevations that are used to regulate new development were greatly reduced.

It was also around this time that the area was starting to recover from the economic recession and a renewed interest in completing a plan for the lower San Jacinto River began. Seeing that there was a renewed interest from various property owners in 2015, Riverside County Supervisor Marion Ashley convened a meeting of interested public and private stakeholders to discuss the lower San Jacinto River. Based on the information derived from that meeting, Supervisor Ashley appointed the District to lead formation of a committee to develop a planning document for the lower San Jacinto River. In 2016, the San Jacinto River Stage 3[3] Advisory Committee was formed and planning efforts commenced as described herein. Refer to **Appendix B** for the presentation made to the Committee in 2016 that provided historical background on the river and prior planning efforts.

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[3] 'Stage 3' refers to the river segment from Ramona Expressway to Canyon Lake, which generally includes 'Reaches' 1 through 4, as defined by the 1975 *Flood Control Master Plan for the Lower San Jacinto River Basin*.

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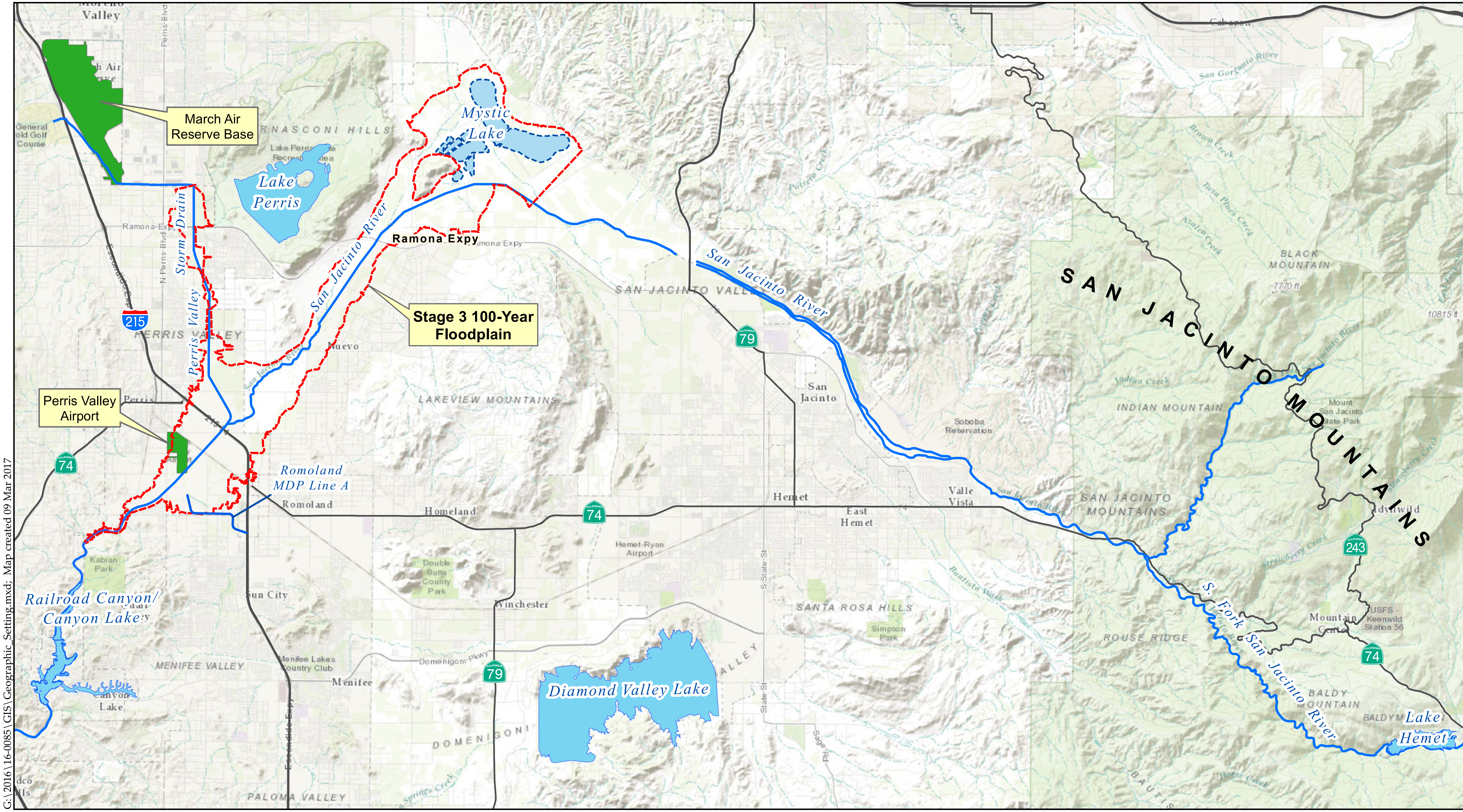

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Sources: Riverside Co. GIS, 2017;
USDA NAIP 2014.

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Figure 2-1 Geographic Setting
San Jacinto River 100-year Floodplain

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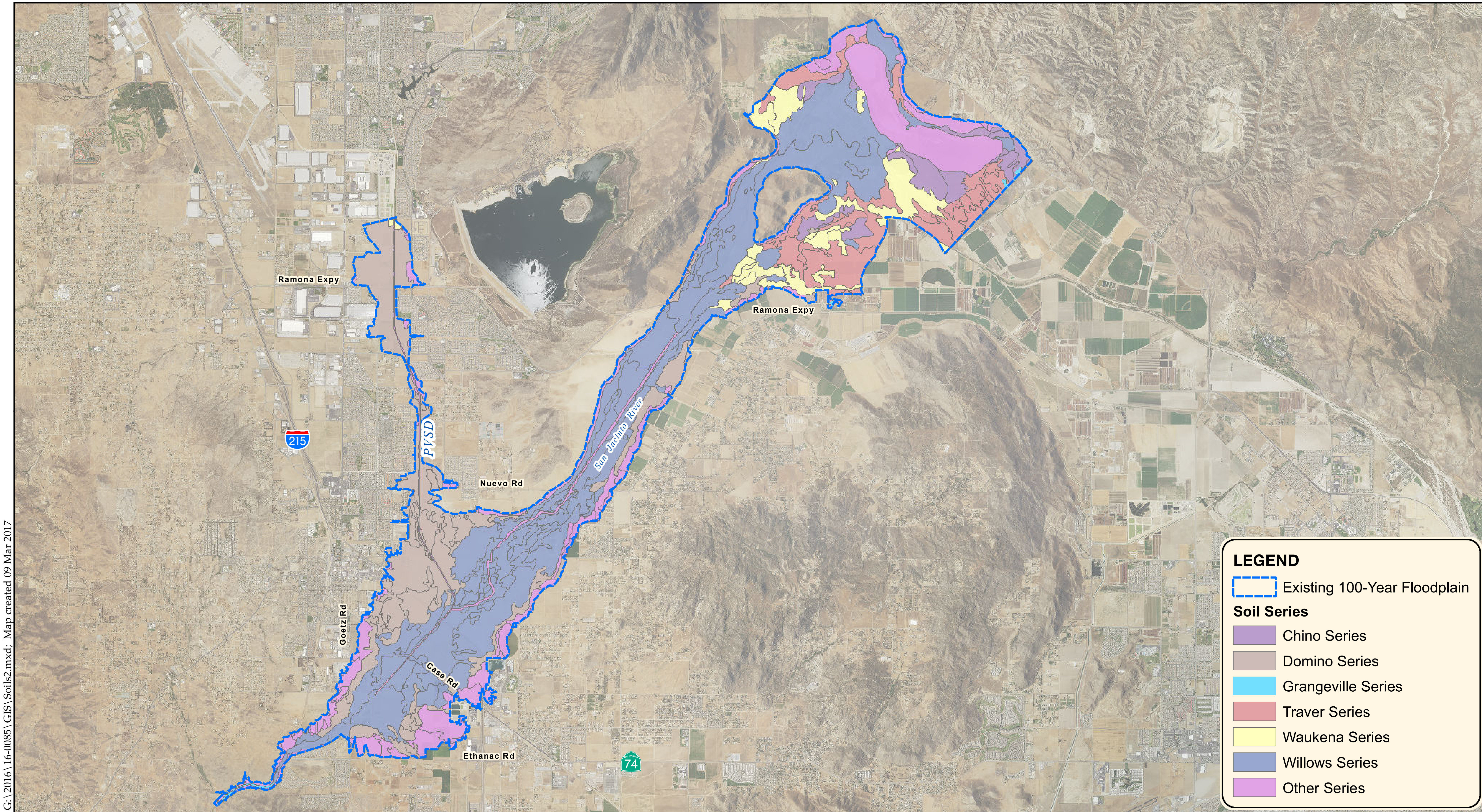

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Source: USGS NRCS SSURGO 2008;
Riverside Co. GIS, 2016; USDA NAIP 2014.

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Figure 2-2 Alkaline Soil Series Within Study Area

San Jacinto River 100-year Floodplain

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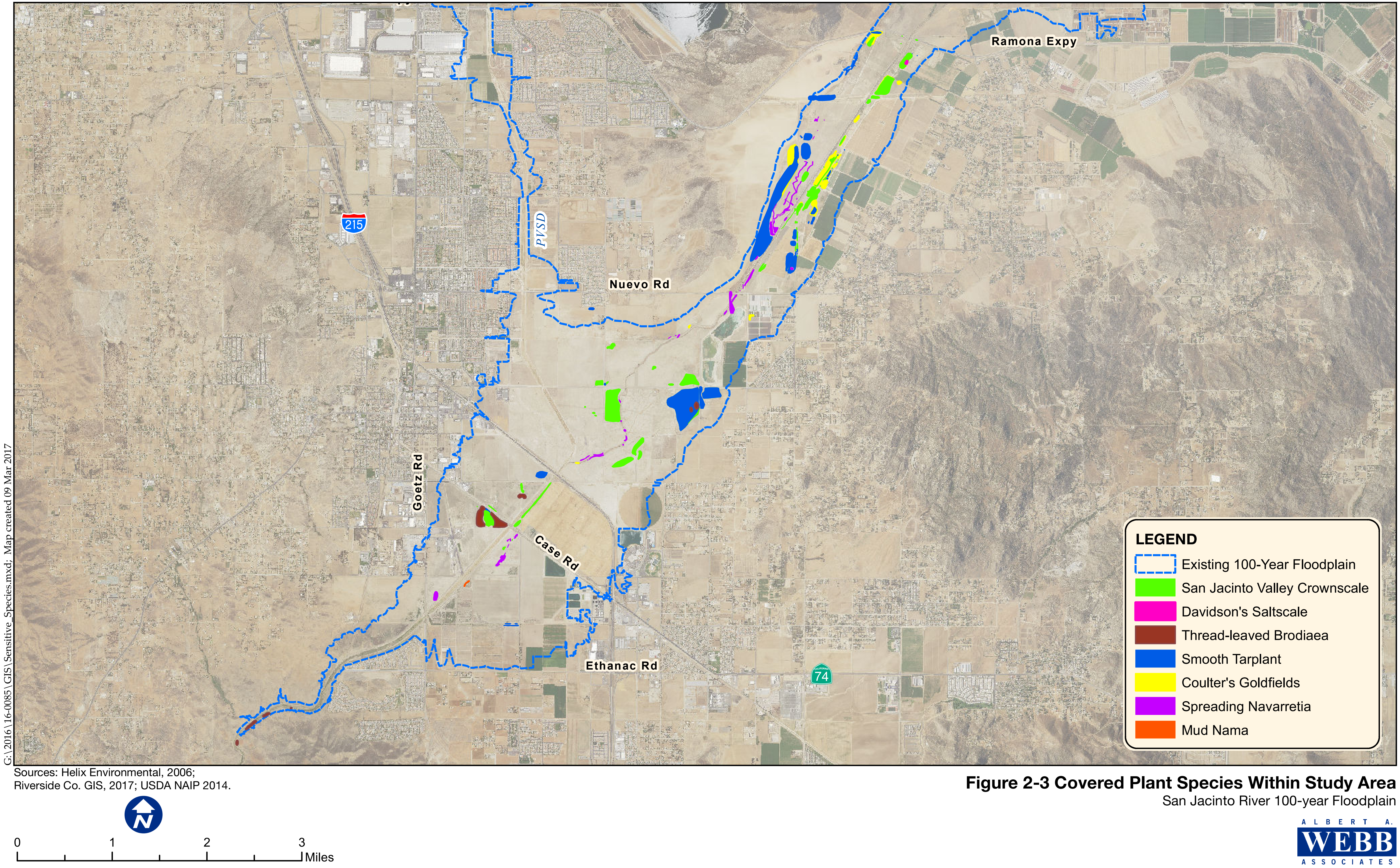

Sources: Helix Environmental, 2006;
Riverside Co. GIS, 2017; USDA NAIP 2014.

Figure 2-3 Covered Plant Species Within Study Area

San Jacinto River 100-year Floodplain

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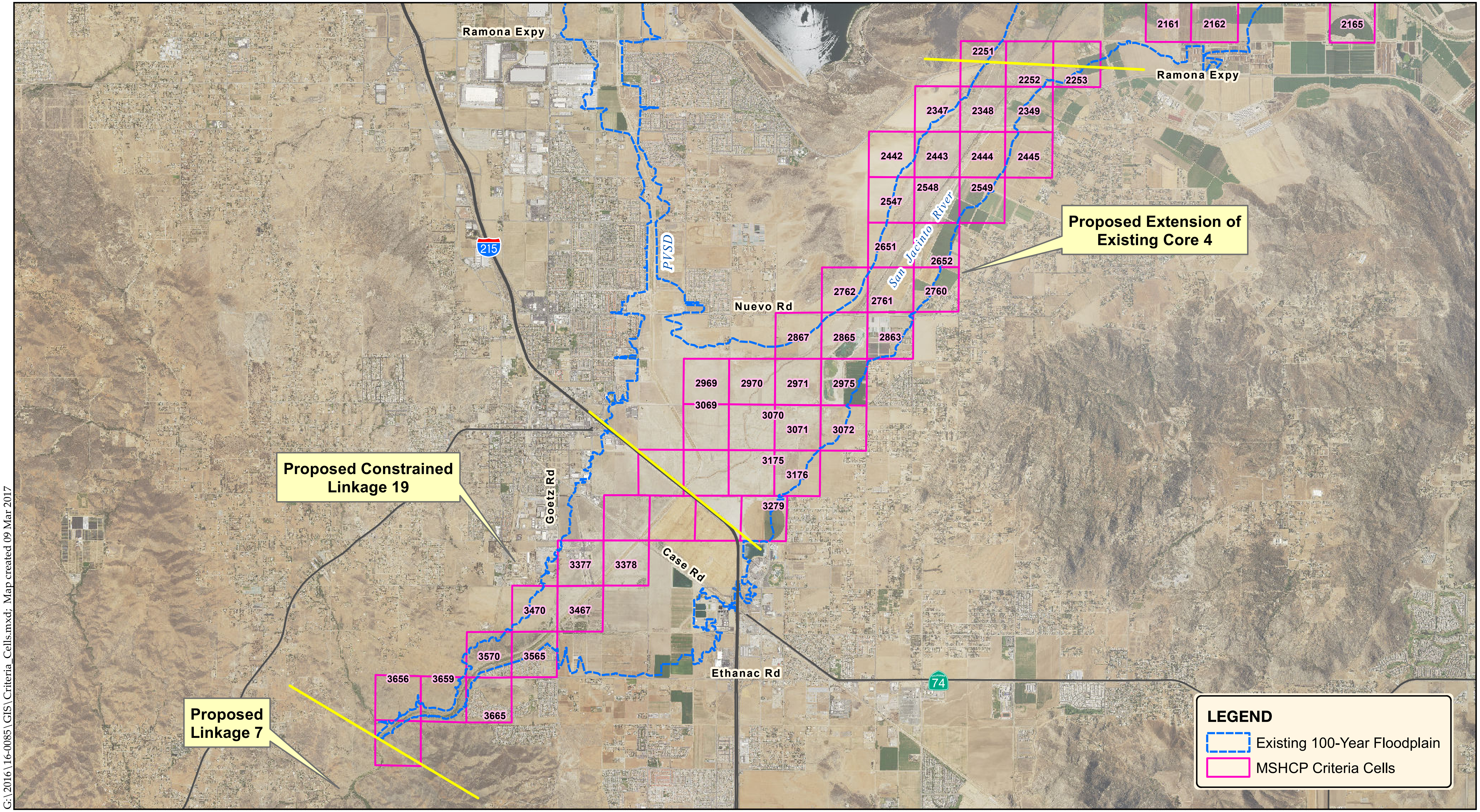

Sources: Riverside Co. MSHCP and
Riverside Co. GIS, 2017; USDA NAIP 2014.

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Figure 2-4 Reserve Features Within Study Area

San Jacinto River 100-year Floodplain

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SECTION 3: ADVISORY COMMITTEE AND TECHNICAL SUBCOMMITTEE

3.1 Members

A successful, comprehensive floodplain management plan for the lower San Jacinto River floodplain requires consideration of economic, transportation, environmental, and public health and safety goals by the agencies and active stakeholders in the region. On February 16, 2016, County Supervisor Marion Ashley sent invitations to representatives that were selected to represent a cross-section of interests, including local agencies, environmental stakeholders and the private land development community. Members were selected based on their knowledge and experience of the issues germane to the floodplain, and their potential to provide a valuable contribution to the Committee. Copies of the initial invitation to participate and objectives survey are provided in **Appendix A**. The members who comprised the Lower San Jacinto River Advisory Committee are listed below in **Table 3-A**.

Table 3-A: Members of the Lower San Jacinto River Advisory Committee

Member	Affiliation
Marion Ashley	Riverside County Supervisor, 5th District
Daryl Busch	Mayor, City of Perris
Dusty Williams (retired) and Jason Uhley	General Manager-Chief Engineer, Riverside County Flood Control and Water Conservation District
Charles Landry	Executive Director, Western Riverside County Regional Conservation Authority
Anne Mayer	Executive Director, Riverside County Transportation Commission
Russell Williams	Environmental/Development Review Division Manager, Riverside County Transportation Department
Paul D. Jones II	General Manager, Eastern Municipal Water District
Dan Silver	CEO, Endangered Habitats League
Brett Feuerstein	New Perris Specific Plan
Patrick Parker	Green Valley Specific Plan (Raintree Investment Corporation)
David Arnold	River Park Mitigation Bank

The Advisory Committee Meetings were chaired by Dusty Williams and Jason Uhley of the Riverside County Flood Control and Water Conservation District (District) and facilitated by Scott Hildebrandt of Albert A. Webb Associates (WEBB). The San Jacinto Advisory Committee convened five times between April and December 2016 at District Headquarters on the following dates:

- April 6, 2016

- May 31, 2016
- June 30, 2016
- October 13, 2016
- December 12, 2016

The Advisory Committee was charged with:

- Articulating desired future outcomes of the Project;
- Ranking and weighting each of the potential outcomes;
- Identifying Project alternatives for further analysis;
- Scoring and ranking the alternatives against the weighted outcomes; and
- Endorsing a recommended project alternative.

Minutes from each meeting are provided in **Appendix C.**

A Technical Subcommittee was also established to prepare materials for Advisory Committee Meetings and analyze the various alternatives that the Advisory Committee developed. The members of the Technical Subcommittee are listed in **Table 3-B** and consist of District staff and staff from the engineering consulting firm hired for the project, Albert A. Webb Associates (WEBB). The Technical Subcommittee collaborated together to ensure that appropriate methodologies and datasets were used to analyze the various elements and alternatives. The Technical Subcommittee met six times between August and December 2016 at District Headquarters.

Table 3-B: Members of the Technical Subcommittee

Member	Affiliation
Jason Uhley	General Manager-Chief Engineer, Riverside County Flood Control and Water Conservation District (RCFC&WCD)
Bob Cullen	Assistant Chief Engineer, RCFC&WCD
Mark Wills	Chief of Planning, RCFC&WCD
Stuart McKibbin	Chief of Watershed Protection, RCFC&WCD
Edwin Quinonez	Engineering Project Manager (Project Planning Section), RCFC&WCD
Scott Hildebrandt	Senior Vice President, Albert A. Webb Associates (WEBB)
Stephanie Standerfer	Vice President and Director of Planning & Environmental Services, WEBB
Joseph Caldwell	Director of Stormwater Engineering, WEBB

3.2 Charge

The charge given to the Lower San Jacinto River Advisory Committee was to support the District in the development of a floodplain management plan for the for the lower San Jacinto River that would consider the need for protection of life and property from flooding, with protection of critical environmental resources, protection of transportation corridors, water resources and accommodate land development proposals along the river.

3.3 Goals and Objectives

There are numerous goals and objectives that a river project could accomplish. The initial list of potential goals and objectives that was presented by the Technical Subcommittee to the Advisory Committee for consideration is provided in **Appendix D**. Based upon discussion with the committee, additional potential objectives were developed. The following list outlines the potential goals and objectives that were discussed with the committee.

- Provide Flood Protection for Roads;
    - The following roads currently do not have 100-Year Flood Protection:
        - Ramona Expressway
        - Nuevo Road
        - Interstate 2-15
        - Case Road
        - Goetz Road
        - Ethanac Road
- Provide Flood Protection for the Future Ellis Avenue Interchange;
- Provide Flood Protection for Rail Facilities;
- Maintain MSHCP Conservation Goals;
- Avoid MSHCP Cell Refinement;
- Provide for Regional Trails;
- Provide Flood Protection for Regional Water Supply;
- Ability to Phase Project; and
- Promote Economic Benefits.

After the initial project goals and objectives were reviewed and discussed with the Advisory Committee, the individual members (with the exception of Supervisor Ashley) were tasked with rating how important each objective was to them and the community that they represent. Committee members were asked to rank each objective on a scale from zero to three. The meaning of each number was provided to the Committee members as defined in **Table 3-C.**

Table 3-C: Project Goals Ranking Scale

Rank	Definition	Description
0	Unclear or Unnecessary	Unsure of objective or feel it is not necessary
1	Secondary Objective	“Nice to have” goal
2	Primary Objective	Important to the project, but may be addressed to varying degrees
3	Critical Objective	Represents pass/fail criteria

To allow the committee members to be completely forthcoming, the results of the goals and objectives survey were anonymously tabulated. The results of the objectives survey are shown in **Table 3-D** below and in **Appendix D**. The rankings were averaged for each objective and were utilized to develop an Alternatives Scoring Spreadsheet.

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Table 3-D: Objectives Scoring Matrix

OBJECTIVE	Interstate 215 Protection	Case Road Protection	Goetz Road Protection	Ethanac Road Protection	Nuevo Road Protection	Ramona Expressway	Future Ellis Interchange Flood Protection	100-Year flood RCTC Rail Station	Maintain Compatibility with MSHCP 7.3.7	Avoid MSHCP Criteria Cell Refinement	Accommodate Regional Trails Plans	Avoids Impacts to Regional Water Supply Infrastructure	Establish Feasible Staging and Implementation Plan	Minimize Project Cost	Address Water Permit Requirements	Economic Benefit
	2	1.5	1	1.5	1	1	1	2	3	3	1	3	3	3	3	3
	3	1	1	2	2	2	2	1	3	3	1	2	3	3	3	2
	3	1	1	0	2	0	2	1	3	3	3	2	2	3	3	1
	2	2	2	2	2	2	2	2	3	2	1	2	2	1	3	1
	3	2	1	2	3	1	1	2	2	3	2	2	2	2	2	2
	3	1	1	1	0	0	0	0	2	2	2	2	1	2	2	1
	3	2	1	2	2	2	0	0	0	0	0	0	0	0	0	3
	3	2	2	2	2	2	1	1	1	3	1	3	3	3	3	3
	3	3	1	1	2	3	0	3	2	2	3	3	2	3	2	3
Average Score	**2.78**	**1.72**	**1.22**	**1.50**	**1.78**	**1.44**	**1.00**	**1.33**	**2.11**	**2.33**	**1.56**	**2.11**	**2.00**	**2.22**	**2.33**	**2.11**
Weighting Factor	**8**	**3**	**1**	**3**	**4**	**2**	**1**	**2**	**5**	**6**	**3**	**5**	**5**	**5**	**6**	**5**

3.4 Scoring

To help rank the project alternatives, a decision scoring matrix spreadsheet was developed based on the results of the Objectives Survey (**Appendix D**). The decision scoring matrix spreadsheet included various project goals as deemed important by the members of the Advisory Committee. The goals and objectives deemed most critical by the Advisory Committee were given a "pass/fail" weighting. If an alternative did not meet the Critical Objectives, it was ranked as a fail and eliminated from further consideration.

