



Hydraulics | Hydrology | Geomorphology | Design



Rose Creek Vegetation Management Plan: Implications for Flood Risk Reduction

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Environmentally sustainable solutions for the water resources industry

Topics Covered

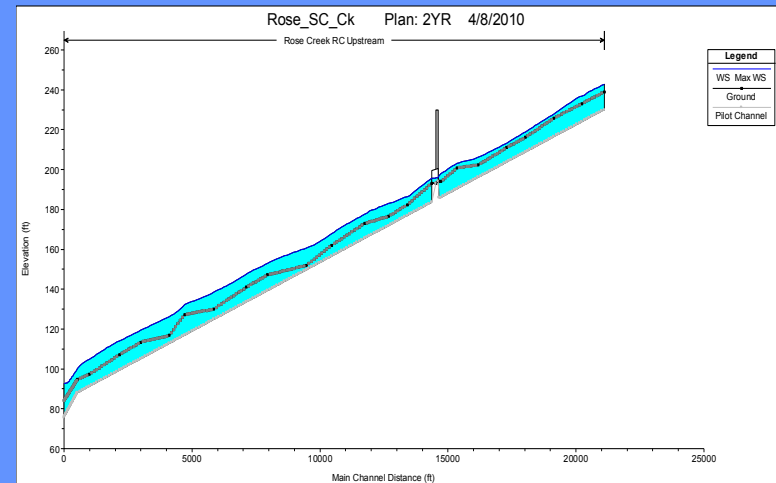
- Review of previous efforts
- Existing conditions hydraulic model
- Vegetation management plan
- Hydraulic roughness and vegetation relationship
- Comparing 100 year flood mapping for with and without vegetation management



A vegetation management plan can increase ecosystem health as well as reduce flood risk. Comparing flood inundation extents and water surface profiles are easy ways to visualize potential benefits for flood risk reduction.

Review of Previous Efforts

- Developed decision support tools for watershed analysis
- Data collection (cross-sections, sediment, water level, flow)
- Hydrologic model of the watershed
- Hydraulic model of existing conditions
- Restoration alternatives



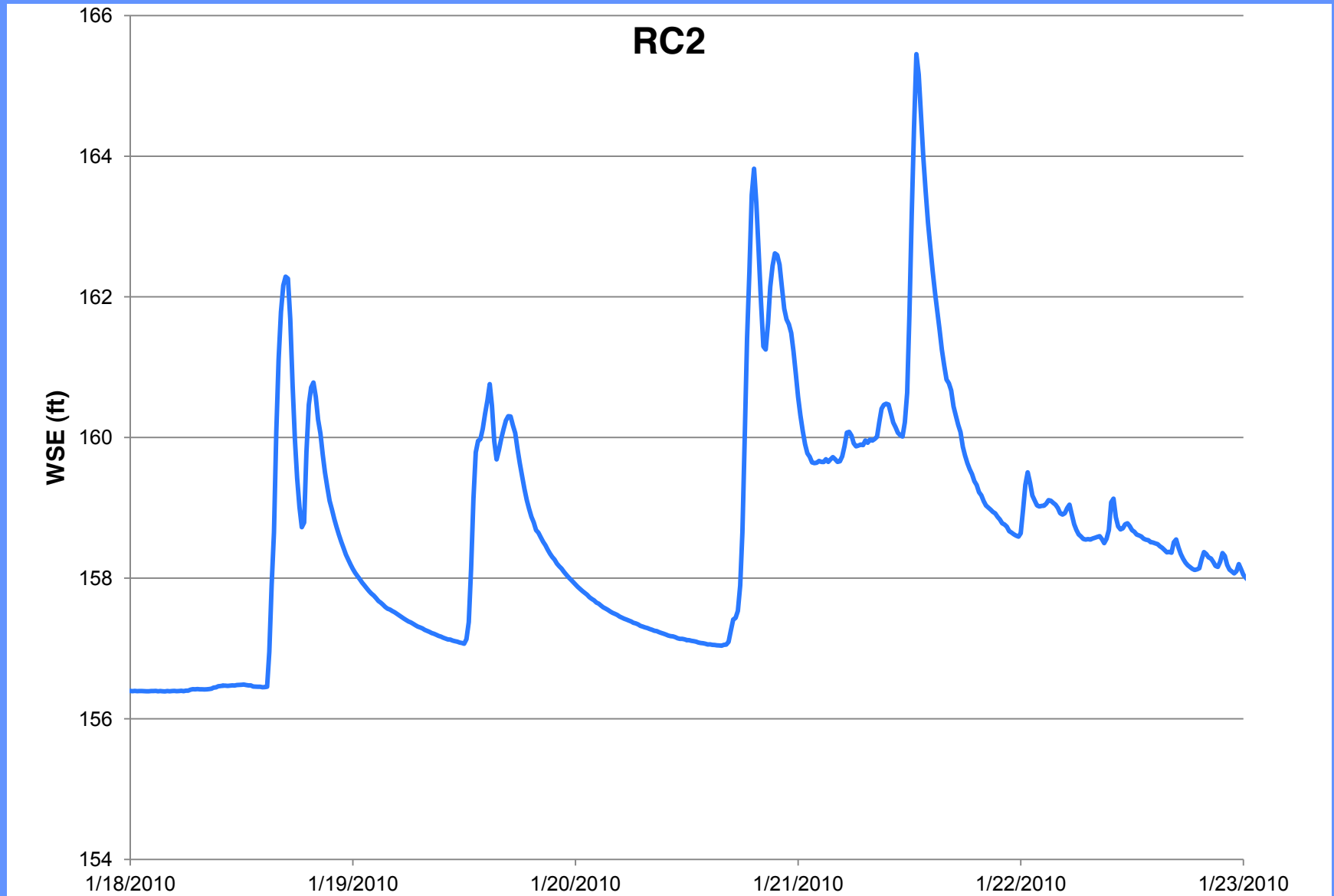
The pictures on the right give an example the type of information that can be derived from the analysis tools. The top graphic shows an example of a profile view of the peak water levels along the channel one would see during a given storm event. The photo below shows the area inundated by the same storm event overlaid onto an aerial image.

Survey



A total station and a survey grade GPS was used to survey cross sections within Rose and San Clemente Creek Canyons. Watch out for the poison oak!!

Stage Data



Here is an example of water level data collected within Rose Creek during the January 2010 storms. Notice an increase in water level of nearly 8 feet from the beginning to the peak of the storm.

Discharge Measurement



2/27/10 ADCP

Measuring discharge (volume of flowing water) is another important way to calibrate a hydraulic model. This device (Acoustic Doppler Current Profiler – ADCP) uses acoustic technology to measure velocity (V) and flow area (A) which are used to calculate discharge (Q).
 $Q = V \times A$