Alternatives that passed the initial critical component screening were then evaluated on a scale from 1 to 4 on a goal by goal basis based upon a scoring criteria developed by the Technical Subcommittee and reviewed and approved by the Advisory Committee. The Alternatives Decision Matrix with Scores is provided in **Appendix D.** The score from each goal was then multiplied by a weighting factor that was developed from the Objectives Survey. The weighting factors are shown below in **Table 3-E**.

Table 3-E: Weighting Factors

Average Score Range		Weighting Factor
1.00	1.25	1
1.25	1.50	2
1.50	1.75	3
1.75	2.00	4
2.00	2.25	5
2.25	2.50	6
2.50	2.75	7
2.75	3.00	8

A summary of each project criteria goal, how each goal was scored, and the weighting factor calculated for each goal is listed below:

1. **Protect I-215 from flooding** – This was the highest scored objective from the Objectives Survey. This was deemed a Critical Objective and given a pass/fail weighting on the Decision Matrix Spreadsheet. If an alternative did not provide flood protection for the I-215 it was eliminated from further consideration.
2. **Avoid Western Riverside MSHCP Major Amendment** – The Advisory Committee overwhelmingly felt it was best to not reopen negotiations on the MSCHP with the resource agencies. This was deemed a Critical Objective and given a pass/fail

weighting on the Decision Matrix Spreadsheet. If an alternative would require a Major MSHCP Amendment it was eliminated from further consideration.

3. **The Project can be Permitted by the Resource Agencies ('Permitable')** – No matter how many other goals and objectives an alternative may achieve, it was reasoned if it was not able to be permitted through the resource agencies, then it would not be a viable project. This was also given a pass/fail weighting.

4. **Complies with the San Jacinto River MSHCP Conservation Goals (Section 7.3.7)** - An alternative would receive **4 points** if it exceeded MSHCP conservation requirements, **3 points** if it met most of the requirements, **2 points** if it met the minimum requirements, and **1 point** if it did not meet the requirements. Based on the average scores, this project criteria goal received a **weighting factor** of **5**.

5. **Addresses Future Transportation Plans** - An alternative would get **4 points** if it provided 100-Year flood protection for all road crossings; **3 points** if it reduced flooding impacts substantially; **2 points** if it reduced flooding impacts somewhat; and **1 point** if it did not improve flooding impacts. Based on the average scores, this project criteria goal received a **weighting factor** of **2**.

6. **Avoids Negative Impacts to Existing and Regional Water Supply and Treatment Systems** - An alternative would get **4 points** if it supports future expansion for water supply and waste water treatment facilities; **3 points** if it reduced flooding impacts to existing facilities; **2 points** if it did not increase flooding impacts to existing facilities; and **1 point** if it increased flooding impacts to existing facilities. Based on the average scores, this goal received a **weighting factor** of **2**.

7. **Accommodates Regional Trail Plans** - An alternative would get **4 points** if it provided full regional trail access; **3 points** if it provides partial regional access; **2 points** if it restricted regional trail access; and **1 point** if it prohibited regional trail access. Based on the average scores, this goal received a **weighting factor** of **3**.

8. **Ability to Receive Regulatory Permits** - An alternative would get **4 points** if it avoided the need for regulatory permits; **3 points** if it required permits but mitigation can be incorporated into the project design; **2 points** if it required permits and mitigation is needed offsite; and **1 point** if it required permits but mitigation options are unknown. Based on the average scores, this goal received a **weighting factor** of **6**.

9. **Feasible Staging and Phasing Plan** - An alternative would get **4 points** if I-215 protection, mitigation needs and developable land are delivered with the first phase; **3 points** if the I-215 is protected and mitigation is provided with the first phase; **2 points** if only the I-215 is protected with the first phase; and **1 point** if it only provides mitigation needs with the first phase or cannot be phased at all. Based on the average of scores received, this goal was given a **weighting factor** of **5**.

10. **Minimize Project Construction Cost** - An alternative would get **4 points** if it required minimal right of way and minimal construction; **3 points** if it required minimal reconstruction or right of way; **2 points** if it required significant reconstruction of existing facilities; and **1 point** if it required significant reconstruction and significant right of way. Based on the average of scores received, this goal was given a **weighting factor** of **5**.
11. **Minimize Project Environmental Cost** - An alternative would get **4 points** if the project design can accommodate mitigation with minimal enhancement or preservation in place; **3 points** if mitigation has moderate cost; **2 points** if mitigation is at least twice as expensive as a 3 point alternative; and **1 point** if environmental mitigation is too expensive. Based on the average scores received, this goal was given a **weighting factor** of **5**.
12. **Increase Opportunities for Economic Development** - An alternative would get **4 points** if it provided significant land for development; **3 points** if it provided additional area along the floodplain fringe for development; **2 points** if it reduced floodplain elevation on developable property; and **1 point** if it does not require beneficial development opportunities. Based on the average scores received, this goal was given a **weighting factor** of **5**.

A decision scoring matrix was utilized to evaluate the various alternatives and select a preferred alternative that best met the objectives set forth by the Advisory Committee. The first five project alternatives ("Foundational" models) were preliminarily reviewed, and scored by members of the Technical Subcommittee to show how they ranked one against another. Throughout this process there was extensive discussion and debating that stemmed from the varied backgrounds and expertise of the subcommittee members. The preliminary scores were presented to the Advisory Committee for further comment and vetting. As hybrid alternatives were developed and refined the decision scoring matrix helped guide the process. Utilizing the scoring matrix in this manner allowed for the identification and refinement of a preferred alternative in a relatively short amount of time. A copy of the final decision scoring matrix is included in **Appendix D** for reference.

SECTION 4: HYDROLOGY AND HYDRAULICS

4.1 Introduction

This section summarizes the hydrologic modeling methodology and results prepared for the San Jacinto River Stage 3 Project. The hydrologic modelling was developed using the following components:

- The 2011 HEC-1[1] watershed model developed by Albert A. Webb Associates (WEBB);
- Updated rainfall input data from the most current NOAA Atlas 14 rainfall depths; and
- Accounting of increased floodplain storage resulting from Stage 3 project features.

Moreover, to verify the hydrology of the critical storm event, WEBB investigated scenarios such as multi-day storms and various antecedent water levels for Mystic Lake to determine the sensitivity that these scenarios have on the overall modeling of the project alternatives.

The updated hydrographs from the HEC-1 model were used as inflows in the various unsteady two-dimensional HEC-RAS[2] hydraulic models (refer to **Appendix E** for the May 18, 2016 Technical Memo describing the hydrology update described herein). Results from these hydrologic and hydraulic analyses were used to evaluate the flood control alternatives proposed for the SJR Stage 3 project in order to determine a “Preferred Alternative” for further refinement in a Master Drainage Plan.

4.2 Previous Studies

Numerous hydrology studies have been prepared for the San Jacinto River by the U.S. Army Corps of Engineers (USACE), Riverside County Flood Control and Water Conservation District (RCFC&WCD or “District”), and various private consulting firms. A summary of the various studies is listed below:

- July 1959 – USACE – “Design Memorandum No. 1, Hydrology for San Jacinto River and Bautista Creek Improvements.”
- May 1970 – USACE - “Flood Plain Information – San Jacinto River (San Jacinto River to Railroad Canyon).”
- March 1975 – RCFC&WCD - “Flood Control Master Plan for the Lower San Jacinto River Basin” (synthetic unit hydrographs and various flood control alternatives).
- January 1994 – RCFC&WCD - “Report of the San Jacinto River Hydrology” – Updated 1975 synthetic unit hydrographs.
- 2000 – WEST Consultants, Inc, - “Report on hydraulic and hydrologic evaluation for proposed raised Ramona Expressway on the San Jacinto River” (refinement of the 1994 RCFC&WCD report and incorporated modified-puls routing).

[1] U.S. Army Corps of Engineers, Hydrologic Engineering Center, “Flood Hydrograph Package HEC-1.”
[2] U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC) River Analysis System (RAS).

- January 2011 – WEBB – "Application for a Letter of Map Revision (LOMR) for a Portion of the San Jacinto River – FEMA Case No. 11-09-0820P" (based on WEST's 2000 HEC-1 Model, unsteady one-dimensional HEC-RAS model of San Jacinto River Floodplain).

4.3 Hydrology Update Using NOAA Atlas 14 Rainfall Data

The 2011 HEC-1 hydrology model of the San Jacinto River prepared by WEBB and approved by the District, utilized the National Oceanic and Atmospheric Administration's (NOAA) Atlas 2 rainfall data. In 2004, the NOAA Atlas 14 data was published and then revised again in 2006.[3] The updated NOAA Atlas 14 publication includes data from several rain gages that were not previously available in the Atlas 2 version, as well as 25 years of additional data at several of the gages used in NOAA Atlas 2.

NOAA Atlas 14 point rainfall values for the 2-year, 5-year, 10-year, 20-year, and 100-year 24-hour durations were retrieved from the NOAA Precipitation Frequency Data Server (PFDS).[4] The rainfall data (in the form of ASCII grid files) were downloaded from the PFDS site and imported into ArcGIS (Geographic Information System). The 23 hydrologic subareas were overlaid onto the rainfall grids to compute the area-weighted (average point value) precipitation-duration frequency data (**Figure 4-1** and **Table 4-A**). Area-average and centroid values were determined for each subarea. These values were compared with the point rainfall values used in the 2011 San Jacinto River LOMR study report.

[3] NOAA Atlas 14, Precipitation Frequency Atlas of the United States. Volume 6, Version 2.0, California.

[4] NOAA Precipitation Frequency Data Server (PFDS) available at http://hdsc.nws.noaa.gov/hdsc/pfds/.

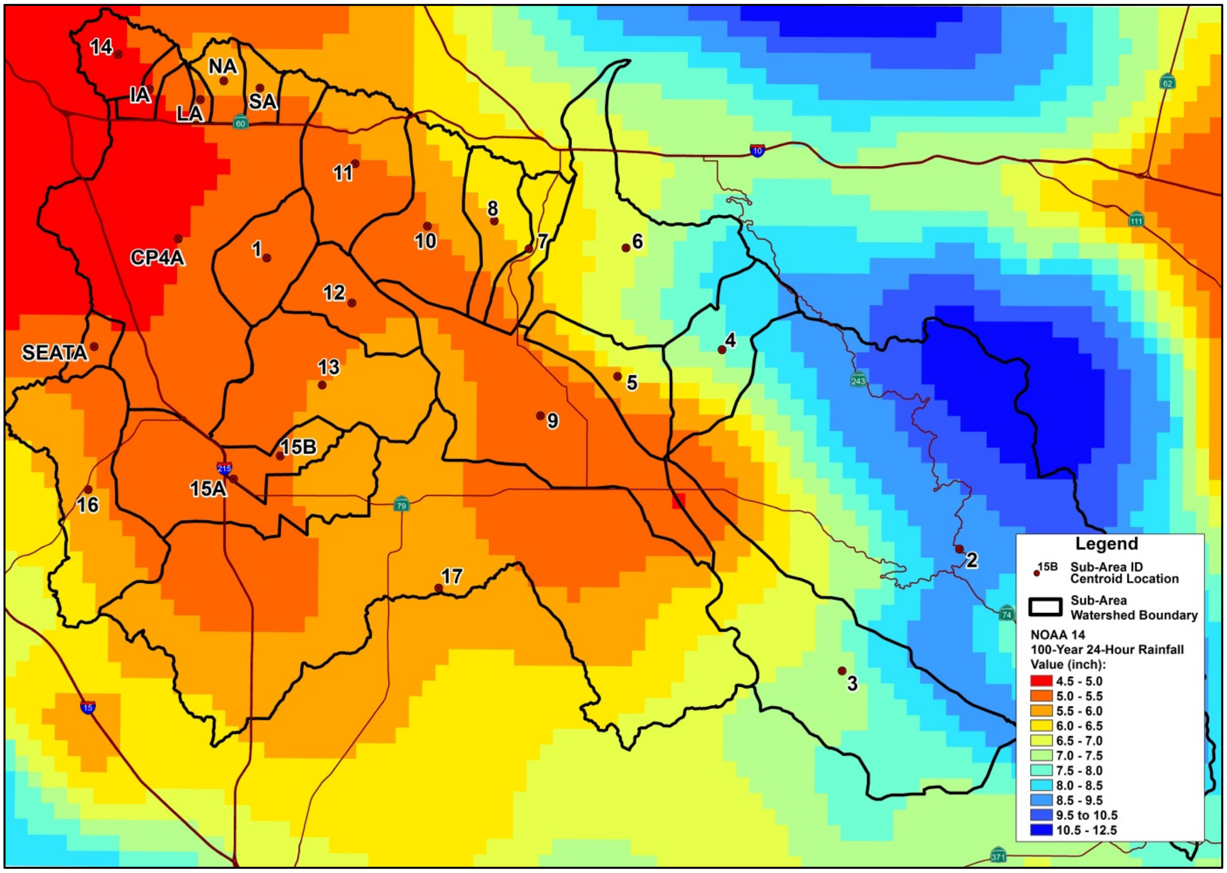


Figure 4-1: San Jacinto River Watershed Map with NOAA Atlas 14 Rainfall Data

The rainfall data from the two NOAA data sources are summarized in **Table 4-A**. The percent difference between rainfall data can range from -14% in the Pigeon Pass subarea to +33% in the Nuevo subarea. Review of the two data sources indicates that NOAA Atlas 14 had lower rainfall depths for the San Jacinto Mountains, thus explaining the lower average point values for the San Jacinto subarea, as well as lower average rainfall depths along the southern slopes of the western Badlands range, and the Railroad Canyon subareas.

Table 4-A: 100-Year Storm Rainfall Depths by Subarea of the San Jacinto Watershed

Subarea ID[1]	Subarea Name	Subarea (sq. mi.)	NOAA 14 Centroid Rainfall Depth (in)	NOAA 14 Average Rainfall Depth (in)	2011 Study [NOAA 2][(1)] Average Rainfall Depth (in)	Percent Difference NOAA 14 vs. 2011 Study
2	San Jacinto Mt. at Bautista Creek	178.50	8.81	8.49	8.99	-5.6%
3	Bautista Creek	51.38	7.33	7.26	7.02	3.5%
4	Poppet Creek	15.76	7.67	7.41	6.90	7.4%
5	Soboba– Gilman	12.07	5.97	5.94	5.66	5.0%
6	Massacre Canyon	35.42	6.80	6.97	6.49	7.4%
7	Lamb Canyon	5.64	6.02	5.97	5.18	15.3%
8	Laborde Canyon	9.73	6.04	5.95	5.04	18.1%
9	San Jacinto Valley	43.98	5.26	5.34	4.73	12.8%
10	Jack Rabbit	17.90	5.44	5.54	4.73	17.2%
11	Badlands	18.10	5.38	5.45	4.75	14.7%
12	Lakeview	12.26	5.36	5.39	4.32	24.7%
13	Nuevo	25.74	5.55	5.52	4.16	32.7%
14	Pigeon Pass	9.031	4.87	4.88	5.68	-14.1%
1A	Indian Festival	1.172	4.90	4.90	5.29	-7.4%
LA	Lasselle Basin	0.689	5.28	5.29	5.30	-0.1%
NA	Nason Basin	4.329	5.51	5.51	5.52	-0.2%
SA	Sinclair Basin	4.34	5.50	5.46	5.50	-0.7%
CP4A	Perris Valley	62.87	5.03	4.98	4.83	3.1%
SEATA	Seaton Basin	3.01	5.22	5.16	5.19	-0.7%
15A	Romoland A-System	28.11	5.32	5.42	4.52	21.3%
15B	Romoland B-System	4.27	5.48	5.49	4.52	19.4%
16	Railroad Canyon	26.04	5.62	5.67	5.75	-1.4%
17	Salt Creek	123.91	5.68	5.69	4.94	15.2%

[1] Refer to Figure 1 for subarea locations.

As part of the rainfall data update for this report, consideration of the HYDRO-40 Area Reduction Factors was reviewed to determine if applicable for the San Jacinto River Basin. Review of NOAA Technical Memorandum NWS HYDRO-40, “Depth-Area Ratios in the Semi-Arid Southwest United States” (August 1984) for purposes of converting NOAA Atlas 14 point rainfall data for areal-effect (depth area reduction) according to the drainage area size was performed.. It was concluded that although the depth area reduction curves from HYDRO-40 better represent the desert areas of California (Colorado Desert, Sonoran Desert, Antelope Valley and the Mojave Desert) as compared to the NOAA Atlas 2 curves, the study area is not located in these regions. Therefore, the San Jacinto River Basin is better represented by the depth-area reduction curves from NOAA Atlas 2, and no changes were made to the model in this regard.

4.4 Hydrology Results

In order to quantify the impacts of the NOAA 14 rainfall data update, a comparison of the hydrographs were made with the NOAA 2 rainfall data used in the 2011 San Jacinto River report. Flood hydrographs were developed by combining subarea hydrographs which were then used as input into the HEC-RAS model. Hydrographs visually depict the rate of flow over time past a specific point in a river. The results of the updated HEC-1 model utilizing the NOAA 14 data is compared to the 2011 model results in **Table 4-B**. The two hydrographs with the highest peak flows showed reduced peak flowrates and volumes as a result of the NOAA 14 data. All other hydrographs showed an increase in peak flowrates and volumes.

Table 4-B: HEC-1 100-Year Hydrograph Summary Comparison

Subarea Name	2016 Study Update		2011 LOMR Study		Comparison	
	Peak Flow (cfs)	Volume (AF)	Peak flow (cfs)	Volume (AF)	Percent Change in Peak Flow	Percent Change in Volume
Bridge Street	61,254	55,198	62,068	56,160	-1.3%	-1.7%
Jack Rabbit	2,964	1,717	2,196	1,231	29.8%	33.0%
Badlands	2,698	1,501	2,063	1,110	26.7%	30.0%
Lakeview	2,217	1,166	1,299	601	52.2%	64.0%
Nuevo	4,115	2,356	2,306	1,262	56.3%	60.5%
CP4	12,519	7,242	14,411	7,525	-14.1%	-3.8%
Romoland (B System)	896	436	652	300	31.5%	37.0%
Romoland (A System)	5,417	2,788	3,988	1,978	30.4%	34.0%

4.5 Multi-Day Storm Analysis

In addition to the 24-hour duration (single day) storm analysis, a multiple day storm analysis was performed. Multiple day storm hydrographs are typically used in the design and analysis for a watershed flood control system that includes one or several detention basins in order to determine that the basins have adequate storage capacity remaining when the peak 24-hour storm event occurs.

A three day-duration storm was developed as part of this hydrology update in order to verify that the 24-hour duration storm is the actual critical duration. The multi-day (3-day) storm is based on a series of individual 24-hour storm patterns, where the third day of the storm contains the 24-hour rainfall amount (PDay3 = P24). The first day storm rainfall depth is calculated as the difference between the 72-hour and the 48-hour rainfall depths (PDay1 = P72

– P48). The second day storm rainfall depth is the difference between the 48-hour and the 24-hour rainfall depths (PDay2 = P48 – P24). The area-averaged depths for the 48-hour rainfall (P48) and the 72-hour rainfall (P72) were obtained from the NOAA PFDS following the same procedures as the 24-hour rainfall described in Section 4.4. The 24-hour, 48-hour, and 72-hour area average rainfall depths used in the multiple day storm hydrology are summarized in **Table 4-C**.

Table 4-C: NOAA Atlas 14 100-Year Storm 24-Hour, 48-Hour, and 72-Hour Rainfall Data

Subarea ID	Subarea Name	Subarea (sq.mi.)	24-Hour Average Rainfall Depth (in)	48-Hour Average Rainfall Depth (in)	72-Hour Average Rainfall Depth (in)
2	San Jacinto Mt. at Bautista Creek	178.50	8.81	11.35	12.64
3	Bautista Creek	51.38	7.33	9.36	10.44
4	Poppet Creek	15.76	7.67	9.92	11.30
5	Soboba– Gilman	12.07	5.97	7.82	8.89
6	Massacre Canyon	35.42	6.80	9.40	10.86
7	Lamb Canyon	5.64	6.02	7.91	9.13
8	Laborde Canyon	9.73	6.04	8.00	9.25
9	San Jacinto Valley	43.98	5.26	6.86	7.75
10	Jack Rabbit	17.90	5.44	7.14	8.07
11	Badlands	18.10	5.38	6.81	7.55
12	Lakeview	12.26	5.36	6.76	7.50
13	Nuevo	25.74	5.55	6.92	7.71
14	Pigeon Pass	9.031	4.87	6.18	6.94
1A	Indian Festival	1.172	4.90	6.21	6.93
LA	Lasselle Basin	0.689	5.28	6.69	7.53
NA	Nason Basin	4.329	5.51	7.02	7.95
SA	Sinclair Basin	4.34	5.50	6.90	7.64
CP4A	Perris Valley	62.87	5.03	6.13	6.80
SEATA	Seaton Basin	3.01	5.22	6.48	7.20
15A	Romoland A-System	28.11	5.32	6.83	7.64
15B	Romoland B-System	4.27	5.48	6.87	7.67
16	Railroad Canyon	26.04	5.62	7.17	8.09
17	Salt Creek	123.91	5.68	7.27	8.09

The peak flow rates and volumes resulting from a multi-day, 100-year storm event at various points in the watershed are summarized below in **Table 4-D**.

Table 4-D: HEC-1 100-Year, Multi-Day (3-Day) Storm Summary

Hydrograph Name	Day 1		Day 2		Day 3	
	Peak Flow (cfs)	Volume (AF)	Peak flow (cfs)	Volume (AF)	Peak Flow (cfs)	Volume (AF)
Bridge Street	1,730	2,075	4,194	4,636	61,254	55,198
Jack Rabbit	91	80	158	139	2,964	1,717
Badlands	75	66	137	119	2,698	1,501
Lakeview	58	43	108	81	2,217	1,166
Nuevo	111	115	195	174	4,115	2,356
CP4	346	290	597	502	12,519	7,242
Romoland (B System)	21	17	37	29	896	434
Romoland (A System)	136	111	236	192	5,417	2,788

The modeling results of the three-day, 100-year storm event helped evaluate the sensitivity of the overall model on the project alternatives. Refer to June 9, 2016 Technical Memorandum, "Mystic Lake Storage Modeling" located in **Appendix E.**

4.6 Multi-Frequency Storm Analysis

In addition to the 100-year frequency storm event, this hydrology study models the 2-year, 5-year, 10-year, and 20-year frequency storm events using the same methods and NOAA Atlas 14 rainfall data as the 100-year storm. The results of the multiple-frequency HEC-1 model are summarized in **Table 4-E.**

Table 4-E: HEC-1 Multi-Frequency Storm Summary

Hydrograph Name	2-Year Storm		5-Year Storm		10-YearStorm		20-Year Storm	
	Peak Flow (cfs)	Volume (AF)	Peak flow (cfs)	Volume (AF)	Peak Flow (cfs)	Volume (AF)	Peak Flow (cfs)	Volume (AF)
Bridge Street	4,025	4,863	5,438	6,517	2,4315	20,854	34,442	29,890
Jack Rabbit	216	190	284	250	1,102	616	1,586	870
Badlands	227	198	294	257	975	540	1,417	766
Lakeview	166	126	287	217	791	336	1,181	494
Nuevo	303	270	403	360	1,471	847	2,206	1,202
CP4	964	830	1,273	1,110	5,109	2,744	7,297	3,915
Romoland (B System)	56	44	75	58	358	157	510	226
Romoland (A System)	343	279	457	372	2,031	960	2,905	1,386

Results from the multi-frequency storm were used to determine the 2-year, 5-year, 10-year, and 20-year inundation areas (floodplain boundaries) and water surface profiles. At the request of the regulatory agencies, the floodplain boundaries for the different storm events assisted in the preliminary design of an optional "terraced" channel between I-215 and Ethanac Road.

4.7 Mystic Lake

Under current conditions, the majority of storm water runoff for the more frequent events (e.g. 2-year and 5-year storms) will flow into Mystic Lake through the San Jacinto River levee breach located just downstream of Bridge Street. Mystic Lake must be filled to a minimum surface elevation of 1,430 feet before the San Jacinto River will continue to flow within the existing levees. When the lake water surface exceeds 1,423 feet, outflow from the lake begins and flows in a westerly direction in an earthen channel returning flows back to the river.

As documented in the Technical Memorandum, "Mystic Lake Storage Modeling, June 9, 2016" (**Appendix E**), several analyses were performed using the unsteady 2D HEC-RAS model to determine the potential flow attenuation that Mystic Lake could provide. Single and multi-day 100-year storm events were modeled with the assumption that Ramona Expressway would remain in place, and assuming Mystic Lake with both "empty" and "full" conditions.

Results of the multi-day model with Mystic Lake "empty" indicated that the first two days of runoff during a 100-year storm fills up Mystic Lake approximately halfway. It was rationalized as being equivalent to a single day 100-year storm with Mystic Lake already half full. Due to the uncertainly of the lake level at the onset of future storms, it was determined that the single-day, 100-year Mystic Lake "full" scenario should be used as the baseline for the alternatives analysis of the San Jacinto River Floodplain. This gives the model a conservative starting point from which to model the lake's attenuation benefits. This approach is also consistent with the current FEMA mapping of the San Jacinto River, with the exception of Ramona Expressway in place (current FEMA model assumes Ramona Expressway is washed out).

4.8 Hydraulic Model

The selection of an appropriate hydraulic model is a very important aspect of the hydraulic analysis process. The San Jacinto River Stage 3 Project reach is characterized as a very wide and flat floodplain, such that when the flows go out into the overbank area, the water will take multiple flow paths and have varying water surface elevations and velocities in multiple directions. Two-dimensional (2D) modeling was assumed to produce better results than one-dimensional (1D) modeling for these areas. Also, dynamic events such as levee overtopping and breaching, which have been known to occur, generally are not modeled well using a steady flow model. Therefore, the hydraulic modeling of the San Jacinto River Stage 3 Project was performed using the HEC-RAS (ver. 5.0.1) computer program (refer to **Appendix E** for the June 8, 2016 Technical Memo on the hydraulic modeling approach described herein).

As with all unsteady flow hydraulic models, stability problems can occur due to sudden changes in conveyance, such as at bridges and at flow control structures, causing the sudden rush of water into an area. However, the implicit finite volume solution algorithm does provide an increment of improved stability and robustness over traditional finite difference and finite element techniques, but does not solve the problem completely. In order to avoid the instability of unsteady flow hydraulic modeling as described, a three reach modeling approach was used as defined in **Table 4-F** and shown in **Figure 4-2**.

Table 4-F: Summary of Modeling Reaches

Reach No.	Start of Reach	End of Reach	Model / State
1	Upstream of Bridge Street	Ramona Expressway	2D HEC-RAS / Unsteady
2	Ramona Expressway	Interstate 215	2D HEC-RAS / Unsteady
3	Interstate 215	Railroad Canyon	1D HEC-RAS / Steady

Reach 1 was modeled using the 2D unsteady flow component of the HEC-RAS model. To account for the uncertainty of the Mystic Lake water elevation (e.g. available storage), it was assumed that Mystic Lake is full and does not provide any flow storage below an elevation of 1,423 feet. The effect of preventing Ramona Expressway from failing, with respect to the overbank flooding and the downstream reduction in San Jacinto River flows, was evaluated in the Reach 1 model. The hydrologic output (routed hydrograph) from Reach 1 was then used as input into the Reach 2 model.

Reach 2 was modeled using the 2D unsteady flow component. The downstream boundary control for Reach 2 was based on a stage-discharge relationship at the I-215 developed from the Reach 1 1D steady flow HEC-RAS analysis. The stage-discharge relationship (curve) was based on the combined discharges of the I-215 flow control structure and eight existing culverts. As explained earlier, unsteady flow models are sensitive to a sudden change of flow such as a rapidly rising water surface at the upstream side of I-215 Freeway, and that 1D hydraulic equations used in the HEC-RAS bridge/culvert routines produce better results than the 2D equations. For these reasons, the stage-discharge curve for Reach 2 was developed using the Reach 3 1D HEC-RAS model.

Reach 3 was modeled using the 1D steady flow components. The downstream boundary control for Reach 3 is based on a normal depth analysis.

4.9 Model Reach 1 Hydraulic Analysis

Model Reach 1 begins upstream of Bridge Street and ends at Ramona Expressway and was hydraulically modeled using the 2D unsteady flow component of the HEC-RAS model. It was evaluated using the condition that Ramona Expressway is protected from washing out and/or breaching of the embankments, resulting in an increase of ponding in the upstream floodplain and a reduction in the downstream 100-year peak discharge to Reach 2. Inflow to Reach 1 consists of four inflow hydrographs as listed in **Table 4-G**, and as shown in **Figure 4-2**.

Table 4-G: Reach 1 Inflow Hydrographs

Name	Peak Flow (cfs)	Volume (AF)	Total Area (sq.mi.)	Comments[1]
Bridge Street*	61,254	55,200	352.5	combination of subareas 2 thru 9
Lakeview	2,217	1,170	12.26	single subarea 12
Jack Rabbit	2,964	1,720	17.90	single subarea 10
Badlands	2,698	1,500	18.10	single subarea 11

[1] Refer to Table 4-A for the list of subarea IDs and names.
*Bridge Street is identified as "San Jacinto River" in Figure 4-2.

The downstream boundary control is based on a stage-discharge relationship developed from the existing Ramona Expressway bridge geometry and roadway profile using a 1D steady flow analysis. Due to the limited capacity of the bridge opening, overtopping of the Ramona Expressway will occur for the 100-year storm, approximately 2 feet above the bridge deck. Results of the Reach 1 routing analysis is summarized in **Table 4-H**.

Table 4-H: Reach 1 Routing Summary

Location	Peak Inflow (cfs)	Peak Outflow (cfs)	Total Area (sq.mi.)	Max. Stage (ft)	Comments
Ramona Expy	66,254	16,000	400.7	1,430.3	outflow used as input into Reach 2 model

As indicated in **Table 4-H**, there is considerable reduction (approximately 76%) in the peak outflow to be expected as a result of preventing the roadway from failing, thereby allowing temporary storage in the upstream floodplain. The outflow hydrograph from Reach 1 was used as input into the Reach 2 model.

4.10 Model Reach 2 Hydraulic Analysis

Model Reach 2 begins at Ramona Expressway and ends at the I-215 Freeway and was hydraulically modeled using the 2D unsteady flow component of the HEC-RAS model. The downstream boundary control for Reach 2 is based on a stage–discharge relationship developed from the proposed I-215 flow control structure/berm system and existing eight (overflow) culverts using a 1D steady flow analysis and the Federal Highway Administration's "Headwater Depth for Box Culverts with Inlet Control" (Chart 8, 1963). It was determined that an elevated berm along the eastern side (upstream) of the I-215 Freeway would protect the roadway from overtopping, and a flow control structure would limit downstream 100-year storm event discharges to approximately 12,800 cfs while maintaining minimum upstream ponding depths. Inflow to Reach 2 consists of four inflow hydrographs as listed in **Table 4-I**, and as shown in **Figure 4-2**.

Table 4-I: Reach 2 Inflow Hydrographs

Name	Peak Flow (cfs)	Volume (AF)	Total Area (sq.mi.)	Comments[1]
Ramona Expy	16,000	55,200	400.7	outflow from Reach 1 model
PVSD	12,519	7,242	85.44	combination of subareas 14, 1A, LA, NA, SA, CP4A, and SETA
Nuevo	4,115	2,356	25.74	single subarea 13
Romoland B	896	433.6	4.27	single subarea 15B

[1] Refer to Table 4-A in Section 4 for the list of subarea IDs and names.

Results of the Reach 2 routing analysis are summarized in **Table 4-J**, and as shown in **Figure 4-2**.

Table 4-J: Reach 2 Routing Summary

Location	Peak Inflow (cfs)	Peak Outflow (cfs)	Total Area (sq.mi.)	Max. Stage (ft)	Comments
I-215 Freeway	17,516	12,800	516.2	1,430.3	outflow used as input into Reach 3 model

Considering an I-215 flow control structure and elevated berm system along the freeway, the peak outflow would be approximately 27% less than the inflow rate. The outflow hydrograph from Reach 2 was used as input into the Reach 3 model.

4.11 Model Reach 3 Hydraulic Analysis

Model Reach 3 begins at the I-215 Freeway and ends at Railroad Canyon and was hydraulically modeled using the 1D steady flow component of the HEC-RAS model. The same cross section locations used in the current FEMA model of the San Jacinto River (FEMA Case No. 11-09-0820P) were used for this reach. Reach 3 was modeled using a widened trapezoidal channel between the I-215 and Ethanac Road (see Element 4E). To improve draining of the nuisance flows, an underground storm drain pipe from Ethanac Road to Railroad Canyon was modeled (see Elements 5F1 and 5F2). Modeling determined that approximately 800 cfs would be conveyed in the pipe during the 100-year storm event. The downstream boundary control for Reach 3 was based on a normal depth using a slope of 0.0020.

Inflow to Reach 3 consists of a single hydrograph at the I-215 Freeway as listed in **Table 4-K**, and as shown in **Figure 4-2**. There are no other major tributaries to this reach that would justify an increase in the peak flowrate.

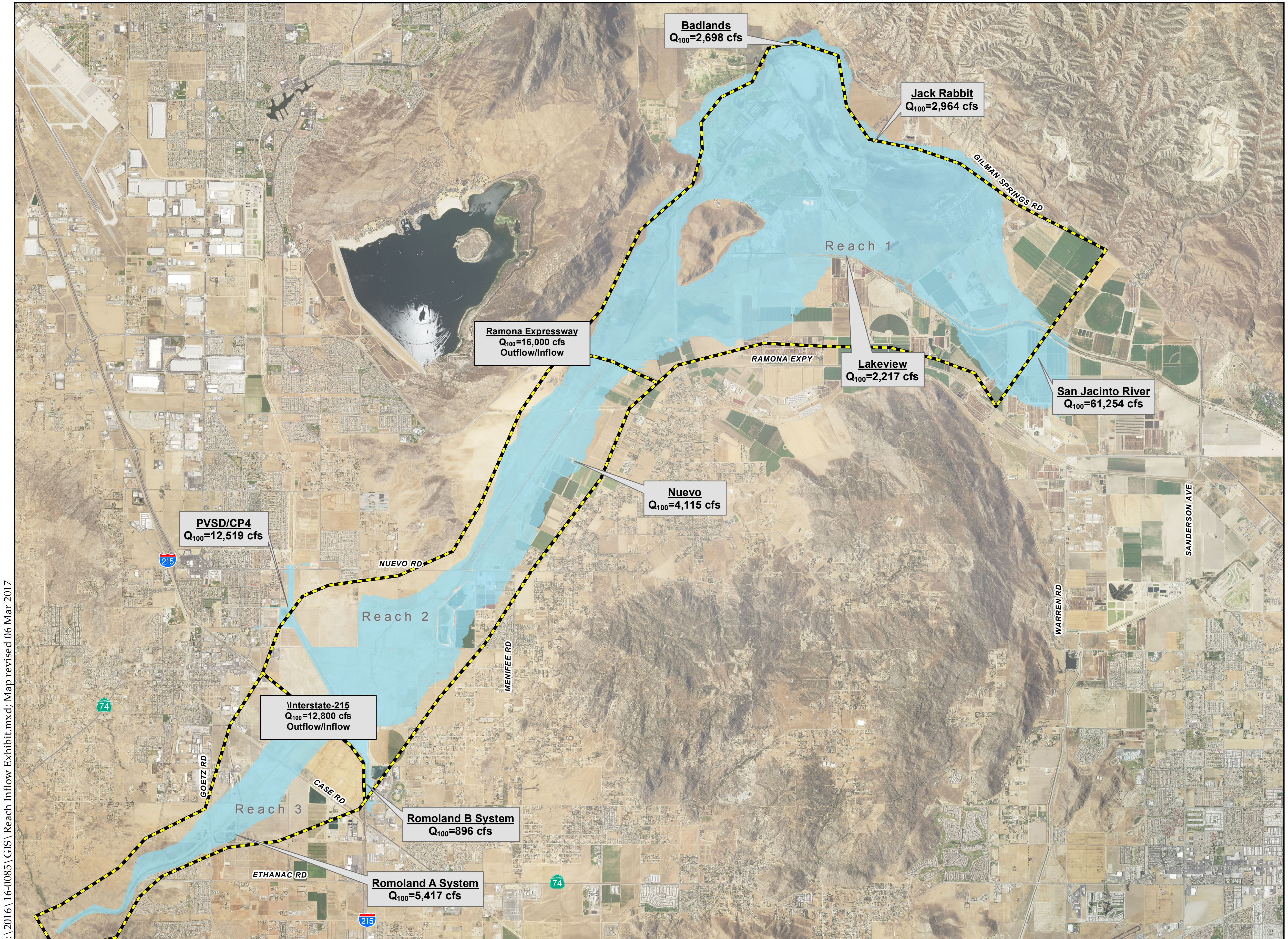
Table 4-K: Reach 3 Inflow Hydrograph

Name	Peak Flowrate (cfs)	Volume (AF)	Total Area (sq.mi.)	Comments
I-215 Freeway	12,800	65,232	516.2	peak flow rate used in 1D steady model

Reach 3 was modeled using a 1D steady hydraulic analysis and as a result, there was no attenuation (reduction in downstream flowrates). Reach 3 has minimal storage available in its overbank areas and would not provide significant attenuation to justify an unsteady flow analysis.

4.12 Conclusion

Breaking up the San Jacinto River Stage 3 (2D unsteady flow) hydraulic model into three separate models avoided the potential instability problems associated with bridges (and other flow control structures) due to the sudden changes in flow conveyance. Replacing Ramona Expressway and the I-215 Flow Control Structure with a hydraulically-equivalent stage-storage curve as the downstream boundary control improved the stability and performance of the models. In addition, the separate models provided better flexibility in evaluating the proposed alternatives and elements by isolating reaches that were not affected for that particular alternative or element.



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LEGEND

Hydraulic Model Reaches

Post Project Floodplain

Fig 4-2: Hydraulic Model Reaches and Inflows

San Jacinto River Stage III
Conceptual Planning Report

ALBERT A. WEBB ASSOCIATES

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Sources: Riverside Co. GIS, 2016;
USDA NAIP, 2014.

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SECTION 5: PROJECT ELEMENTS

5.1 Introduction

Each of the modeling scenarios described in Section 6 of this report are comprised of individual ‘Elements.’ For purposes of this report, an Element refers to a particular design configuration or concept at a given location or region along the study area of the river. The purpose of this section is to define the individual design elements considered in this study. There are five general element categories that impact specific reaches and/or locations along Reach 3 of the San Jacinto River, shown in **Figure 5-1** and listed below in **Table 5-A**.

Table 5-A: Element Categories

Lower San Jacinto River Region
Element 1 Category: Ramona Expressway Crossing
Element 2 Category: Floodplain Storage Alternatives Upstream of Interstate 215
Element 3 Category: Interstate 215 Crossing and Perris Valley Storm Drain
Element 4 Category: Channel Modifications from Interstate 215 to Ethanac Road
Element 5 Category: Ethanac Road Crossing and Channel Modifications to Railroad Canyon

Within each Element Category, an orderly system of “Element ID” codes was developed to track the different design configurations to provide a framework for discussion. Each element identification code begins with a number followed with a letter, which may be followed with another number corresponding to an alternative version of the original idea.

Elements within each category are identified as either “foundational” or “outreach” depending on whether they were developed early-on or during the community outreach efforts. Outreach elements were developed with community input during the later planning stages after the foundational elements were reviewed by the Technical Subcommittee and Advisory Committee (see Tables 3-A and 3-B). This type of input is valuable for this project because it allows those with an interest in the community to become involved in shaping the future of the Lower San Jacinto River area. Coordination efforts are detailed in Section 7.

Table 5-B: Project Elements

Element ID[1]	Description	Element Type[3]
Element 1 Category: Ramona Expressway Crossing		
1A	Ramona Expressway Embankment Protection	F
1AC	Ramona Expressway Embankment Protection – no berms downstream	F
1B	Ramona Flow Control – Berm and Flow Control Structure	F
1BC	Ramona Flow Control – Berm, Flow Control Structure, and No Berms Downstream	F
Element 2 Category: Floodplain Storage Alternatives Upstream of I-215		
2A1	Expanded Volume Upstream of I-215 (Alternative 1)	F
2A2	Expanded Volume Upstream of I-215 (Alternative 2)	F
2B	Existing Condition Upstream of I-215 (No expanded volume)	F
Element 3 Category: I-215 Crossing and Perris Valley Storm Drain (PVSD)		
3A	Flow Control Structure at I-215 and PVSD Low Flow Channel	F
3AF	Flow Control Structure at I-215 with Flared PVSD	F
3ANL[2]	Flow Control Structure at I-215 with No Lowering of PVSD	O
3B1	Flow Control Structure at I-215 with PVSD and Fill	F
3B1F	Flow Control Structure at I-215 with Flared PVSD and Fill	O
3B2	Flow Control Structure at I-215 with PVSD Berm	F
3B2F	Flow Control Structure at I-215 with Flared PVSD, Fill and Berm	O
Element 4 Category: Channel Modifications from I-215 to Ethanac Road		
4A	Remove berms	F
4B	1,000-foot Channel	F
4C	10-foot Low Flow Channel	F
4D	No Grading	O
4E	Low Flow and Terraced Channel	O
Element 5 Category: Ethanac Road Crossing and Channel Modifications to Railroad Canyon		
5B	Ethanac Grading, Low Flow Channel & Short Span Bridge	F
5C	Low Flow Channel with Short Span Bridge	F
5D	Low Flow Channel with Full Span Bridge	F
5E1	No Grading, No Bridge	O
5E2	No Grading, With Bridge	O
5F1	No Grading, Underground Storm Drain, No Bridge	O
5F2	No Grading, Underground Storm Drain, With Bridge	O

[1]Not all of the element design configurations are shown because they were ruled out during the process of discerning viable project components.
[2] This is the only Region 3 element that can be paired with the "No Grading" options downstream of the I-215.
[3] "F" for Foundational Elements and "O" for Outreach Elements.

5.2 Element 1 Category: Ramona Expressway Crossing

Element 1 Category consists of various elements that prevent the Ramona Expressway crossing from washing-out during a 100-year storm event (**Figure 5-2**). Two general approaches were developed; the first includes strengthening the structural integrity of Ramona Expressway to prevent washout of the road (see Elements 1A and 1AC), and the second is a berm and flow control structure immediately upstream of the expressway in order to reduce or attenuate 100-year flood flows as they cross beneath the road (see Elements 1B and 1BC).

Element 1A: Ramona Expressway Embankment Protection

Element 1A consists of armoring the southern embankment of the Ramona Expressway across the entire width of the San Jacinto River floodplain. The embankment would be graded and covered with a concrete liner or other armor to protect against erosion. The purpose of this element is to prevent the Ramona Expressway from being washed out when floodwaters overtop the road, thus reducing the effects of downstream flooding. Reinforcing the roadway from washout also provides upstream storage on the north side of the road.

Element 1AC: Ramona Expressway Embankment Protection – No Berms Downstream

Element 1AC also consists of grading and armoring the southern embankment of the Ramona Expressway across the entire width of the San Jacinto River floodplain as described in Element 1A. However in this case, the agricultural berms currently located along the San Jacinto River would be removed downstream of Ramona Expressway all the way to Nuevo Road. Removing the agricultural berms would provide slightly higher conveyance during the base flood event and allow for natural overbank flood patterns.

Element 1B: Ramona Flow Control – Berm and Flow Control Structure

Element 1B consists of installing a berm and flow control structure immediately upstream of the Ramona Expressway. The upstream face of the berm would be protected from erosion with a concrete liner and the flow control structure would consist of several concrete box culverts. The combination of the berm and flow control structure allows the stormwater retained upstream of the expressway to be released at a controlled rate to protect the roadway and limit downstream flooding. This Element does not include armoring the southern embankment of Ramona Expressway along the width of the floodplain as proposed in Elements 1A and 1AC.

Element 1BC: Ramona Flow Control - Berm, Flow Control Structure and No Berms Downstream

Element 1BC builds on the previous elements and includes installing a berm and flow control structure immediately upstream of the Ramona Expressway as described in Element 1B; but in addition, the agricultural berms along the San Jacinto River would be removed downstream of Ramona Expressway all the way to Nuevo Road. Again, the combination of the berm and flow control structure allows the flooding across and downstream of the expressway to be controlled. Removing the agricultural berms would provide slightly higher conveyance during the base flood event and promote more natural overbank flood patterns. This Element does not include armoring the southern embankment of Ramona Expressway along the width of the floodplain as proposed in Elements 1A and 1AC.

5.3 Element 2 Category: Floodplain Storage Alternatives Upstream of I-215

The Element 2 Category consists of increasing the floodplain storage volume of the Perris Valley Storm Drain (PVSD) and San Jacinto River floodplains upstream of the I-215 freeway crossing (**Figure 5-3**). The approach for this area of the river consists of evaluating various options for excavating "shallow ponds" at different locations and using excavated soil to remove properties out of the floodplain. It should be noted that the "shallow ponds" are not actually incised ponds, but rather areas that have been graded to provide additional floodplain storage and are free-draining to the river.

Currently, there is a compensatory storage requirement for development within or adjacent to the lower San Jacinto River floodplain. After completion of Phase 1 of the Preferred Alternative (see Section 8), properties representing up to approximately 800 acre-feet of floodplain fill, similar to those identified in **Figure 5-3a**, would no longer be subject to the compensatory storage requirement since they were included in the assumptions and modeling of the Preferred Alternative. Once the modeled fill limits are met, additional properties would continue to be subject to any applicable development criteria including compensatory storage requirements.

Element 2A1: Expanded Volume (Alternative 1)

Element 2A1 consists of excavating soil from portions of the "Park West" and "New Perris" properties (**Figure 5-3a**). Excavation would occur immediately upstream of the San Jacinto River and Perris Valley Storm Drain Confluence. The excavated areas, referred to herein as "shallow ponds," would provide additional volume where floodwaters can be stored upstream of the I-215 in order to mitigate flooding in downstream areas. Additionally, the excavated material could then be used as fill to raise other locations out of the floodplain and make them available for development.

Element 2A2: Expanded Volume (Alternative 2)

Element 2A2 consists of excavating soil from a portion of the "Intex" property in addition to the Park West and New Perris properties as described in Element 2A1 (**Figure 5-3a**). Similarly to Element 2A1, these excavated areas, referred to herein as "shallow ponds," would provide more storage volume for floodwaters to be detained upstream of I-215 to mitigate flooding in downstream regions. Additionally, the excavated material could then be used as fill to raise other locations out of the floodplain and make them available for.

Element 2B: Existing Condition (No Expanded Volume)

Element 2B consists of leaving the Park West, New Perris, and Intex properties in the existing condition. This option would not provide the benefit of increased floodplain storage upstream of the I-215.

5.4 Element 3 Category: I-215 Crossing and Perris Valley Storm Drain

Element 3 Category consists of various elements that prevent the I-215 Freeway from flooding during the 100-year storm event (**Figure 5-4**). All elements in this category include construction of an upstream flow control structure to provide reduction of flood flows thereby allowing the 100-year discharge to pass safely through the existing culvert and bridge opening. This flow control structure is based on the original "shallow pond" flow control structure that was part of the San Jacinto River Stage 3 Alternatives (Alternative 5) presented to the District in 2005.

Element 3A: Flow Control Structure at I-215 and Low Flow Channel

Element 3A consists of a concrete-lined flow control structure in the San Jacinto River, immediately upstream of the I-215 crossing. Berms of engineered fill would be located on either side of the structure running parallel to I-215 across the width of the floodplain. The berms would funnel floodwaters through the flow control structure and prevent flooding of I-215. The flow control structure would be sized so that the amount of floodwater passing underneath the I-215 can be controlled and thus allow for upstream and downstream development.

Element 3A also includes excavation of the Perris Valley Storm Drain from Nuevo Road to the I-215 in order to create a trapezoidal channel with a nested low-flow channel in the centerline. The Perris Valley Storm Drain would be wider and deeper than currently exists for conveying greater volumes in the future.

Element 3AF: Flow Control Structure at I-215 with Flared Perris Valley Storm Drain

Element 3AF consists of a concrete-lined flow control structure in the San Jacinto River, immediately upstream of the I-215. Berms of engineered fill would be located on either side of the structure running parallel to I-215 across the width of the floodplain. The berms would funnel floodwaters through the flow control structure. The flow control structure can be sized so that the amount of floodwater passing underneath the I-215 can be controlled for upstream and downstream development. The auxiliary culverts would be extended through the flow control berms in order to maintain a hydraulic connection.

Element 3AF also includes excavation of the Perris Valley Storm Drain from Nuevo Road to the I-215 in order to create a trapezoidal channel with a low-flow channel in the centerline to drain the system. The Perris Valley Storm Drain would also be flared immediately upstream of the flow control structure to provide a flow path to the auxiliary culverts below the I-215. The Perris Valley Storm Drain would be wider and deeper than currently exists for conveying greater volume in the future.

Element 3ANL: Flow Control Structure at I-215 with No Lowering of the Perris Valley Storm Drain

Element 3ANL consists of a concrete-lined flow control structure in the San Jacinto River, immediately upstream of the I-215 crossing. Berms of engineered fill would be located on either side of the structure running parallel to I-215 across the width of the floodplain. The berms would funnel floodwaters through the flow control structure. The flow control structure can be sized so that the amount of floodwater passing underneath the I-215 can be controlled for upstream and downstream development.

Element 3ANL also includes the widening of the Perris Valley Storm Drain from Nuevo Road to the I-215; however, the existing invert (floor elevation) of the Perris Valley Storm Drain would not be lowered (i.e., no low flow channel). This element is always paired with "No Grading" options downstream.

Element 3B1: Flow Control Structure at I-215 with Perris Valley Storm Drain and Fill

Element 3B1 consists of a concrete-lined flow control structure in the San Jacinto River, immediately upstream of the I-215 crossing. Berms of engineered fill would be located on either side of the structure running parallel to I-215 across the width of the floodplain. The berms would funnel floodwaters through the flow control structure. The flow control structure can be sized so that the amount of floodwater passing underneath the I-215 can be controlled for upstream and downstream development.

Element 3B1 includes excavation of the Perris Valley Storm Drain from Nuevo Road to the I-215 in order to create a trapezoidal channel with a nested low-flow channel in the centerline.

Element 3B1 also assumes that fill will be placed on portions of the New Perris, Park West, and the Eastern Municipal Water District (EMWD) properties located north of the I-215 / San Jacinto River crossing (**Figure 5-3a**). The fill material would raise these locations out of the floodplain and allow for development of those sites.

Element 3B1F: Flow Control Structure at I-215 with Flared Perris Valley Storm Drain and Fill

Element 3B1F consists of a concrete-lined flow control structure in the San Jacinto River, immediately upstream of the I-215 crossing. Berms of engineered fill would be located on either side of the structure running parallel to I-215 across the width of the floodplain. The berms would funnel floodwaters through the flow control structure. The flow control structure can be sized so that the amount of floodwater passing underneath the I-215 can be controlled for upstream and downstream development.

Element 3B1F also includes excavation of the Perris Valley Storm Drain from Nuevo Road to the I-215 in order to create a trapezoidal channel with a nested low-flow channel in the centerline. The Perris Valley Storm Drain would be flared immediately upstream of the flow control structure to provide a path to existing auxiliary culverts situated on both sides of the I-215 bridge crossing. The auxiliary culverts would be extended through the flow control berms in order to maintain a hydraulic connection.

In addition to the features discussed above, earthen fill would also be placed on portions of the New Perris, Park West properties, and the Eastern Municipal Water District (EMWD) property located north of the I-215 crossing (**Figure 5-3a)**. The fill material would raise portions of these properties out of the floodplain and allow for development of those sites.

Element 3B2: I-215 Flow Control Structure & Perris Valley Storm Drain Berm

Element 3B2 consists of a concrete-lined flow control structure in the San Jacinto River, immediately upstream of the I-215 crossing. Berms of engineered fill would be located on either side of the structure running parallel to I-215 across the width of the floodplain. The berms would funnel floodwaters through the flow control structure. The flow control structure can be sized so that the amount of floodwater passing underneath the I-215 can be controlled for upstream and downstream development.

Element 3B2 includes excavation of the Perris Valley Storm Drain from Nuevo Road to the I-215 in order to create a trapezoidal channel with a nested low-flow channel in the centerline.

In addition to the features discussed above, an earthen berm would be constructed along the west bank of the Perris Valley Storm Drain to protect the lower portion of the New Perris Property. This berm would take the place of fill on that portion of the New Perris property. Earthen fill would also be placed on portions Park West, Eastern Municipal Water District (EMWD), and the remaining north portion of the New Perris Property (**Figure 5-3a**). The fill material would raise portions of these properties out of the floodplain and allow for development of those sites.

Element 3B2F: Flow Control Structure at I-215 with Flared Perris Valley Storm Drain, Fill and Berm

Element 3B2F consists of a concrete-lined flow control structure in the San Jacinto River, immediately upstream of the I-215 crossing. Berms of engineered fill would be located on either side of the structure running parallel to I-215 across the width of the floodplain. The berms would funnel floodwaters through the flow control structure. The flow control structure can be sized so that the amount of floodwater passing underneath the I-215 can be controlled for upstream and downstream development.

Element 3B2F includes excavation of the Perris Valley Storm Drain from Nuevo Road to the I-215 in order to create a trapezoidal channel with a nested low-flow channel in the centerline. The Perris Valley Storm Drain would also be flared immediately upstream of the flow control structure to provide a flow path to the auxiliary culverts below the I-215. In addition, the auxiliary culverts would be extended through the flow control berms in order to maintain a hydraulic connection. The Perris Valley Storm Drain would be wider and deeper than currently exists for conveying greater volume.

In addition to the features discussed above, an earthen berm would be constructed along the west bank of the Perris Valley Storm Drain to protect the lower portion of the New Perris Property. This berm would take the place of fill on that portion of the New Perris property. Earthen fill would also be placed on portions Park West, Eastern Municipal Water District (EMWD), and the remaining north portion of the New Perris Property (**Figure 5-3a**). The fill material would raise portions of these properties out of the floodplain.

5.5 Element 4 Category: Channel Modifications from I-215 to Ethanac Road

Element 4 Category consists of various channel improvement elements to the existing San Jacinto River earthen channel from I-215 freeway to Ethanac Road in order to improve the flow capacity and provide 100-year flood containment (**Figure 5-5**). Removals of the existing levee berms, a new low flow channel, and combined 1,000-foot wide and low flow channel were considered. Construction of new road and bridge crossings at Goetz, Ethanac, Case and the BNSF Railroad crossings will provide all-weather access between the north and south side of the San Jacinto River, if desired, but are not specifically included in any of the Elements.

Element 4A: Remove Berms

Element 4A consists of removing the agricultural berms along the west and east banks of the San Jacinto River between the I-215 and Ethanac Road. Removing these berms would provide slightly higher conveyance during the base flood event and promote more natural overbank flood patterns. Element 4A would only be paired with Element 3ANL.

Element 4B: 1,000-foot Channel

Element 4B consists of a widened trapezoidal channel between the I-215 and Ethanac Road. The channel would be approximately 1,000-feet wide in areas where existing topography, environmental considerations, and land use constraints permit. In areas where that space was not available the channel would be narrowed as needed. The main advantage to the 1,000-foot wide channel is that it would keep most of the floodwater in the river channel and reduce the width of the floodplain itself. Additionally, some of the fill needed to raise the Region 3 properties (i.e., North New Perris, EMWD, and Park West) out of the floodplain could be obtained from the channel excavation.

Element 4C: 10-foot Low Flow Channel

Element 4C consists of excavating a low flow trapezoidal channel into the San Jacinto River between the I-215 and Ethanac Road. The low flow channel could be routed through the existing San Jacinto River channel in order to protect existing riparian area. The low flow channel would have a relatively small impact on the floodplain compared to more drastic channel modifications but it would significantly improve the drainage of nuisance (dry weather) flows in the existing river channel. Bridge configurations of the existing bridge crossings are assumed.

Element 4D: No Grading

Element 4D is an Outreach Element that consists of leaving the San Jacinto River channel in its existing state between the I-215 and Ethanac Road. This option would not provide the benefits of increased drainage capacity or additional fill for surrounding properties, but would provide cost savings for the project as a whole. For this element to be viable, the regions upstream and downstream would need to have the same channel elevation as the existing ground. Element 4D would be paired with Element 3ANL.

Element 4E: Low Flow and Terraced Channel

Element 4E is an Outreach Element that consists of two phases: the first phase would consist of a deepened low-flow channel from the I-215 to Ethanac Road. The second phase would consist of expanding the low-flow channel by including a 'terraced' channel between the I-215 and Ethanac Road. The terraced channel would be partitioned into two levels with the lower being sized to handle storms with up to a 10-year recurrence interval,[1] and the upper terrace having adequate capacity for storms of a 100-year recurrence interval. The terracing immediately downstream of I-215 would be flared wider than the rest of the channel in order to capture flows from existing culverts crossing the interstate, but would taper down prior to reaching Case Road. The terraced channel option would need to be paired with Category 3 elements utilizing the flared Perris Valley Storm Drain design. This option has similar benefits to the 1,000-foot wide channel described in Element 4B in that it would reduce the width of the floodplain and provide fill that could be used on surrounding properties (see **Figure 8-1** for the reclaimable floodplain below I-215 that would require fill as part of full second phase – developer-led – implementation of this Element). In addition, the terracing would allow the channel to mimic the existing frequency with which floodwaters contact different portions of the river bed (i.e. a low spot in the channel that floods with a greater frequency than a higher elevation).

The hydraulic analysis for this alternative shows that sufficient drainage would be provided without replacing or constructing any new bridges within the project corridor. Modeling has assumed no change to the existing bridge configurations that cross the river.

[1] A storm with a 10 year recurrence interval has a 1 in 10 probability of occurring in any given year, or 10% chance of occurring in any given year.

5.6 Element 5 Category: Ethanac Road Crossing and Channel to Railroad Canyon

Element 5 Category consists of alternative configurations at Ethanac Road crossing and channel improvements to extend the downstream to the mouth of Railroad Canyon in order to improve the flow capacity and provide 100-year flood containment (**Figure 5-6**).

Element 5B: Ethanac Grading & Low Flow Channel

Element 5B consists of excavating a widened channel with a low flow pilot channel within the river that extends approximately one half mile downstream of Ethanac Road. After the widened channel ends, the low flow trapezoidal channel would continue down to Railroad Canyon. The intent of the widened channel is to increase the capacity of the San Jacinto River and reduce the width of the floodplain in this region. Including the low flow channel component would accommodate and focus dry weather flows. Element 5B also considers the “short span” bridge crossing the river at Ethanac Road. The costs of constructing this bridge are not included herein. The hydraulic analysis for this alternative shows that sufficient drainage would be provided without replacing or constructing any new bridges within the project corridor.

Element 5C: Low Flow Channel with Short Span Bridge

Element 5C contains the same components as Element 5B except it does not include the approximately one half mile of widening (grading) of the river south of Ethanac. Element 5C consists of a low flow trapezoidal channel within the San Jacinto River between Ethanac Road and Railroad Canyon, and a short span bridge at Ethanac. The low flow channel would have a limited effect on the behavior of the river during large scale flooding, but its construction would improve drainage for nuisance flows. The hydraulic analysis for this alternative, like Element 5B, shows that sufficient drainage would be provided without replacing or constructing any new bridges within the project corridor.

Element 5D: Low Flow Channel with Full Span Bridge

Element 5D consists of a low flow trapezoidal channel in the San Jacinto River between Ethanac Road and the Railroad Canyon and a “full span” bridge at Ethanac Road. This Element does not include widening the river south of Ethanac. The low flow channel would have a limited effect on the behavior of the river during large scale flooding, but its construction would improve drainage of nuisance (dry weather) flows. The longer bridge would span the floodplain in a 100-year storm event and not create a point of constriction for the river. The hydraulic analysis for this alternative shows that sufficient drainage would be provided without replacing or constructing any new bridges within the project corridor.

Element 5E1: No Grading, No Bridge

Element 5E1 is an Outreach Element that consists of taking no action between Ethanac Road and Railroad Canyon. It would not provide any upgrades to the existing drainage conditions or make efforts to protect transportation infrastructure, but would provide some cost savings for the project as a whole. For this element to be viable, the regions upstream would need to have chosen elements with the same channel bottom elevation as the existing ground. Element 5E1 would be paired with Element 3ANL and 4A or 4D.

Element 5E2: No Grading, With Bridge

Element 5E2 is an Outreach Element that consists of constructing a 700-foot long bridge at Ethanac Road without undertaking any drainage improvements between Ethanac Road and Railroad Canyon. Based on the hydraulic modeling, a bridge of approximately 700 feet in length would be required to span the floodplain. This alternative would connect the east and west banks of the San Jacinto River in order to facilitate development, while providing some cost savings with respect to excavation and grading. For this element to be viable, the regions upstream would need to have chosen elements with the same channel bottom elevation as the existing ground.

Element 5F1: No Grading, Underground Storm Drain, No Bridge

Element 5F1 is an Outreach Element that consists of burying a underground storm drain along the side of the San Jacinto River from Ethanac Road to Railroad Canyon. This approach would avoid the existing riparian channel while still providing better drainage for nuisance (dry weather) flows. This Element does not include a bridge crossing at Ethanac Road.

Element 5F2: No Grading, Underground Storm Drain, With Bridge

Like Element 5F1, Element 5F2 is an Outreach Element that consists of burying a underground storm drain along the length of the San Jacinto River from Ethanac Road to Railroad Canyon. However, this Element includes a bridge of approximately 700-feet in length at Ethanac Road to cross the San Jacinto River. This approach would avoid the existing riparian channel while still providing better drainage for nuisance flows. Element 5F2 would be paired with Element 3ANL.

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Figure 5-1: Project Area

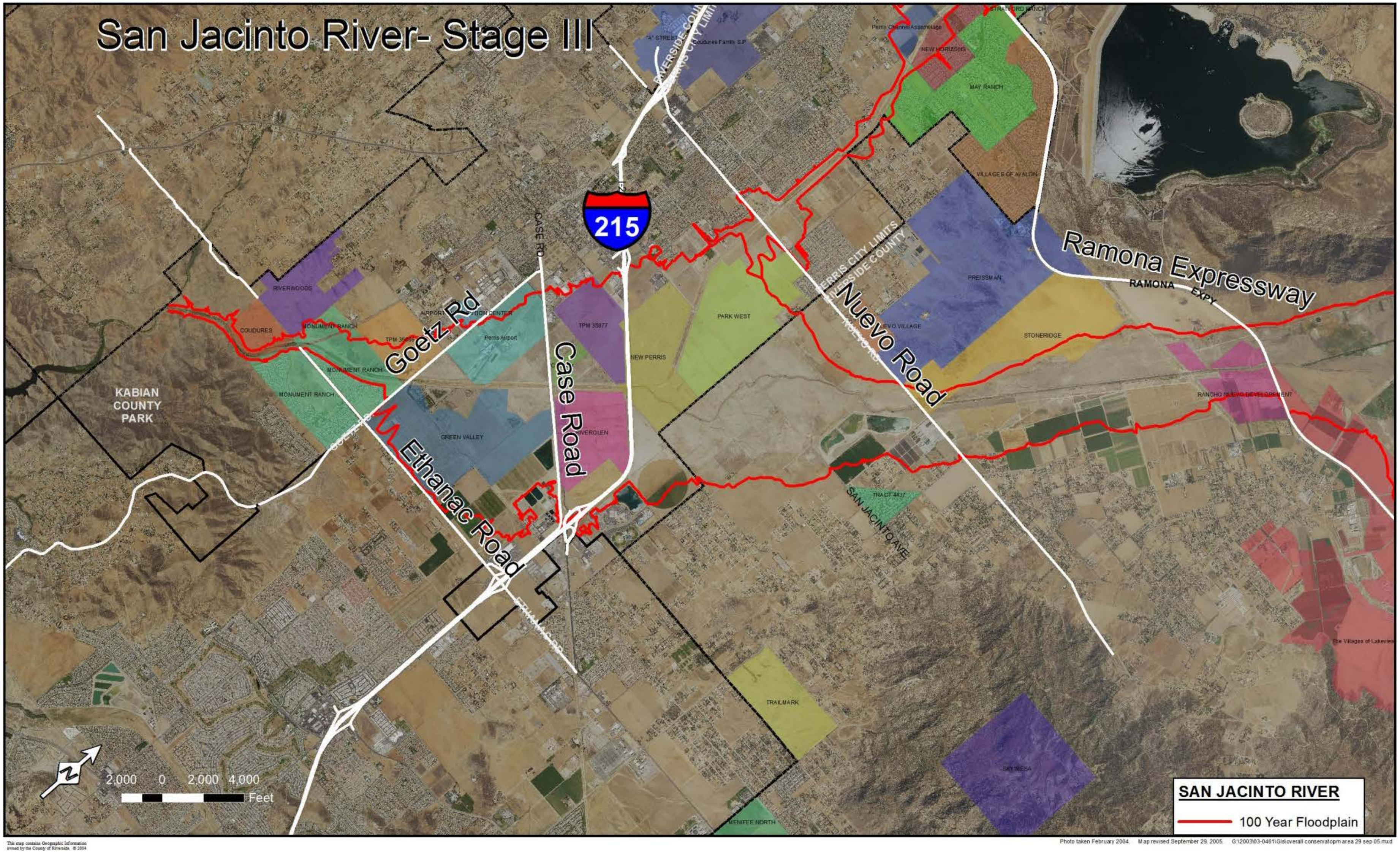


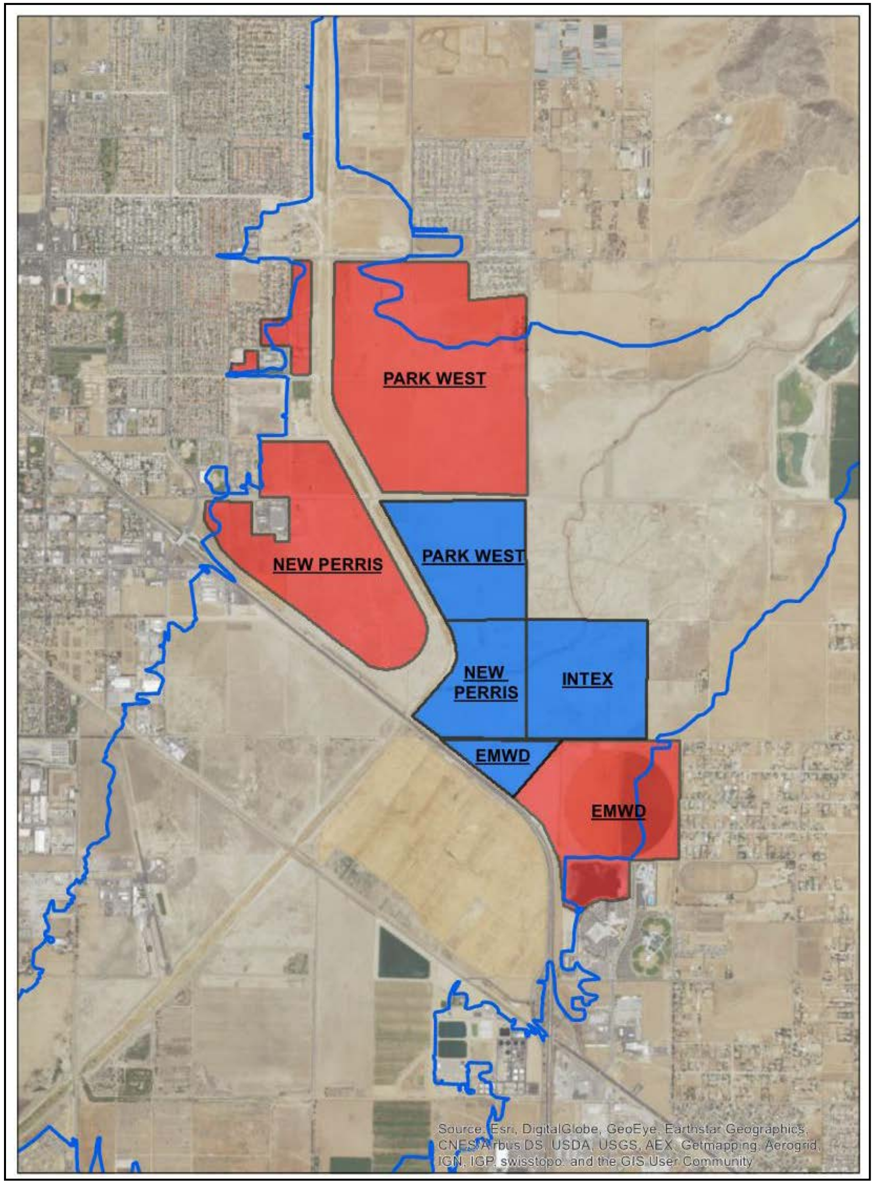
Figure 5-2: Element 1 Category - Ramona Expressway Crossing

- 1A - Ramona Embankment Protection
- 1AC - Ramona Embankment Protection - No Berms Downstream
- 1B - Ramona Flow Control – Berm and Flow Control Structure (1974 MDP)
- 1BC - Ramona Flow Control – Berm, Flow Control Structure, and No Berms Downstream.

Figure 5-3: Element 2 Category – Floodplain Storage Alternatives Upstream of I-215

- 2A1- Expanded Volume Upstream of I-215 (Alternative 1) New Perris/Park West
- 2A2 - Expanded Volume Upstream of I-215 (Alternative 2) New Perris/Park West/Intex
- 2B - Existing Condition Upstream of I-215 (no expanded volume)

Figure 5-3a: Properties Designated for Excavation and/or Fill



Red properties: areas of potential fill.

Blue properties: areas of potential excavation.

Blue line: 100-year floodplain

Figure 5-4: Element 3 Category – I-215 Crossing and Perris Valley Storm Drain

- 3A - Flow Control Structure at I-215 and PVSD Low Flow Channel.
- 3AF – Flow Control Structure at I-215 with Flared PVSD.
- 3ANL – Flow Control Structure at I-215 with No Lowering of PVSD.
- 3B1 – Flow Control Structure at I-215 with PVSD and Fill.
- 3B1F – Flow Control Structure at I-215 with Flared PVSD and Fill.
- 3B2 – Flow Control Structure at I-215 with PVSD Berm.
- 3B2F – Flow Control Structure at I-215 with Flared PVSD, Fill and Berm.

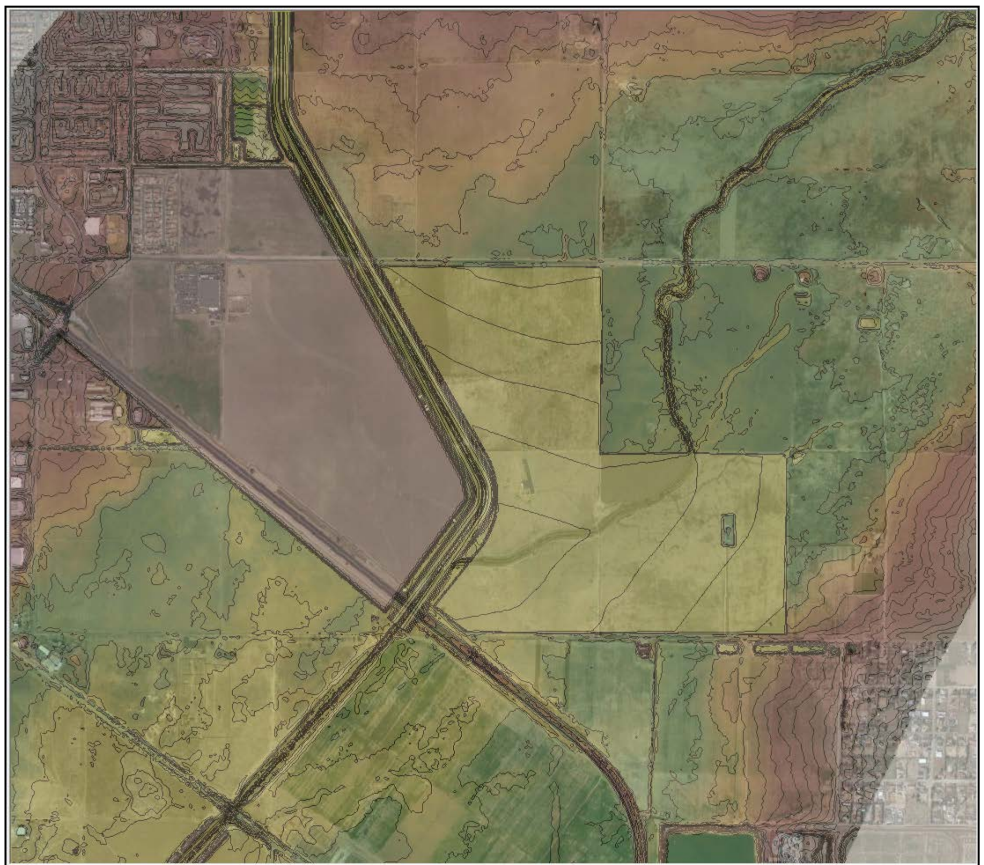
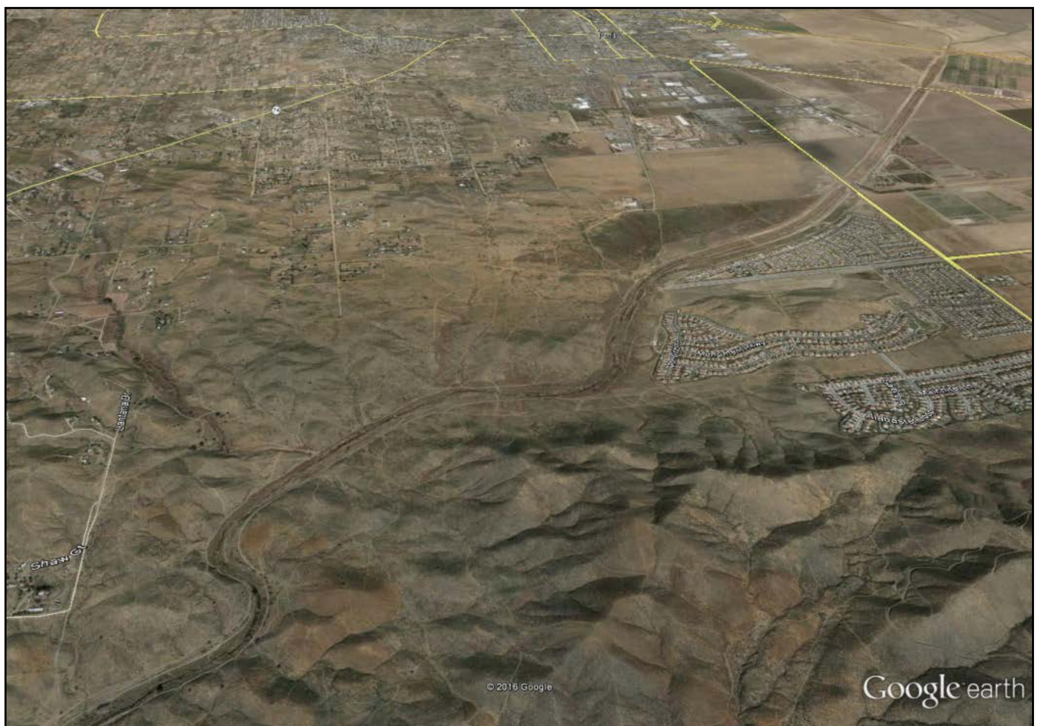


Figure 5-5: Element 4 Category – Channel Modifications from I-215 to Ethanac

- 4A - Remove Berms
- 4B – 1,000-foot Channel
- 4C – 10-foot Low Flow Channel
- 4D – No Grading
- 4E – Terraced Channel

Figure 5-6: Element 5 Category – Ethanac Crossing and Channel to Railroad Canyon

- 5B - Ethanac Grading, Low Flow Channel & Short Span Bridge
- 5C - Low Flow Channel with Short Span Bridge
- 5D – Low Flow Channel with Full Span Bridge
- 5E1 – No Grading, No Bridge
- 5E2 – No Grading, With Bridge
- 5F1 – No Grading, Underground Low Flow Storm Drain, No Bridge
- 5F2 – No Grading, Underground Low Flow Storm Drain, With Bridge



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SECTION 6: PROJECT ALTERNATIVES

6.1 Introduction

Nine different project alternatives for the Lower San Jacinto River were evaluated by the Advisory Committee for this report. These alternatives are made up of the elements discussed in the Project Elements section of this report (Section 5). The alternatives are intended as composite strategies for meeting several objectives related to public health, safety, traffic circulation, community development, habitat and species conservation, and other infrastructure and community needs.

The first five project alternatives (Models 1 through 5) are “foundational” and were created by the Technical Subcommittee with direction from the Advisory Committee during the early phases of this study prior to extensive outreach to regulatory agencies and major landowners. These five foundational alternatives tend to optimize the Lower San Jacinto River improvements for specific traits such as minimizing environmental impacts, supporting future development, protecting transportation infrastructure, species habitat conservation, and minimizing project costs. Over the course of the study, four additional project alternatives (Models 6 through 9) were developed. These four new project alternatives arose from outreach and further discussion within the Advisory Committee. These project alternatives are referred to as “outreach” or “hybrid” alternatives.

For each alternative, a floodplain model was developed and a hydraulic analysis was performed using the methods discussed in Section 4 of this report. Each analysis provided several key parameters used to evaluate the model and to compare with other alternatives. These include the total floodplain footprint area of the alternative, the flow rates at the Ramona Expressway and the I-215 crossings, and the water surface elevations at the Ramona Expressway and the I-215 crossings. From these results, the required conservation footprint area was identified and the total area of land reclaimed for development from the current FEMA floodplain acreage was calculated. The construction footprint area and the estimated construction cost were also estimated for each alternative using the District’s cost spreadsheet. Lastly, a brief summary of the environmental implications of each Model is provided.

This section provides a detailed discussion for each of the alternatives evaluated. The discussion includes a description of the alternative, the elements used in the alternative, the results of the analysis for each alternative, a discussion of environmental considerations, and cost. Summary tables for all the scenarios are included at the end of this section.

6.2 Model 1: Enhanced Environmental Alternative

The Enhanced Environmental Alternative is a foundational alternative that was studied to determine what would be required to maximize the floodplain area and minimize environmental impacts. Maximizing the land area kept in floodplain would maximize the land kept in conservation.

According to the elements of this alternative as listed in **Table 6-A**, floodwaters moving through the Lower San Jacinto River would flow over the Ramona Expressway and through the proposed I-215 flow control structure. Existing agricultural berms downstream of the Ramona expressway would be removed, restoring natural overbank flood patterns. The Perris Valley Storm Drain would be widened and lowered between the Nuevo Road and I-215 crossings. Downstream of the I-215 a low flow channel would be graded into the existing river channel. A summary of Model 1 components is provided in **Figure 6-1**.

Table 6-A: Elements of Model 1 - Enhanced Environmental Alternative

Element ID	Element Name
1AC	Ramona Expressway Embankment Protection – No Berms Downstream
2B	Existing Condition Upstream of I-215 (no expanded volume)
3A	Flow Control Structure at I-215 with PVSD Low Flow Channel
4C	10-Foot Low Flow Channel
5C	Low Flow Channel with Short Span Bridge

Under the Enhanced Environmental Alternative, the limited embankment protection of existing Ramona Expressway, the removal of berms downstream of Ramona Expressway as well as the limited improvements to other roadway crossings, would result in a floodplain that mimics the existing floodplain in a 100-year storm event. Storm water would spread and recede unencumbered in this scenario, which makes for a better environment for the endemic plants and species.

This alternative does include grading of a low-flow channel downstream of the I-215 all the way through Railroad Canyon. Even though the resultant floodplain will be very large and mimic the existing flooding regime, grading the low flow channel will have significant impacts to riverine, riparian and jurisdictional waters. Mitigation for these impacts is expected to include retaining a certain amount of the top soil and seedbank for local revegetation after construction.

The hydraulic analysis for this alternative shows that sufficient drainage would be provided without replacing or constructing any new bridges within the project corridor. It is anticipated that agencies may desire to expand existing bridges or construct new infrastructure. These items are not included as part of this cost estimate.

The modeling results of the Enhanced Environmental Alternative indicate there would be approximately 6,250 acres remaining in the floodplain, which can be considered conservation land, and approximately 835 acres that could be “reclaimed’ for development. Model 5, the Cost-Effective Alternative, also proposes the same acreages in conservation and reclaimed for development. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, and located at the end of this section.

6.3 Model 2: Development Alternative

The Development Alternative is a foundational alternative and was studied to determine what would be required to maximize the area reclaimed from the floodplain and used for development.

According to the elements of the Development Alternative as listed in **Table 6-B**, floodwaters moving through the Lower San Jacinto River would encounter a series of flow control structures located at the Ramona Expressway and the I-215 crossings. Existing agricultural berms downstream of the expressway would be removed, restoring natural overbank flood patterns. Additional land located upstream of I-215, could be reclaimed from the floodplain by either placing earthen fill on adjacent properties until they were above the floodwater elevations, or using a levee or berm. Additionally, the properties immediately upstream of the I-215 crossing along the banks of the San Jacinto River could be graded to lower elevations in order to expand the storage volume available for floodwaters, and further reduce the size of the floodplain. The Perris Valley Storm Drain would be widened and lowered between the Nuevo Road and I-215 crossings. Downstream of the I-215 crossing, the existing river channel would be widened to approximately 1,000-feet in order to increase drainage capacity and decrease the size of the floodplain. Further downstream, near Ethanac Road, the river would transition from the 1,000-foot wide section to a much smaller low flow channel. The elements required for the Development Alternative are listed in **Table 6-B** and a summary of Model 2 components is provided in **Figure 6-2**.

Table 6-B: Elements of Model 2 - Development Alternative

Element ID	Element Name
1BC	Ramona Flow Control – Berm, Flow Control Structure, and No Berms Downstream
2A1 or 2A2	Expanded Volume Upstream of I-215 (alternatives 1 or 2)
3B1 or 3B2	Flow Control Structure at I-215 with PVSD (fill for development or fill for two berms)
4B	1,000-Foot Channel
5B	Ethanac Grading, Low Flow Channel & Short Span Bridge

The Development Alternative includes a flow control structure immediately upstream of the interstate that would limit the amount of flow through the roadway. Under this alternative, there would be expanded flood storage volume that would be created by excavating and removing soil to allow for more water to be “stored” in the “shallow pond” areas of the floodplain. Excavating the ponds would impact plant and animal species living in these areas, and create more flood storage which would have a modest effect on the extent of the floodplain. The greater capacity of the ponds in turn would lower the water surface elevation and decrease the flow under the I-215. Downstream of I-215, the existing low-flow channel would be widened to 1,000 feet between I-215 and Ethanac Road. This condition would result in a much smaller floodplain footprint than what is experienced under the current FEMA floodplain, but it would not be confined to just the 1,000 foot channel. Under this alternative, there would be substantial grading associated with the Ethanac Bridge project and grading down in the low flow river channel south of Ethanac Road into Railroad Canyon. The grading impacts to riverine, riparian, and jurisdictional areas would be large. Mitigation for these impacts is expected to include retaining a certain amount of the top soil and seedbank for local revegetation after construction.

The hydraulic analysis for this alternative shows that sufficient drainage will be provided without replacing or constructing any new bridges within the project corridor. It is anticipated that agencies may desire to expand existing bridges or construct new infrastructure. These items are not included as part of this cost estimate. In addition, the cost of removing properties from the floodplain with fill or berm (see Elements 3B1/3B2) is not included in the cost estimates. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, and located at the end of this section.

The modeling results of the Development Alternative indicate there would be approximately 4,350 acres remaining in the floodplain, which can be considered in conservation, and approximately 2,735 acres that could be “reclaimed’ for development.

6.4 Model 3: Transportation Alternative

The Transportation Alternative is a foundational alternative and was studied because to determine what is required to maximize the protection of critical transportation infrastructure in the region.

According to the elements of this alternative as listed in **Table 6-C**, floodwaters moving through the Lower San Jacinto River would encounter two flow control structures located at the Ramona Expressway and the I-215 crossings. Existing agricultural berms between the expressway and flow control structure would be removed, restoring natural overbank flood patterns. Also, the storage volume of the floodplain upstream of the I-215 would be increased through the excavation of shallow ponds along the San Jacinto River. The Perris Valley Storm Drain would be widened and deepened between the Nuevo Road and I-215 crossings. Downstream of the I-215 crossing, the existing channel would be widened to approximately 1,000-feet and a low flow channel would also be included to account for nuisance flows. Further downstream, near Ethanac Road, the channel would transition from the 1000-foot wide section to a much smaller low flow channel. A summary of Model 3 components is provided in **Figure 6-3**.

Table 6-C: Elements of Model 3 - Transportation Alternative

Element ID	Element Name
1BC	Ramona Flow Control –Berm, Flow Control Structure, and No Berms Downstream
2A1 or 2A2	Expanded Volume Upstream of I-215 (Alternatives 1 or 2)
3A	Flow Control Structure at I-215 and PVSD Low Flow Channel
4B	1,000-Foot Channel
5B	Ethanac Grading, Low Flow Channel, & Short Span Bridge

The main environmental difference from the Transportation Alternative compared to the other alternatives is that there would be a slight reduction in the floodplain from current FEMA levels south of Ramona Expressway. The flood control structure at I-215 would be accompanied by excavating the land upstream of the I-215 for greater flood storage capacity. Additionally, the water surface elevations and flow rates would be mostly contained within the 1,000-foot wide constructed channel south of I-215 as set forth in this alternative. This alternative would include widening of the river channel for approximately one half mile beginning at the Ethanac Road Bridge, followed with a low flow trapezoidal channel south to Railroad Canyon.

This alternative offers the least amount of acres available for conservation, and therefore would result in the most indirect impacts to species and habitats as a result. Any widening, grading or lowering of the river channel would also create significant impacts to riverine, riparian and jurisdictional waters. Mitigation for these impacts is expected to include retaining a certain amount of the top soil and seedbank for local revegetation after construction.

The hydraulic analysis for this alternative shows that sufficient drainage would be provided without replacing or constructing any new bridges within the project corridor. It is anticipated that agencies may desire to expand existing bridges or construct new infrastructure. These items are not included as part of this cost estimate. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, and located at the end of this section.

The modeling results of the Transportation Alternative indicate there would be approximately 4,100 acres to remain in the floodplain, which can be considered conservation land, and approximately 2,985 acres that could be "reclaimed' for development. This alternative proposes the largest amount of land reclaimed for development.

6.5 Model 4: MSHCP Alternative

The MSHCP Alternative is a foundational alternative and was studied to determine what would be required to comply with Section 7.3.7 of the Western Riverside County MSHCP, which specifically identifies this project and lists the following criteria that shall apply:

1. *Conserve land ("Mitigation Lands") and provides hydrology for the continued survival of the following Covered Species: San Jacinto Valley crownscale, Davidson's saltscale, thread-leaved brodiaea, smooth tarplant, vernal barley, Coulter's goldfields, spreading navarretia, and Wright's trichocoronis. Mitigation Lands may include acreage located outside the Lakeview/Nuevo and Mead Valley Area Plans if the Wildlife Agencies determine that such acreage provides the same or greater Conservation value and acreage to the MSHCP Conservation Area.*
2. *Conserve the two thread-leaved brodiaea populations located downstream of I-215 at Case Road and Railroad Canyon. One of these populations may be transplanted to a suitable receiver site, in accordance with a mitigation and monitoring program that includes success criteria and requirements to ensure that the population has been established.*
3. *Establish a minimum 1,000-foot wide multi-species Linkage between the Ramona Expressway and the [mouth] of Railroad Canyon, which includes the San Jacinto River channel and other land acquired for the Corridor. This Linkage shall be within those Mitigation Lands located adjacent to the San Jacinto River channel. The Linkage width may be reduced with the concurrence of the Wildlife Agencies: (1) to accommodate existing facilities and operations at the Perris Valley Airport; (2) to accommodate Covered Activities; or (3) if a reduced width elsewhere would provide adequate Linkage.*

According to the elements of this alternative as listed in **Table 6-D**, floodwaters moving through the Lower San Jacinto River would flow over the Ramona Expressway and through the I-215 flow control structure. The Perris Valley Storm Drain would be widened and lowered between the Nuevo Road and I-215 crossings. Downstream of the I-215 crossing, the existing channel would be widened to approximately 1,000-feet. Further downstream, near Ethanac Road, the channel would transition from the 1,000-foot wide section to a much smaller low flow channel. The elements required for Model 4 are listed in **Table 6-D** and a summary of Model 4 components is provided in **Figure 6-4**.

Table 6-D: Elements of Model 4 - MSHCP Alternative

Element ID	Element Name
1AC	Ramona Expressway Embankment Protection – No Berms Downstream
2B	Existing Condition Upstream of I-215 (no expanded volume)
3A	Flow Control Structure at I-215 and PVSD Low Flow Channel
4B	1,000-foot Channel
5D	Low Flow Channel with Full Span Bridge

The MSHCP Alternative incorporates only an embankment protection at Ramona Expressway and no excavation of soil material out of the area upstream of the I-215. The resultant floodplain upstream of I-215 under this scenario is very similar to the existing FEMA floodplain.

Generally for the area upstream of the I-215 this alternative is almost like a “no project” condition. South of the I-215, however, there would be the widening of the river to 1,000-feet wide, similar to the Transportation and Development Alternatives. During a flood event, stormwater would break out of the channel and flood a wider area than just the 1,000 feet, thus benefiting the endemic plants and animals that live in this portion of the river. The Ethanac Bridge crossing under this Alternative would be a full span, thereby reducing significantly the amount of grading needed and creating one less point of constriction for the floodplain. Less grading would mean less impacts to species and riverine, riparian and jurisdictional habitats. However, a low flow channel would still be dug south of Ethanac Road into Railroad Canyon, which would still create significant impacts to the riverine, riparian and jurisdictional waters there. Mitigation for these impacts is expected to include retaining a certain amount of the top soil and seedbank for local revegetation after construction.

The hydraulic analysis for this alternative shows that sufficient drainage will be provided without replacing or constructing any new bridges within the project corridor. It is anticipated that agencies may desire to expand existing bridges or construct new infrastructure. These items are not included as part of this cost estimate. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, and located at the end of this section. A summary of Model 4 components is provided in **Figure 6-4**.

The modeling results of the MSHCP Alternative indicate there would be approximately 5,100 acres remaining in the floodplain, which can be considered in conservation, and approximately 1,985 acres that could be “reclaimed’ for development. Model 8, the Hybrid 3 Alternative has nearly the same acreages in conservation and reclaimed for development as the MSHCP Alternative.

6.6 Model 5: Cost-Effective Alternative

The Cost-Effective Alternative is a foundational alternative and was studied to determine the most cost-effective approach to meeting the project objectives.

According to the elements of this alternative, as listed in **Table 6-E**, floodwaters moving through the Lower San Jacinto River would flow over the Ramona Expressway and through the flow control structure at the I-215 crossing. The Perris Valley Storm Drain would be widened and lowered between the Nuevo Road and I-215 crossings. Downstream of the I-215 a low flow channel would be graded into the existing river channel. The elements required for Model 5 are listed in **Table 6-E** and a schematic of Model 5 is provided in **Figure 6-5.**

Table 6-E: Elements of Model 5- Cost-Effective Alternative

Element No.	Element Name
1A	Ramona Expressway Embankment Protection
2B	Existing Condition Upstream of I-215
3A	Flow Control Structure at I-215
4C	10-Foot Low Flow Channel – No Berms
5C	Low Flow Channel with Short Span Bridge

The footprint of the floodplain and resultant impacts would be the same for the Cost Effective Alternative as those described above for the Enhanced Environmental Alternative discussed previously. Mitigation for impacts resulting from Model 5 is expected to include retaining a certain amount of the top soil and seedbank for local revegetation after construction.

The hydraulic analysis for this alternative shows that sufficient drainage will be provided without replacing or constructing any new bridges within the project corridor. It is anticipated that agencies may desire to expand existing bridges or construct new infrastructure. These items are not included as part of this cost estimate. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, and located at the end of this section.

According to the Cost-Effective Alternative, there would be approximately 6,250 acres remaining in the floodplain, which could be considered in conservation, and approximately 835 acres that could be “reclaimed’ for development. These are the same acreages proposed by Model 1, the Enhanced Environmental Alternative.

6.7 Model 6: Hybrid 1 Alternative

The Hybrid 1 Alternative is an outreach alternative and was studied to determine the effect of providing additional flows to the Development Alternative (Model 2) by providing embankment protection at Ramona Expressway, rather than a flow control structure.

According to the elements of this alternative as listed **Table 6-F**, floodwaters moving through the Lower San Jacinto River would have to flow over the Ramona Expressway and through the proposed flow control structure at the I-215 crossing. Existing agricultural berms between the expressway and flow control structure would also be removed. Additional land, upstream of I-215, would be reclaimed from the floodplain by placing earthen fill on adjacent properties until they were above the floodwater elevations. Alternatively, some of this land could be reclaimed from the floodplain by installing a berm on the west bank of the Perris Valley Storm Drain. The Perris Valley Storm Drain would be widened and lowered between the Nuevo Road and I-215 crossings. Downstream of the I-215 crossing, the existing channel would be widened to approximately 1,000-feet in order to increase drainage capacity. Further downstream, near

Ethanac Road, the channel would transition from the 1,000-foot wide section to a much smaller low flow channel into Railroad Canyon.

The hydraulic analysis for this alternative shows that sufficient drainage will be provided without replacing or constructing any new bridges within the project corridor. It is anticipated that agencies may desire to expand existing bridges or construct new infrastructure. These items are not included as part of this cost estimate. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, and located at the end of this section. The elements required for Model 6 are listed in **Table 6-F** and a schematic of Model 6 is provided in **Figure 6-6**.

Table 6-F: Elements of Model 6 - Hybrid 1 Alternative

Element ID	Element Name
1AC	Ramona Expressway Embankment Protection – No Berms Downstream
2A2	Expanded Volume Upstream of I-215 (Alternative 2)
3B1or 3B2	Flow Control Structure at I-215 with PVSD Fill and/or Berm
4B	1,000-Foot Channel
5C	Low Flow Channel with Short Span Bridge

The environmental implications of the Hybrid 1 Alternative are similar to the Development Alternative, but the Hybrid 1 Alternative includes embankment protection on the south bank of Ramona Expressway. In addition, this Alternative includes reclaimed floodplain land in the area north and south of I-215. If these areas are developed, they could have impacts to local species and habitats. Impacts to riverine, riparian and jurisdictional areas would be expected with grading the 1000-foot wide river channel south of I-215, as well as grading in and around the river at Ethanac Road and the creating the low flow channel south to Railroad Canyon. Mitigation for these impacts is expected to include retaining a certain amount of the top soil and seedbank for local revegetation after construction.

The modeling results of the Hybrid 1 Alternative indicate there would be approximately 4,350 acres remaining in the floodplain, which can be considered in conservation, and approximately 2,735 acres that could be “reclaimed’ for development. These are the same acreages proposed in Model 2, the Development Alternative, and nearly the same as Model 9, the Hybrid 4 Alternative.

6.8 Model 7: Hybrid 2 Alternative

The Hybrid 2 Alternative is an outreach alternative and was studied to determine the floodplain effect of providing embankment protection at Ramona Expressway and a flow control structure at I-215.

According to the elements of this alternative, floodwaters moving through the Lower San Jacinto River would have to flow over the Ramona Expressway and through the flow control structure at the I-215 crossing. At this time no drainage improvements would be undertaken on the existing channel downstream of the I-215 crossing. The Perris Valley Storm Drain would be widened but could not be lowered since lowering the channel would create a vertical discontinuity with downstream river sections.

The hydraulic analysis for this alternative shows that this alternative would not provide sufficient drainage to ensure that the I-215 is not flooded during the 100-year storm event. Like the other alternatives, it is anticipated that agencies may desire to expand existing bridges or construct new infrastructure in the future. These items are not included as part of this cost estimate. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, and located at the end of this section. The elements required for Model 7 are listed in **Table 6-G**.

Table 6-G: Elements of Model 7 - Hybrid 2 Alternative

Element ID	Element Name
1A	Ramona Expressway Embankment Protection
2B	Existing Condition Upstream of I-215 (no expanded volume)
3ANL	Flow Control Structure at I-215 with No Lowering of PVSD
4D	No Grading
5E1 or 5E2	No Grading (with or without bridge)

This Hybrid 2 Alternative would generally mimic the existing condition except for widening of the Perris Valley Storm Drain. The floodplain would remain nearly the same size, as only 532 acres are reclaimed. No grading would occur downstream of the I-215, so therefore riparian, riverine and jurisdictional impacts associated with this alternative would be minimal.

The modeling results of the Hybrid 2 Alternative indicate there would be approximately 6,553 acres remaining in the floodplain, which could be considered conservation land, and approximately 532 acres that could be “reclaimed’ for development. This alternative provides the greatest amount of land remaining in the floodplain. A summary of Model 7 components is provided in **Figure 6-7**.

6.9 Model 8: Hybrid 3 Alternative

The Hybrid 3 Alternative is an outreach alternative and was studied to determine the effect of adding a terraced channel between I-215 and Ethanac, as well as a low flow pipe downstream of Ethanac to address habitat conversion concerns.

According to the elements of this alternative, floodwaters moving through the Lower San Jacinto River would flow over the Ramona Expressway and through the flow control structure at the I-215 crossing. The Perris Valley Storm Drain would be widened and lowered between the Nuevo Road and I-215 crossings. The Perris Valley Storm Drain would also be flared immediately upstream of the flow control structure to provide a flow path to the auxiliary culverts below the I-215. Immediately downstream of the I-215 crossing, the existing San Jacinto River channel would be widened to nearly 3,000-feet in order to capture flow from the existing auxiliary culverts flowing below the I-215 Bridge. This flow would be funneled into a roughly 700-foot wide terraced river channel along with other floodwaters flowing below the I-215 Bridge. Just downstream of Ethanac, the river channel widening would cease and transition into the existing river channel. At this point, the lowest section of the proposed terraced channel would be connected to an underground storm drain that would convey nuisance flows in into Railroad Canyon. The low flow pipe would also prevent dry weather nuisance flows from entering the river system and causing a change in habitat types. The elements required for Model 8 are listed in **Table 6-H** and a summary of Model 8 components is provided in **Figure 6-8**.

Table 6-H: Elements of Model 8 - Hybrid 3 Alternative

Element ID	Element Name
1A	Ramona Expressway Embankment Protection
2B	Existing Condition Upstream of I-215 (no expanded volume)
3AF	Flow Control Structure at I-215 with Flared Perris Valley Storm Drain
4E	Terraced Channel
5F1 or 5F2	No Grading, Underground Storm Drain, (with or without bridge)

The hydraulic analysis for this alternative shows that sufficient drainage will be provided without replacing or constructing any new bridges within the project corridor. It is anticipated that agencies may desire to expand existing bridges or construct new infrastructure in the future. These items are not included as part of this cost estimate. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, and located at the end of this section.

The Hybrid 3 Alternative incorporates a few new elements to lessen the environmental impacts. This alternative utilizes all existing nine culverts under the I-215 Bridge to widen the floodplain moving through this area to approximately 3,000 feet. This would allow the water to behave in a more natural condition providing the necessary slow flooding and receding flows that the endemic plants and habitats require. Additionally, under this alternative there would be a terraced channel constructed downstream from I-215 to Ethanac Road that would allow smaller flowrates than those anticipated in the 100-year storm to flood out at variable limits depending on the storm event. This terraced channel would provide more dry areas so that the entire river floodplain would be inundated in smaller storm events. This alternative incorporates an underground storm drain to be located along the river. The low flow pipe would convey dry weather flows and flows from small storm events, which are the more typical storms, outside the existing drainage channel. This pipe would limit the amount of habitat type conversion from the existing alkali playa and meadows to riparian, and would significantly reduce the amount of jurisdictional impacts of the project. Mitigation for these impacts is expected to include retaining a certain amount of the top soil and seedbank for local revegetation after construction.

The modeling results of the Hybrid 3 Alternative indicate there would be approximately 5,102 acres to remain in the floodplain, which can be considered in conservation, and approximately 1,983 acres that could be "reclaimed' for development. This alternative proposes nearly the same areas in floodplain and reclaimed for development as Model 4, the MSHCP Alternative. A summary of Model 8 components is provided in **Figure 6-8**.

6.10 Model 9: Hybrid 4 Alternative

The Hybrid 4 Alternative is an outreach alternative and was studied to determine the impact on the floodplain if the land upstream of I-215 is reclaimed for development, while also considering the habitat conversion concerns.

According to the elements of this alternative, floodwaters moving through the Lower San Jacinto River would flow over the Ramona Expressway and through the proposed flow control structure at the I-215. As with Hybrid 3, the Perris Valley Storm Drain would be widened and lowered between the Nuevo Road and I-215 crossings. The Perris Valley Storm Drain would be flared immediately upstream of the flow control structure to provide a flow path to the auxiliary culverts below the I-215. However, unlike Hybrid 3, Hybrid 4 proposes to modify the remaining floodplain upstream of the I-215 crossing to allow the property that is currently within the ParkWest and New Perris Specific Plans to be reclaimed along with property owned by EMWD during Phase 2. The removal of these properties from the floodplain does not impact the elements contemplated in Hybrid 3. Immediately downstream of the I-215, the existing river channel would be widened to nearly 3,000-feet in order to capture flow from existing culverts running below the I-215. This flow would then be funneled into a roughly 700-foot wide terraced channel along with other floodwaters running below the I-215 Bridge. Just downstream of Ethanac Road, the channel grading improvements would cease and transition into the existing channel. At this point, the invert (bottom elevation) of the terraced channel would be connected to an underground low flow storm drain to ensure drainage of nuisance flows in the transition.

The hydraulic analysis for this alternative shows that sufficient drainage will be provided without replacing or constructing any new bridges within the project corridor. In the future it is probable that a municipality may want to take steps towards improving or installing bridges. These items are not included as part of this cost estimate. The costs, floodplain impacts and hydraulic modeling results for all models have been summarized in **Tables 6-J** and **6-K**, located at the end of this section. The elements required for Model 9 are listed in **Table 6-I** and a schematic of Model 9 is provided in **Figure 6-9.**

Table 6-I: Elements of Model 9- Hybrid 4 Alternative

Element No.	Element Name
1A	Ramona Expressway Embankment Protection
2B	Existing Condition Upstream of I-215 (no expanded volume)
3B1F or 3B2F	Flow Control Structure at I-215 with Flared Perris Valley Storm Drain and Fill and/or Berm
4E	Low Flow and Terraced Channel
5F1 or 5F2	No Grading, Underground Storm Drain (with or without bridge)

From an environmental perspective, there are limited impacts downstream of Ethanac Road due to the bridge construction and low flow storm drain. Impacts would occur to construct the terraced river channel between I-215 and Ethanac Road, and excavation within the floodplain upstream of I-215 Bridge. Mitigation for these impacts is expected to include retaining a certain amount of the top soil and seedbank for local revegetation after construction.

The modeling results of the Hybrid 4 Alternative indicate there would be approximately 4,332 acres remaining in the floodplain, which can be considered in conservation, and approximately 2,753 acres that could be “reclaimed’ for development. This alternative proposes roughly the same acreages remaining in floodplain and reclaimed for development as Model 2, the Development Alternative and Model 6, the Hybrid 1 Alternative.

6.11 Summary Tables

6.11.1 Cost Summary

The materials and construction costs for each of the nine project alternatives were estimated in order to provide an economic comparison between the alternatives. The construction cost estimates (dated January 9, 2017) for each element component of each model are provided in **Appendix F.** It should be noted that the costs only reflect those elements that would be incorporated into a flood control master drainage plan as part of a future flood control project. In some cases, elements recommend components such as potential bridges, fill, and berms that will be paid for by others (e.g. local agencies or private developers) as they may be constructed at a later date.

The cost estimates include the total construction footprint for each element and alternative. The construction footprint is included as a ceiling for the amount of Property or Right-of-Way

(R/W) purchased that might be required in order to implement the alternative. In reality some land will already be owned by various government agencies and other entities with an interest in the project. For this reason, no right-of-way cost has been associated with the construction footprint at this time. Further, environmental mitigation costs are also largely unknown. Some portions of the project may be self-mitigating; however, until actual permits are negotiated these costs cannot be accurately estimated. Mitigation costs are therefore also not included in the cost estimates. The results for the construction cost estimate (not including right-of-way acquisition or mitigation) have been summarized below in **Table 6-J**.

6.11.2 Land Recovered and Land Conserved Summary

The amount of land recovered from the existing FEMA floodplain as well as the amount of land remaining in the floodplain for each of the nine project alternatives was estimated using hydraulic models. At present, the Lower San Jacinto River FEMA floodplain consists of approximately 7,085 acres of land. Each of the proposed alternatives would reduce the size of the existing floodplain to one degree or another. The amount of land recovered from the existing floodplain, for each alternative, was estimated by comparing the new floodplain with the proposed improvements to the existing FEMA floodplain. The land conserved represents the acreage in the new floodplain that would be set aside as conservation area. The impacts of each alternative on the extents of the floodplain are summarized in **Table 6-J**.

Table 6-J: Floodplain Impact Summary

Alternative No.	Alternative Name	Floodplain Reclaimed (acres)	Floodplain Conserved (acres)	Construction Cost Estimate[1]	Construction Footprint (acres)
1	Enhanced Environmental	835	6,250	$18,516,000	277
2	Development	2,735	4,350	$94,788,000 to $102,627,000	1,649 – 1,799
3	Transportation	2,985	4,100	$94,788,000 to $102,627,000	884 to 1,034
4	MSHCP	1,985	5,100	$79,489,000	598
5	Cost Effective	835	6,250	$16,838,000	214
6	Hybrid 1	2,735	4,350	$100,916,000	1,772
7	Hybrid 2	532	6,553	$13,571,000	140
8	Hybrid 3	1,983	5,102	$72,289,000	561
9	Hybrid 4	2,753	4,332	$72,289,000	1,3332

[1] Costs were estimated using the RCFC&WCD 2016 Cost Project Planning Spreadsheet, and are provided in **Appendix F**.

6.11.3 Hydraulic Modeling Output Summary

Hydraulic models were developed to estimate the water surface elevations (WSE) and flow rates of floodwaters moving through the Lower San Jacinto River floodplain at two locations: the I-215 and Ramona Expressway. The results of these hydraulic models are summarized in **Table 6-K**. These locations were chosen for two reasons. The first is that these roads have the ability to temporarily detain floodwaters. Depending on how long the floodwaters are detained you can control flow rates downstream of them, water surface elevations upstream of them, and the size of the floodplain on both the upstream and downstream sides. Secondly, both of these roads are important pieces of transportation infrastructure and it is desirable to protect them from flood waters. In the case of the I-215, it is a priority that it not be flooded during a major storm event. The Ramona Expressway may be overtopped, but it should not be lost in a wash-out.

Table 6-K: Hydraulic Modeling Output Summary

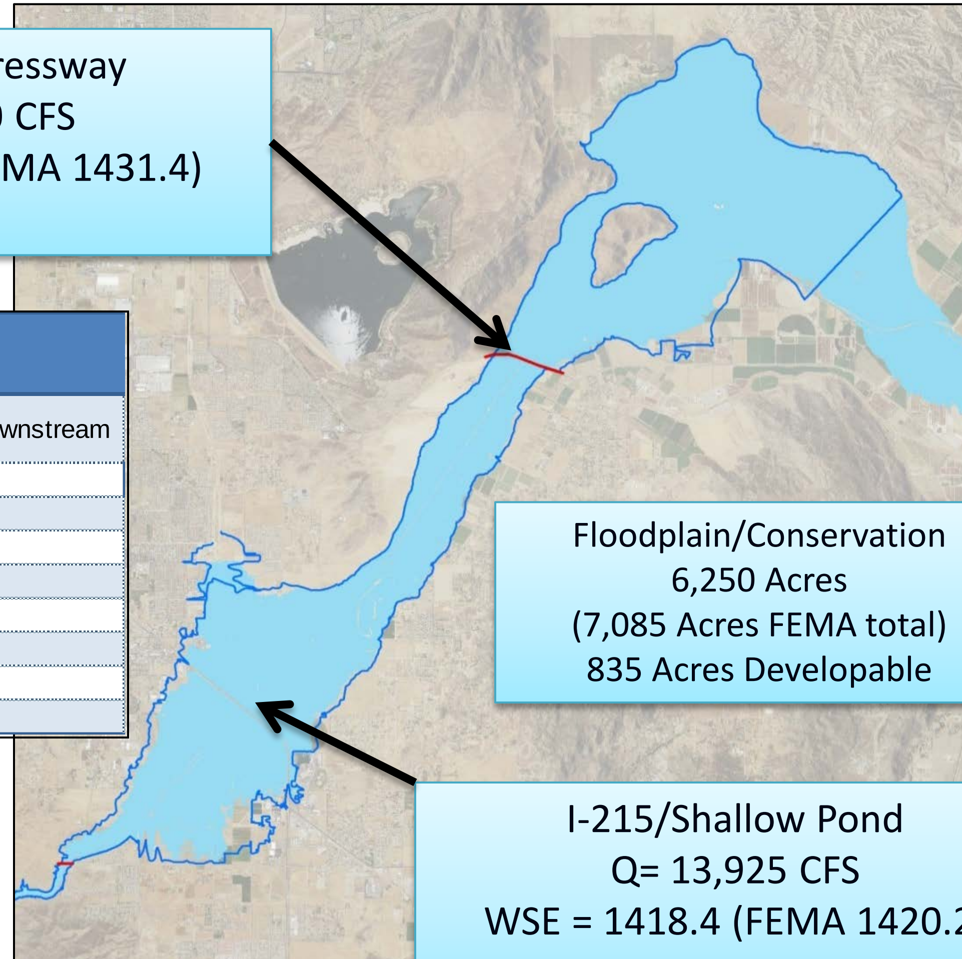
Alternative No.	Alternative Name	WSE[1] at Ramona Expressway (feet)	Flowrate at Ramona Expressway (cfs[2])	WSE at I-215 (feet)	Flowrate at I-215 (cfs)
1	Enhanced Environmental	1,430.3	16,000	1,418.4	13,925
2	Development	1,431.9	5,325	1,418.1	13,180
3	Transportation	1,431.9	5,325	1,416.4	8,055
4	MSHCP	1,430.3	16,000	1,418.3	13,500
5	Cost Effective	1,430.3	16,000	1,418.4	13,925
6	Hybrid 1	1,430.3	16,000	1,418.1	13,630
7	Hybrid 2	1,430.3	16,000	1,418.8	13,165
8	Hybrid 3	1,430.3	16,000	1,418.0	13,600
9	Hybrid 4[3]	1,430.3	16,000	1,418.2	14,000

[1] WSE = water surface elevation measured in feet above mean sea level.
[2] cfs = cubic feet per second.
[3] Model output data for Hybrid 4 is provided on enclosed CD.

Figure 6-1: Model 1 - Enhanced Environmental Alternative

Ramona Expressway
Q= 16,000 CFS
WSE = 1430.3 (FEMA 1431.4)

Model 1 - Enhanced Environmental Scenario	
Elements	Description
1AC	Ramona Exp Embankment Protection - No Berms Downstream
2B	Existing Condition upstream of I-215
3A	Flow Control Structure at I-215
4AC	Low Flow Channel between Ethanac Rd and I-215
5C	Low Flow Channel downstream of Ethanac Rd

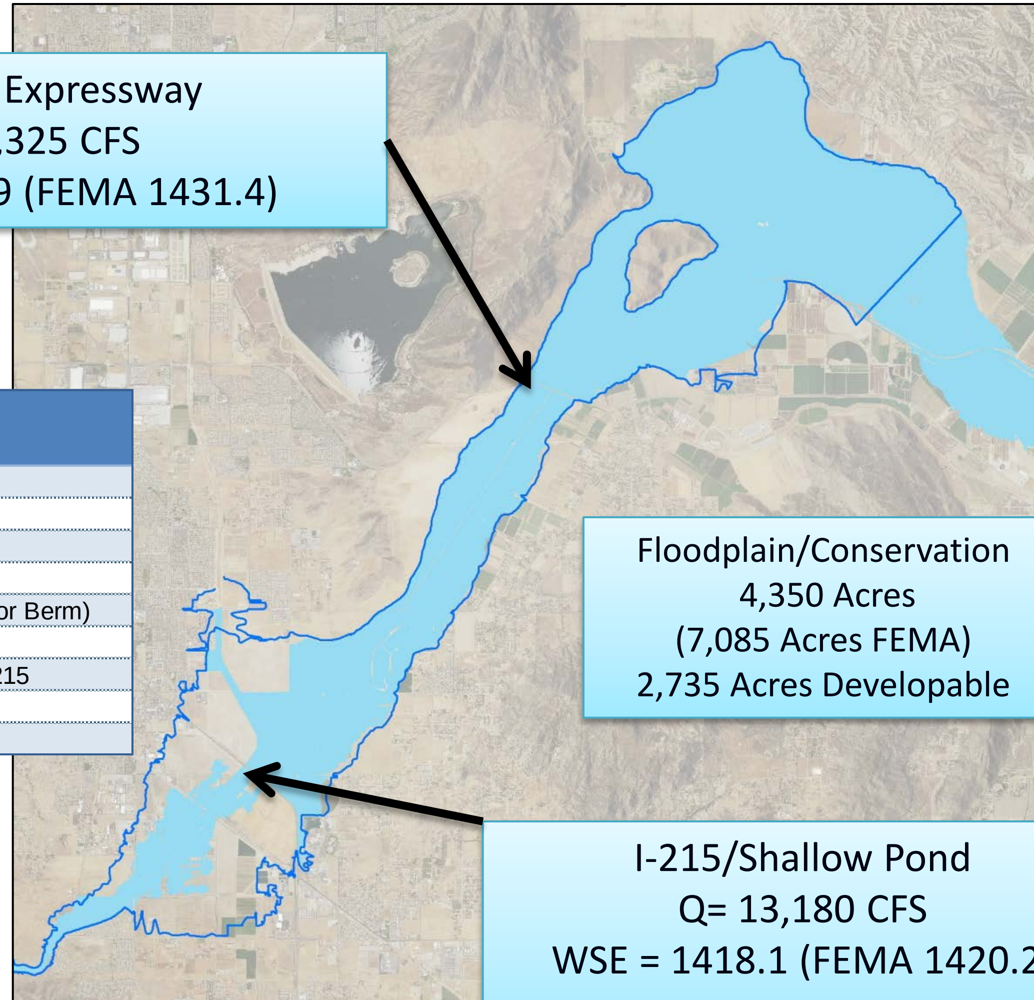


Floodplain/Conservation
6,250 Acres
(7,085 Acres FEMA total)
835 Acres Developable

Cost
$18.5 Million

I-215/Shallow Pond
Q= 13,925 CFS
WSE = 1418.4 (FEMA 1420.2)

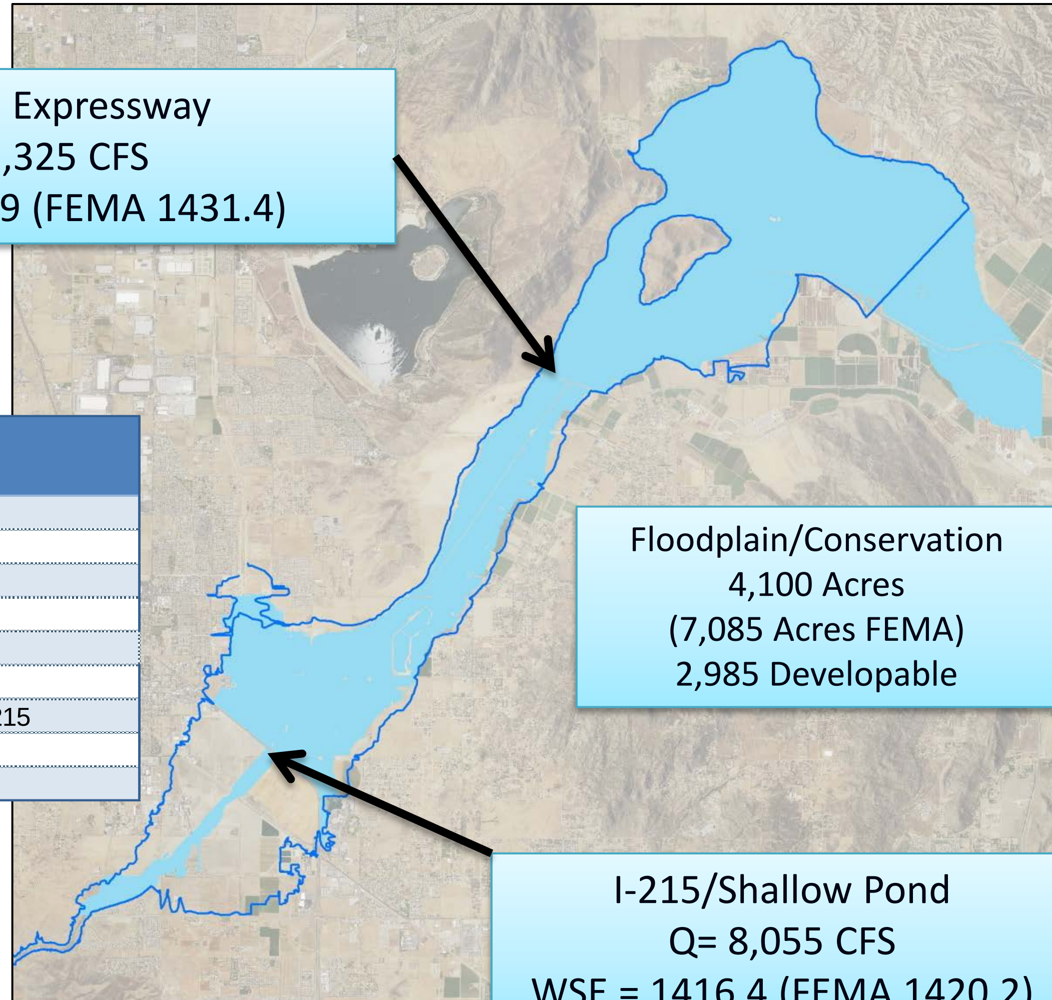
Figure 6-2: Model 2- Development Alternative



Model 2 - Development Scenario	
Elements	Description
1BC	Ramona Exp Flow Control with No Berms
2A1 or 2A2	Expanded Volume upstream of I-215 (2 alternatives)
3B1 or 3B2	Flow Control Structure at I-215 with New Perris (Fill or Berm)
4B	1000' Widened Channel between Ethanac Rd and I-215
5B	Ethanac Grading with low flow channel

Cost
$95 million to
$103 million

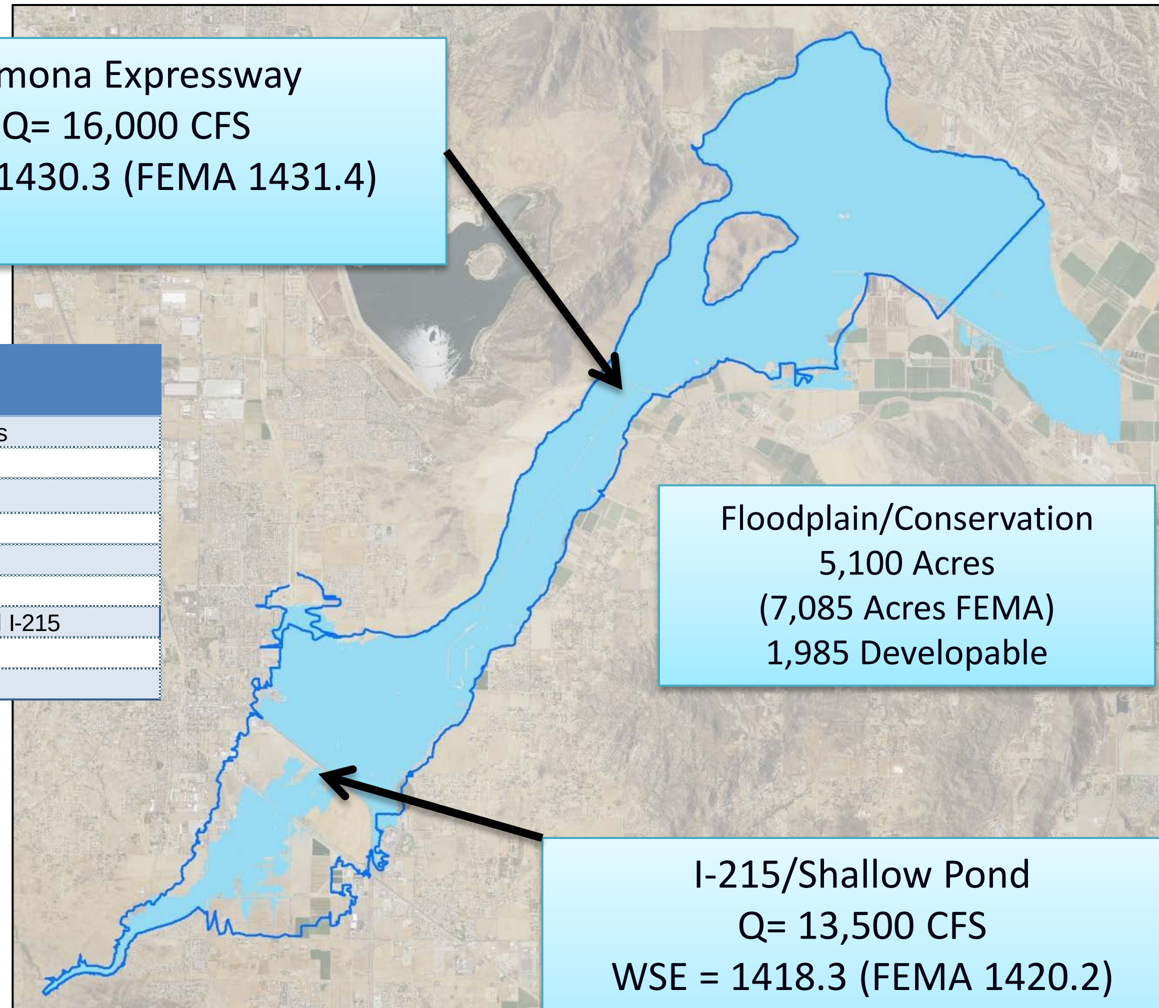
Figure 6-3: Model 3 – Transportation Alternative



Model 3 - Transportation Infrastructure Scenario	
Elements	Description
1BC	Ramona Exp Flow Control with No Berms
2A1 or 2A2	Expanded Volume upstream of I-215 (2 alternatives)
3A	Flow Control Structure at I-215
4B	1000' Widened Channel between Ethanac Rd and I-215
5A	Ethanac Grading with flow channel

Cost
$95 million to
$103 million

Figure 6-4: Model 4 – MSHCP Alternative



Model 4 - MSHCP Consistency Scenario	
Elements	Description
1AC	Ramona Exp Embankment Protection - No Berms
2B	Existing Condition upstream of I-215
3A	Flow Control Structure at I-215
4B	1000' Widened Channel between Ethanac Rd and I-215
5D	Full Span Bridge at Ethanac Rd..with low flow

Cost
$79.5 million

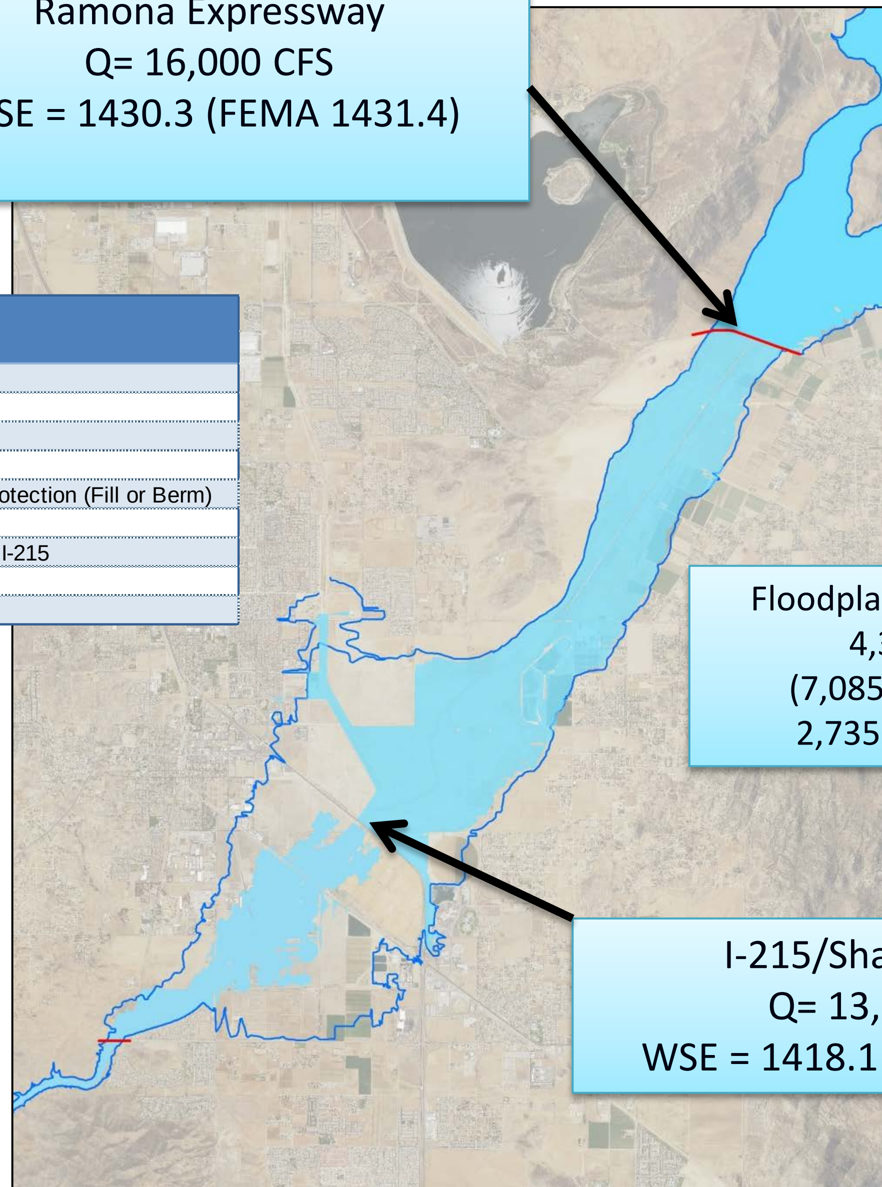
Figure 6-5: Model 5 – Cost-Effective Alternative

Cost
$16.8 million

Figure 6-6: Model 6 – Hybrid 1 Alternative

Ramona Expressway
Q= 16,000 CFS
WSE = 1430.3 (FEMA 1431.4)

Hybrid 1	
Elements	Description
1AC	Ramona Exp Embankment Protection - No Berms
2A2	Expanded Volume Upstream of I-215 (alternate 2)
3B1 or 3B2	Flow Control Structure at I-215 with New Perris Protection (Fill or Berm)
4B	1000' Widened Channel between Ethanac Rd and I-215
5C	Low Flow Channel downstream of Ethanac Rd

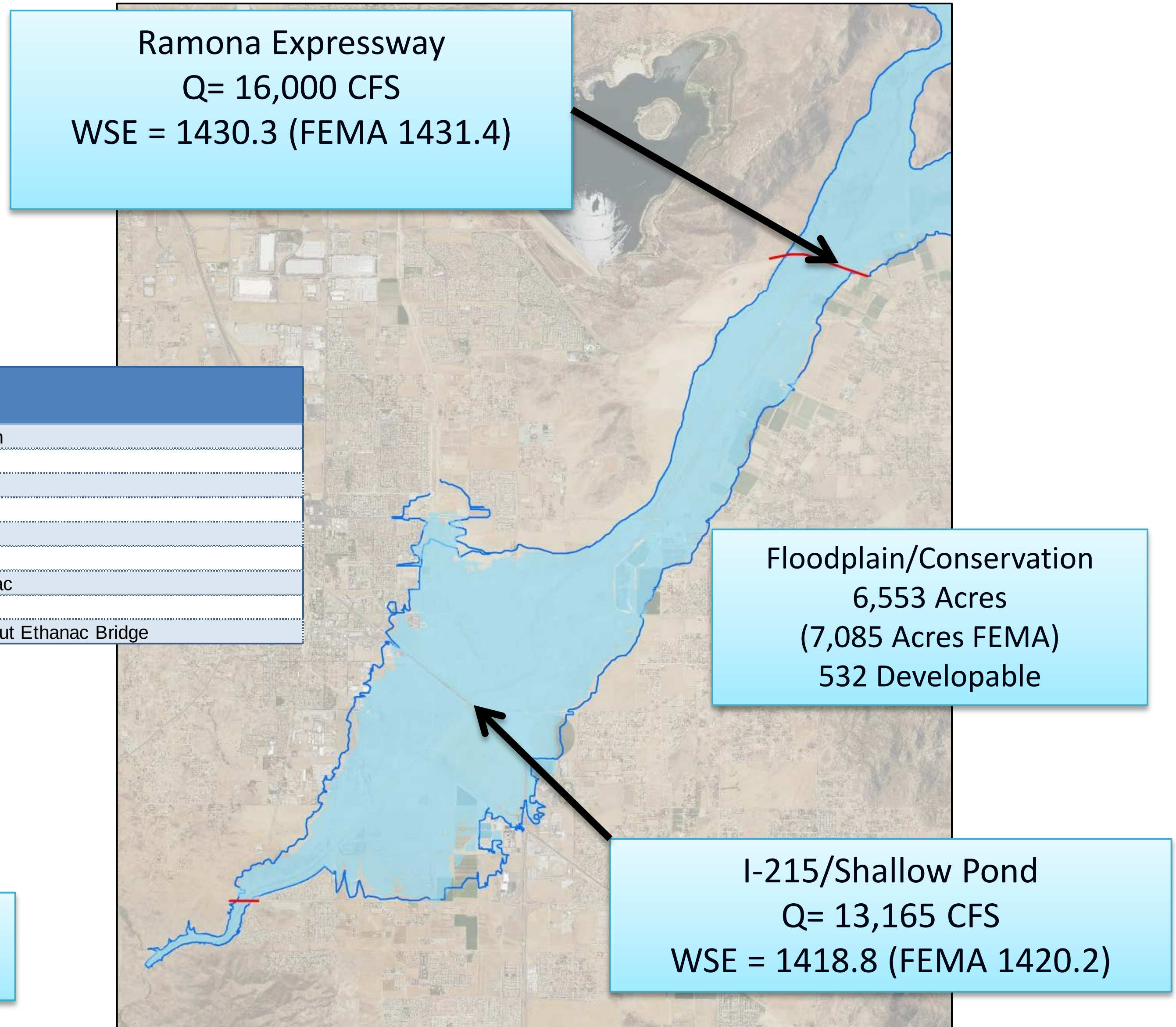


Floodplain/Conservation
4,350 Acres
(7,085 Acres FEMA)
2,735 Developable

I-215/Shallow Pond
Q= 13,630 CFS
WSE = 1418.1 (FEMA 1420.2)

Cost
$100.9 million

Figure 6-7: Model 7 – Hybrid 2 Alternative

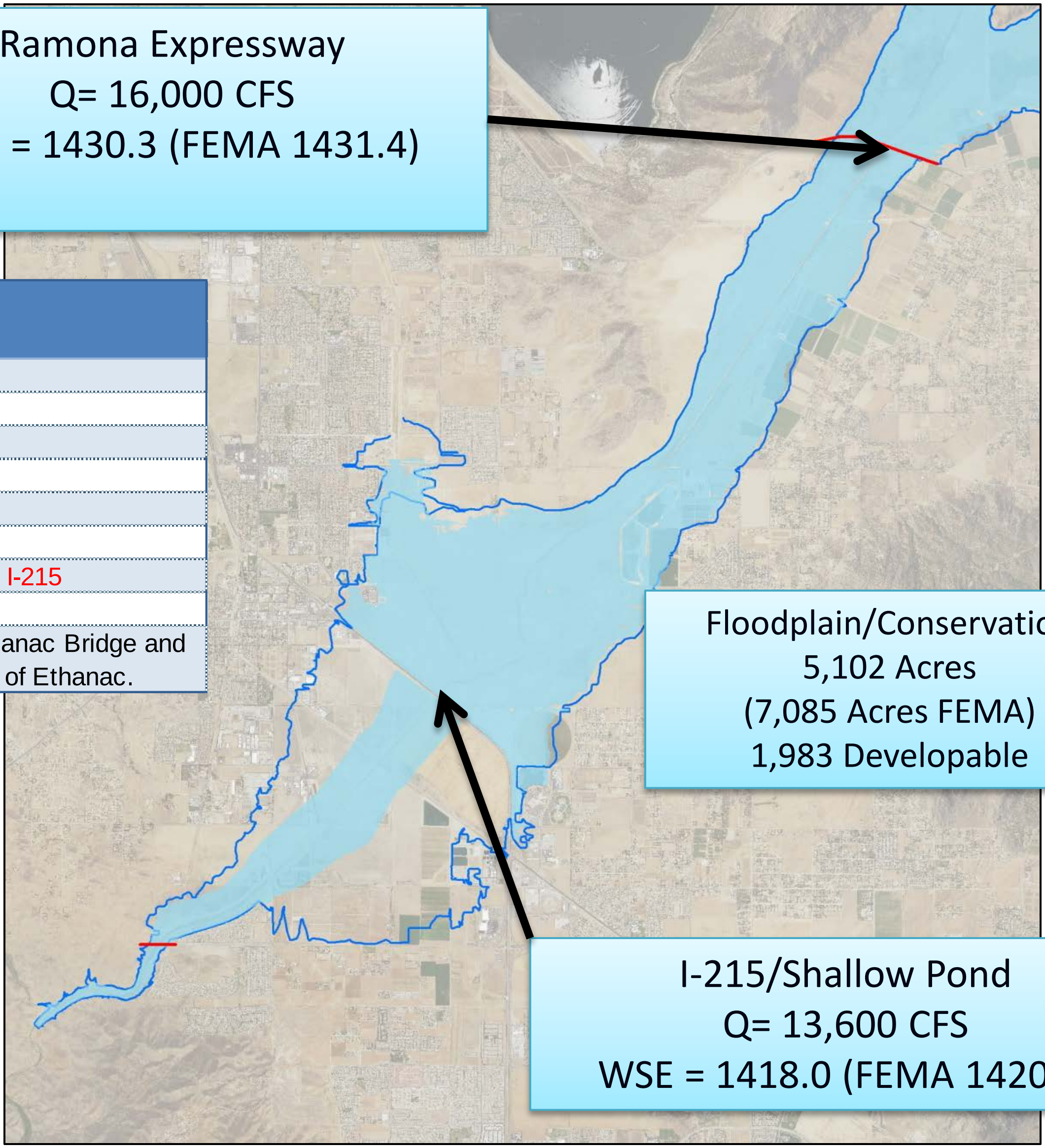


HYBRID 2	
Elements	Description
1A	Ramona Exp Embankment Protection
2B	Existing Condition upstream of I-215
3A	Flow Control Structure at I-215
4D	No Grading between I-215 and Ethanac
5E1 or 5E2	No Grading at Ethanac - with or without Ethanac Bridge

I-215 FLOODS

Cost
$13.6 million

Figure 6-8: Model 8 – Hybrid 3 Alternative



Ramona Expressway
Q= 16,000 CFS
WSE = 1430.3 (FEMA 1431.4)

Hybrid 3	
Elements	Description
1A	Ramona Exp Embankment Protection
2B	Existing Condition upstream of I-215
3A	Flow Control Structure at I-215
4E	Terraced Channel between Ethanac Rd and I-215
5F1 or 5F2	No Grading at Ethanac - with or without Ethanac Bridge and with underground low flow pipe downstream of Ethanac.

Floodplain/Conservation
5,102 Acres
(7,085 Acres FEMA)
1,983 Developable

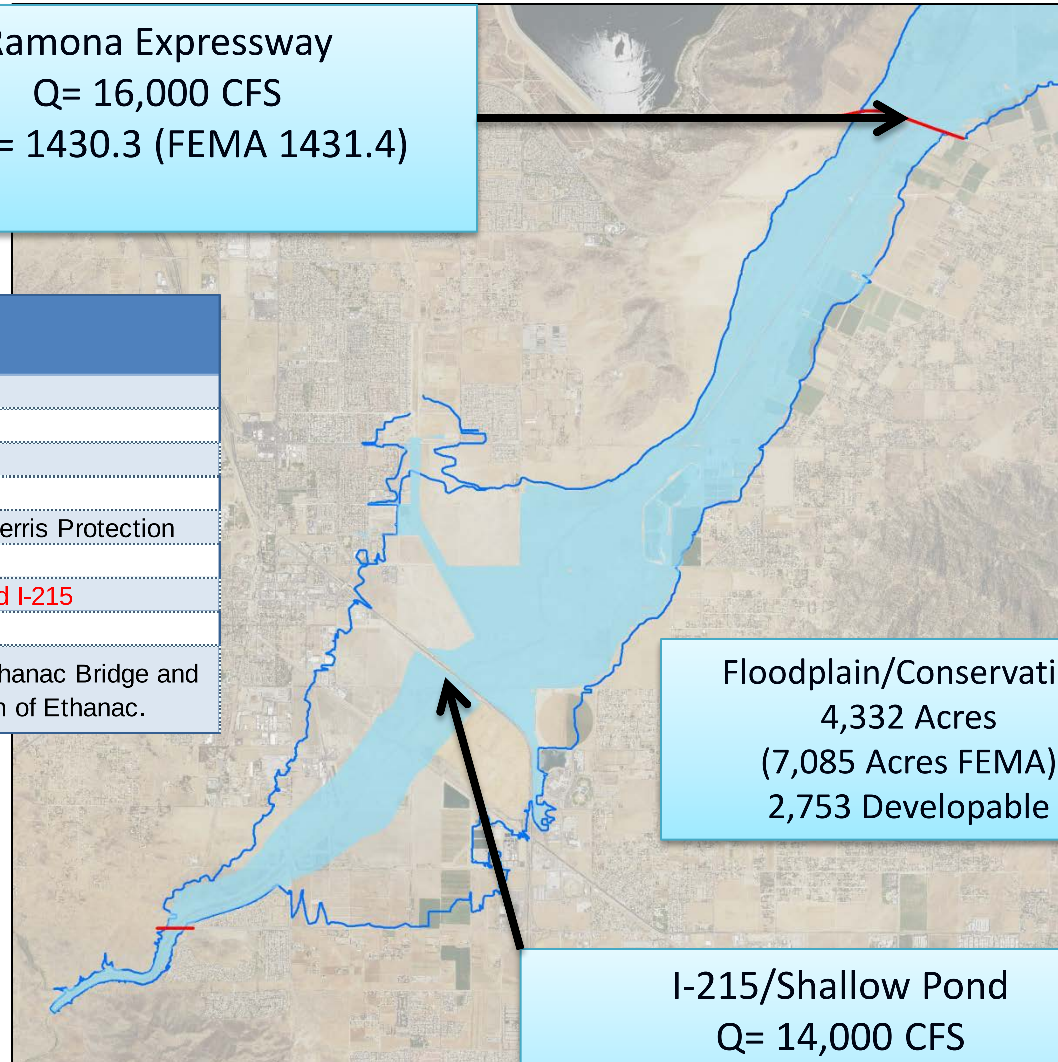
I-215/Shallow Pond
Q= 13,600 CFS
WSE = 1418.0 (FEMA 1420.2)

Cost
$72.3 million

Figure 6-9: Model 9 – Hybrid 4 Alternative

Ramona Expressway
Q= 16,000 CFS
WSE = 1430.3 (FEMA 1431.4)

Hybrid 4	
Elements	Description
1A	Ramona Exp Embankment Protection
2B	Existing Condition upstream of I-215
3B1 or 3B2	Flow Control Structure at I-215 with New Perris Protection
4E	Terraced Channel between Ethanac Rd and I-215
5F1 or 5F2	No Grading at Ethanac - with or without Ethanac Bridge and with underground low flow pipe downstream of Ethanac.



Floodplain/Conservation
4,332 Acres
(7,085 Acres FEMA)
2,753 Developable

I-215/Shallow Pond
Q= 14,000 CFS
WSE = 1418.2 (FEMA 1420.2)

Cost
$72.3 million

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SECTION 7: OUTREACH

Members of the Technical Subcommittee conducted outreach with two main groups:

1. The regulatory agencies consisting of representatives from the U.S. Army Corps of Engineers (USACE), California Department of Fish and Wildlife (CDFW or 'Department'), U.S. Fish and Wildlife Service (Service), Santa Ana Regional Water Quality Control Board (RWQCB) and the Regional Conservation Authority (RCA) of Western Riverside County;[1] and,
2. Additional property owners within the San Jacinto River Stage 3 study area who had not directly been involved in the Advisory Committee (see **Table 3-A**).

The purpose of communicating with the regulatory agencies was to receive constructive guidance and helpful feedback during the process of designing the preferred alternative elements and hydraulic models. These agencies are anticipated to have regulatory authority in the form of issuing permits for implementation of the master plan components, therefore early and forthright outreach efforts are considered critical for this effort. Additionally, these agencies will be reviewing any future CEQA documents and so their advanced input will help the CEQA review process.

The purpose of involving the private individuals who own property within the Stage 3 area was to convey details of how the proposed elements would potentially affect their properties; and then, in turn, receive their feedback to optimize design details. The goal of the outreach efforts was to clearly illustrate to property owners the ramifications the elements of the various alternatives/models for Stage 3 may have to their properties, garner their input and determine their support for various alternatives.

7.1 Regulatory Agency Outreach

Several meetings were held between members of the Technical Subcommittee, which includes staff from Riverside County Flood Control & Water Conservation District (District) and Albert A. Webb Associates (WEBB), and the five regulatory agencies (USACE, CDFW, USFWS, RWQCB, and RCA) in the late summer and fall of 2016. Please refer to **Table 3-B** for a listing of the members of the Technical Subcommittee. The many Stage 3 models, alternatives and elements developed by the Advisory Committee were presented. Meetings with the regulatory agencies are expected to be ongoing throughout the master plan updating process and during development of environmental analysis documents, and will not be limited to the meetings that have already occurred.

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[1] The Western Riverside County RCA is a Joint Powers Authority created in 2004 to oversee the Riverside County Multiple Species Habitat Conservation Plan (MSHCP). Local development mitigation fees, and other funding sources such as tipping fees, public project and participating special entity fees pay for RCA's core activities. It is governed by a Board of Directors and Executive Committee composed of elected officials from Riverside County and the cities who are signatories to the Joint Exercise of Powers Agreement.

The following is a list of meetings that were held with regulatory agencies regarding the San Jacinto River, Stage 3:

1. August 2016: Attended by staff from the USFWS, CDFW, RCA, WEBB and the District.
2. August 2016: Attended by staff from the USACE, WEBB and the District.
3. September 2016: Attended by staff from USFWS, CDFW, WEBB and the District; included a field site visit.
4. October 2016: Attended by staff from USACE, USFWS, CDFW, RCA, Santa Ana RWQCB, WEBB and the District.

The following is a list of the main points of discussion that were raised during these meetings:

- The 5-year, 10-year, and 20-year return interval storm events are of greater concern to the wildlife resource agencies than the 100-year event;
- Skepticism of flooding at Interstate 215 posing a public safety issue; could have ramifications when processing USACE approvals;
- Desire for minimal floodplain reclamation for development purposes;
- Request for Ramona Expressway left alone (not armored on south side);
- Shallow pond excavation still to be worked out as far as how impacts and mitigation will be addressed;
- Sediment transport study may be needed for Perris Valley Storm Drain and San Jacinto River;
- Focus efforts on how to handle dry weather storm water flows – redirect and keep out of main channel;
- There are more uniform flows through roadway at I-215 crossing location than current proposal; and
- Low-flow pipe in San Jacinto River downstream of Ethanac to solve grading problems for that stretch.

In summary, the main concern of the regulatory agencies appears to be related to the hydrology and the ability of the floodplain to continue supporting sensitive plants and species that currently experience, and may depend on, episodic flooding and drying of the floodplain. They were also concerned that urban runoff would increase the wetting periods of the floodplain, thus impacting habitat. Finally, the agencies expressed a desire for the plan to limit the amount of disturbance to existing habitat.

7.2 Property Owner Outreach

Meetings were held between WEBB staff and a number of major land owners within the study area that were not a part of the Advisory Committee in late summer and fall of 2016 (refer to **Table 3-A** for list of Advisory Committee members). The property owners included representatives from Intex Properties Corporation, Richland Communities Inc., IDS Real Estate Group, and Hackman Capital Partners, LLC. The goals, alternatives and elements developed by the Advisory Committee were presented to the property owners. Additional ongoing inquiries are expected from the property owners in the study area.

The following is a list of meetings that were held with the private property owners:

1. August 2016: Meeting with Hackman Capital Partners and WEBB to discuss the alternatives as they related to the ParkWest Specific Plan.
2. August 2016: Meeting with Richland Communities and WEBB to discuss the alternatives as they relate to the Riverwoods Specific Plan and other land holdings that Richland owns within the Stage 3 study area.
3. September 2016: Phone conference with IDS Real Estate Group and WEBB to discuss the alternatives as they related to the various land holdings that IDS owns within the Stage 3 study area.
4. October 2016: Meeting with Intex Properties Corporation and WEBB to discuss the alternatives as they related to the River Glen Specific Plan and other land holdings that Intex owns within the Stage 3 study area.

In summary, the property owners were supportive. The owners asked about timing and what the expected cost would be. Since most of the land holdings are within the floodplain, the property owners wanted to get an understanding of how much of their property would be needed for the various alternatives, and how much property would they have left for their use. Finally, all property owners requested that they be advised of the progress of the master plan document.

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SECTION 8: PREFERRED ALTERNATIVE

8.1 Introduction

The Lower San Jacinto Advisory Committee (Committee) was convened in order to inform the development of a management plan for the Lower San Jacinto River floodplain. The Committee endeavored to identify a floodplain management approach that maximized community benefits while remaining feasible with respect to engineering, economic, and environmental constraints. Each member of the Committee represented a stakeholder interest which must be considered in the development of a floodplain management approach (or 'preferred alternative').

The Committee utilized staff members from the District and Albert A. Webb Associates to assist in developing the various alternatives to floodplain management. Over the course of the effort, many project alternatives were presented to the committee. The final nine project alternatives (or 'models') have been outlined in this report in Section 6. The alternatives scoring matrix (see Section 3) developed for this project was used to evaluate, refine, and shape the various project alternatives into a preferred alternative that best met the objectives set forth by the Committee. Additionally, several meetings with staff members from the various regulatory agencies (see Section 7) helped to refine the preferred alternative.

From these nine project alternatives, and based on the decision matrix, the Committee has chosen "Hybrid 4" as the "preferred alternative." The preferred alternative will serve as the basis for future CEQA analysis and further project refinement. Refer to **Figure 6-9**, "Hybrid 4 Alternative" and **Appendix H** for phased preliminary construction drawings.

8.1.1 Phasing

The ability to phase an alternative was a key objective identified by the Committee. As the preferred alternative was being refined, the Technical Subcommittee evaluated how this alternative could reasonably be phased. Once the elements had been defined (see Section 5), an initial construction phase was developed that would provide the primary and essential public benefits, such as flood protection of regional transportation corridors, addressing side drainage issues that contribute to local flooding issues in Perris and Menifee and providing environmental protection of threatened and endangered species.

Phase 1. Phase 1 of construction for the preferred alternative includes the following elements, which are considered essential for public safety and would be led by the District (see **Figure ES-1**):

- Armoring of Ramona Expressway;
- Low Flow Channel in PVSD from Nuevo Road to I-215;
- Flow Control Structure at I-215;
- Low Flow Channel from I-215 to Ethanac Road; and

- Underground storm drain downstream of Ethanac Road to Railroad Canyon to convey low flows.

These Phase 1 elements will provide 100-year storm event protection of the I-215, allow for Master Drainage Plan (MDP) lateral connections to be made to the San Jacinto River and the Perris Valley Storm Drain, and allow for entitled projects in the City of Perris to viably move forward. Depending on budgetary constraints, the Phase 1 elements could be constructed in sub-phases, however full benefits would not be realized until all of the elements of Phase 1 were constructed. Conceptual plans of Phase 1 (sheets 1 through 18) are included in **Appendix H.**

Phase 2. Optional developer-led elements (referred to collectively as Phase 2) could benefit both local private development and the river corridor by allowing additional floodplain reclamation above and below the I-215 as well as creation of a terraced river channel below the I-215 to Ethanac Road. The terraced channel would in turn promote the habitat within the riparian corridor that is supported by reduced areas of inundation for endemic sensitive species, which also permits better species movement. Refer to **Figure 8-1** for the maximum scope of area south of the I-215 that could be reclaimed from the floodplain with fill in conjunction with full implementation the optional developer-led Phase 2 elements. To be clear, Developer-led Phase 2 elements should not be misconstrued as an automatic next step for the District after completion of Phase 1. Phase 2 elements would be driven by private development interests - not led by the District. Phase 2 could include the following elements, which are considered optional and non-essential for public safety (see **Figure ES-2)**:

- Excavation of shallow ponds[1] upstream of I-215 (Elements 2A1 or 2A2);
- Placement of fill to reclaim land from the floodplain designated by the alternative;
- Widening of the PVSD Channel from I-215 to Nuevo Rd; and
- Widened terraced channel from Ethanac Road to I-215.

The elements of Phase 2 could be completed independently of each other, but all of them would require Phase 1 elements to be completed first in order to proceed. Again, it is assumed Phase 2 elements of the preferred alternative would be led by private development projects. Conceptual plans of Phase 1 and Phase 2are included in **Appendix H.**

The preferred alternative would ultimately support the conservation of more than 4,300 acres of existing floodplain; while allowing incremental development of approximately 2,700 acres (see **Figure 6-9**). In addition, the preferred alternative (with and without Phase 2) would provide a hydrologic regime that does not hinder or alter the ability of the MSHCP Conservation Goals to be met, as discussed below in Section 8.3.

[1] It should be noted that the "shallow ponds" are not actually incised ponds, but rather areas that have been graded for additional floodplain storage and are free-draining to the river.

8.1.2 Project Costs

The total cost for the preferred alternative would be made up of three general components: construction cost, right-of-way cost, and environmental mitigation cost. Right-of-way costs and environmental mitigation costs were not developed at this stage of the planning process. The RCFC&WCD 2016 Project Planning Cost spreadsheets were used to prepare construction cost estimates for the various elements of the preferred alternative, as shown in **Table 8-A**.

Table 8-A: Preferred Alternative Construction Cost Summary

Element[1]	Cost[2]	Approximate Right-of-Way (acres)[3]	Approximate Jurisdictional Impacts (acres)
(1A) Ramona Embankment Protection	$2,967,000	7	1
(3B1F or 3B2F) PVSD Low Flow Channel with Flare with Fill and/or Berm and Widening	$7,097,000	120	38
(3B1F or 3B2F) I-215 Flow Control Structure	$7,865,000	42	2
(4E) Low Flow and Terraced Channel	$44,528,000	358	49
(5F1 or 5F2) Underground Low Flow Storm Drain	$9,832,000	9	2
Total	**$72,289,000**	**536**	**92**

[1] Element 2B (Existing Condition Upstream of I-215, no expanded volume) is assumed in this alternative.
[2] Construction cost only, does not include costs for engineering, administration, right-of-way purchases, or environmental mitigation. Cost does include estimated cost of compacted fill.
[3] Floodplain encroachment areas for future development not included.

Right–of-way need was calculated based on the total acres required to install the various project elements. Jurisdictional impact areas were calculated as the total area of jurisdictional impact (to waters of the U.S. and State) relative to each element. It should be noted that environmental mitigation costs for impacts to habitat and waterways resulting from the regulatory permitting process can be at least $250,000 per acre of impact, and mitigation ratios could range from 3:1 to 5:1. In this analysis, it was assumed that with greater right-of-way required, and greater jurisdictional impact area, the larger the associated total costs would be. The estimated construction costs for just Phase 1 elements are shown in **Table 8-B.**

Table 8-B: Preferred Alternative Phase 1 Construction Cost Summary

Element[1]	Cost[2]	Approximate Right-of-Way (acres)[3]	Approximate Jurisdictional Impacts (acres)
(1A) Ramona Embankment Protection	$2,967,000	7	1
(3B1F or 3B2F) PVSD Low Flow Channel and Flare	$4,821,000	70	22
(3B1F or 3B2F) I-215 Flow Control Structure	$7,865,000	42	2
(4E) Low-Flow Channel	$8,390,000	77	33
(5F1 or 5F2) Underground Low Flow Storm Drain	$9,832,000	9	2
Total	**$33,875,000**	**205**	**60**

[1] Element 2B (Existing Condition Upstream of I-215, no expanded volume) is assumed in this alternative.
[2] Construction cost only, does not include costs for engineering, administration, right-of-way purchases, or environmental mitigation. Cost does include estimated cost of compacted fill.
[3] Floodplain encroachment areas for future development not included.

The estimated construction costs to implement the optional Phase 2 elements are shown in **Table 8-C**, which does not include the costs of placing fill to reclaim land from the floodplain.

Table 8-C: Preferred Alternative Phase 2 Construction Cost Summary

Element	Cost[1]	Approximate Right-of-Way (acres)[2]	Approximate Jurisdictional Impacts (acres)
(3B1F or 3B2F) PVSD Widening – Phase 2	$2,276,000	50	16
(4E) Terraced Channel downstream of I-215 – Phase 2	$36,138,000	281	16
Total	**$36,138,000**	**331**	**32**

[1] Element 2B (Existing Condition Upstream of I-215, no expanded volume) is assumed in this alternative.
[2] Construction cost only, does not include costs for engineering, administration, right-of-way purchases, or environmental mitigation. Cost does include estimated cost of compacted fill.
[3] Floodplain encroachment areas for future development not included.

The preferred alternative assumes the existing floodplain conditions upstream of the I-215 (Element 2B); however, the preferred alternative can accommodate reclamation of properties shown on **Figure 5-3a.** Notably, if developers wish to pursue excavation and/or fill in this area of the floodplain prior to the implementation of Phase 1, they would be subject to compensatory storage requirements. Pursuing the regulatory requirements tied to excavation and fill activities, such as those described in Elements 2A1 and 2A2, would be the responsibility of the entities shown in Figure 5-3a and not the District. After completion of Phase 1 of the Preferred Alternative, properties representing up to approximately 800 acre-feet of floodplain fill, similar to those identified in **Figure 5-3a** would no longer be subject to the compensatory storage requirement since they were included in the assumptions and modeling of the Preferred Alternative. Once the modeled fill limits are met, additional properties would continue to be subject to any applicable development criteria including compensatory storage requirements.

Developer-led Phase 2 of Elements 3B1F or 3B2F consists of additional excavation of the Perris Valley Storm Drain to reach ultimate width and depth, for ultimate planned conveyance. Likewise, Developer-led Phase 2 of Element 4E consists of enhancing the interim trapezoidal channel proposed in Phase 1 from the I-215 to Ethanac Road by creating multiple grade brakes – or terraces – for ultimate planned conveyance (**Figure 8-1**). Again, these elements would be driven by private development, and not led by the District. In addition, Phase 2 elements upstream of the I-215 could occur independently of Phase 2 elements downstream of the I-215, and vice-versa.

8.2 Regulatory Permitting Feasibility

Each of the nine alternatives discussed herein would require regulatory permits. Therefore, in developing the preferred alternative, significant time was spent by the Technical Subcommittee to coordinate with staff members from the United States Fish and Wildlife Service (Service), the California Department of Fish and Wildlife (CDFW) and the United States Army Corps of Engineers (USACE). The coordination efforts with the regulatory agencies (as described in Section 7) led to several project refinements including the addition of the underground storm drain downstream of Ethanac Road, the terraced channel between the I-215 and Ethanac Road, and the use of multiple-culvert crossings at the I-215. These project elements, all constituents of the preferred alternative, will help the project to be permitted through the regulatory agencies. It is anticipated that as the preferred alternative moves forward through the environmental review process (i.e., CEQA), that additional design modifications should be expected to address engineering needs, reduce environmental mitigation and other costs, and to enable the project to be permitted.

8.3 MSHCP Consistency

In addition to requiring permits through the Service, CDFW, and USACE, the project will also require consistency with the MSHCP. The District is a Permittee to the MSHCP and any action the District would take on the preferred alternative would be subject to demonstrating MSHCP compliance. Coordination with the Regional Conservation Authority (RCA), the entity responsible for ensuring Permittees are implementing the MSHCP correctly, has also been ongoing through the Committee and through the regulatory agency meetings that have been held.

The preferred alternative is expected to be consistent with the Reserve Assembly requirements of the MSHCP as it provides 4,332 acres of land that will remain in the floodplain and would not be developed, that can ultimately be conserved. Phase 1 of the preferred alternative would allow for the areas called out for Conservation by the MSHCP to be conserved; Phase 2 would not preclude the ability for the MSHCP reserve assembly goals to be met, as discussed below. The areas that can be conserved by the preferred alternative generally meet not only the acreage targets of the MSHCP, but the configurations and biological goals.

The Developer-led Phase 2 of the preferred alternative would expand the PVSD and increase the capacity of the river with grading of the terraced channel, which would provide an enhanced riverine corridor below the I-215. The terraced channel would allow for areas of the river to stay wet, and areas to dry out which is a better hydrologic regime for the sensitive plants in the area. Additionally, the terracing would decrease the extent of inundation during a storm event, thus allowing animals to traverse and move through the protected floodplain areas. The expanding and terracing components of Phase 2 would also meet the goals of the MSHCP.

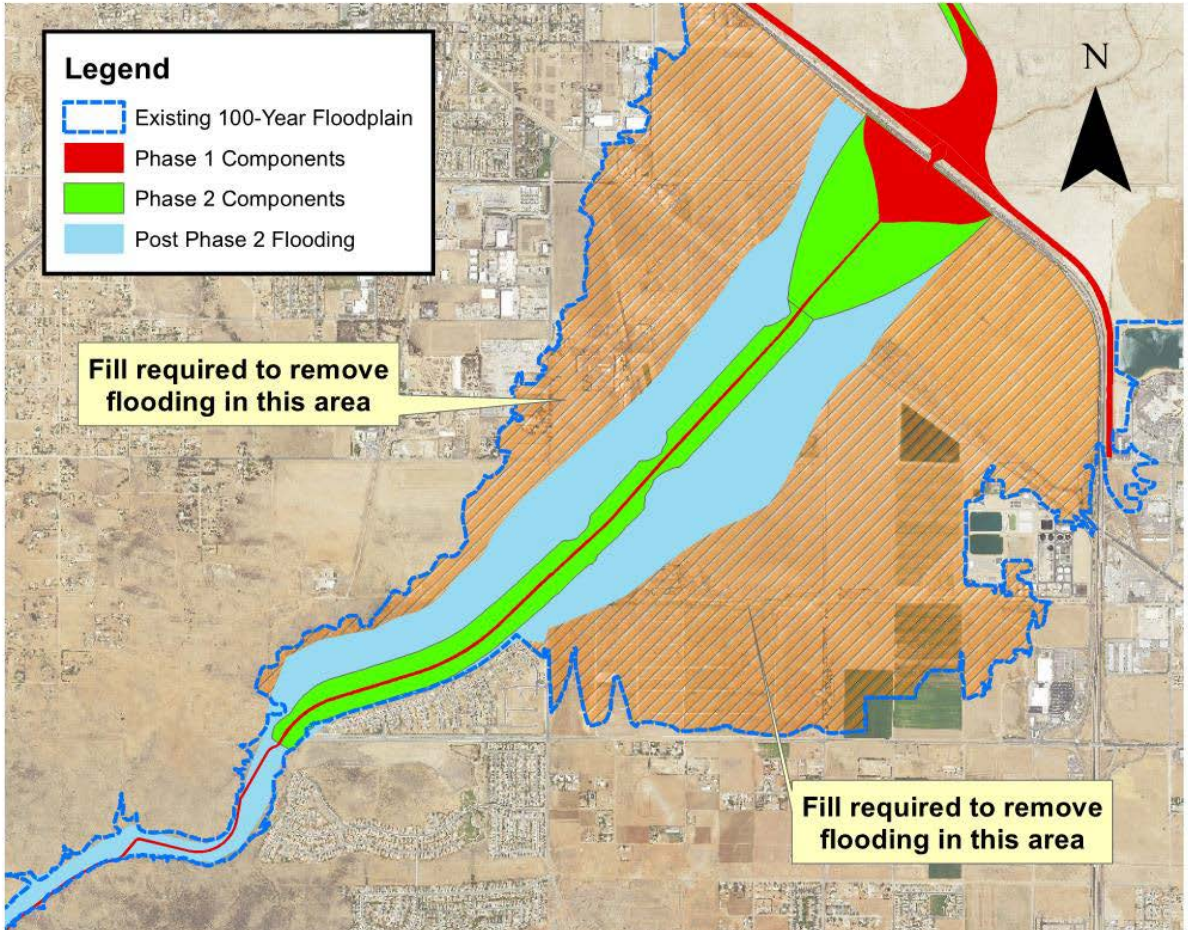
Floodplain excavation and/or fill activities included in Phase 2, which are expected to be initiated by private land development projects, would need to be evaluated on a project-by-project basis to ensure that the areas contemplated for Conservation by the MSHCP are still met by the floodplain fill.

Once Phase 1 and 2 elements have been evaluated through the CEQA process, other MSHCP compliance requirements would still need to be addressed, such as compliance with the species survey areas. It would be expected that once the necessary surveys are completed, that any component of Phase 1 or 2 would either have design modifications or provide mitigation to address the requirements of the MSHCP.

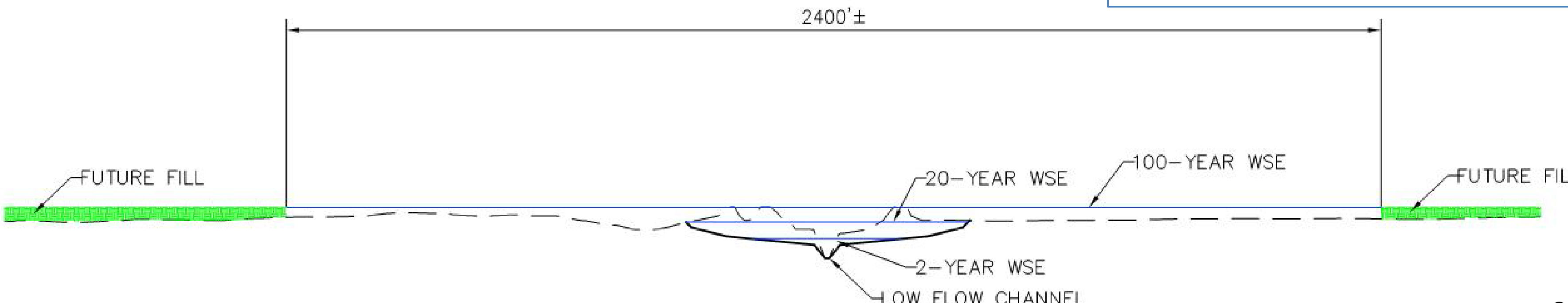
8.4 Conclusion

The preferred alternative was developed through a collaborative process that engaged not only critical stakeholders from a number of perspectives, such as land development proponents and land owners impacted by the project elements, but also regulatory agencies that will eventually have to permit the project. The preferred alternative best met the outcomes and objectives set forth by the Lower San Jacinto River Advisory Committee. It is anticipated that this alternative will serve and the basis for future CEQA analysis and future project refinement.

Figure 8-1: Fill Required with Phase 2 Elements Below I-215



Cross-section of Phase 2 Terraced Channel below I-215



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SECTION 9: PROJECT RECOMMENDATIONS

9.1 Summary

The Lower San Jacinto River Advisory Committee was convened to develop a preferred alternative for the lower San Jacinto River that considers public health and safety, transportation, water resource, economic development and environmental demands along the lower San Jacinto River corridor. The Committee was comprised of members who represented stakeholder groups with a wide range of viewpoints. The Committee members collaboratively worked together to develop and refine alternatives that balanced the competing stakeholder interests. The alternatives were presented to the local, state and federal resource agencies that will ultimately have to permit the project, and to land owners along the river that would be impacted by the project. Feedback from these agencies was incorporated into the refined alternatives to address their concerns. These efforts lead to the selection of a comprehensive preferred alternative that is anticipated to guide the development and conservation of the Lower San Jacinto River floodplain.

The preferred alternative meets the following objectives:

- **Phasing:** The preferred alternative can be constructed in phases (see construction drawings in **Appendix H** for each phase). Phase 1 elements are considered essential for public safety and would need to be built before Phase 2 elements. Phase 1 would be led by the District and include backbone infrastructure that would flood-protect the I-215 and allow master-planned flood control facilities in the City of Perris to be constructed to ultimate depth. After the public safety components of Phase 1 are implemented, future phases of the preferred alternative would be possible as driven by development interests along the San Jacinto River.
- **Cost–Effective:** The project is effective in its goals in relation to its cost. Phase 1 is estimated to have a construction cost of approximately $33.9 million for construction (mitigation and rights-of-way costs not included), which includes the five essential elements for public safety developed by the Committee: i) embankment reinforcement of Ramona Expressway, ii) flared and low flow channel in Perris Valley Storm Drain, iii) flow control structure at I-215, iv) low flow San Jacinto River channel, and v) low flow diversion pipe to avoid habitat conversion impacts to alkali soils. The project also facilitates future cost-savings and public-private partnership opportunities.
- **Regulatory Feasibility:** The preferred alternative has evolved from foundational components and Committee input to arrive at a phased project that is anticipated to be permitted by the regulatory agencies, and for which mitigation is likely available and adequate. The Phase 1 public-safety components leave significant portions of the floodplain intact; while also promoting hydrologic conditions that better replicate pre-development floodplain functionality. If built, the Phase 2 developer-enhancements would allow additional floodplain reclamation in exchange for creation of a terraced channel that creates new riparian habitat and enhances the viability of species movement corridors, while also maintaining critical habitat and floodplain function

developed in Phase 1. The preferred alternative will likely be further refined through the development of the updated San Jacinto River Master Drainage Plan and project-level environmental review. The preferred alternative provides a reasonably viable regulatory path forward.

- **Provides Flood Protection and Planned Floodplain Management:** Phase 1 of the preferred alternative provides 100-year flood event protection of Interstate 215 where it crosses the San Jacinto River. It also allows for master-planned flood control lateral connections to be made to the San Jacinto River at ultimate depth and improves the flood protection provided by other transportation elements crossing the San Jacinto River by lowering the floodplain elevation. The preferred alternative preserves a very significant portion of the San Jacinto River floodplain while also accommodating some future development within the floodplain fringe.

9.2 Recommendations

The Lower San Jacinto River Advisory Committee recommends that the following actions be undertaken moving forward:

1. **Formally develop and adopt the San Jacinto River Stage 3 Master Plan and associated environmental documents:** To bring this planning effort and the preferred alternative to fruition, it is recommended that the District further develop the preferred alternative into the San Jacinto River Stage 3 Master Drainage Plan, including necessary CEQA documentation, which are adopted by the County Board of Supervisors and Perris City Council.
2. **Continued Community Coordination:** Continued outreach efforts should be made during the development of the updated San Jacinto Master Drainage Plan to various boards and councils and community groups in the area. Included in this list are the Perris City Council, Eastern Municipal Water District Board of Directors, and the Riverside County Transportation Commission Board of Directors.
3. **Continued Regulatory Agency Coordination:** Continued coordination and collaboration with the pertinent regulatory agencies will be integral to ultimately permitting the preferred alternative.

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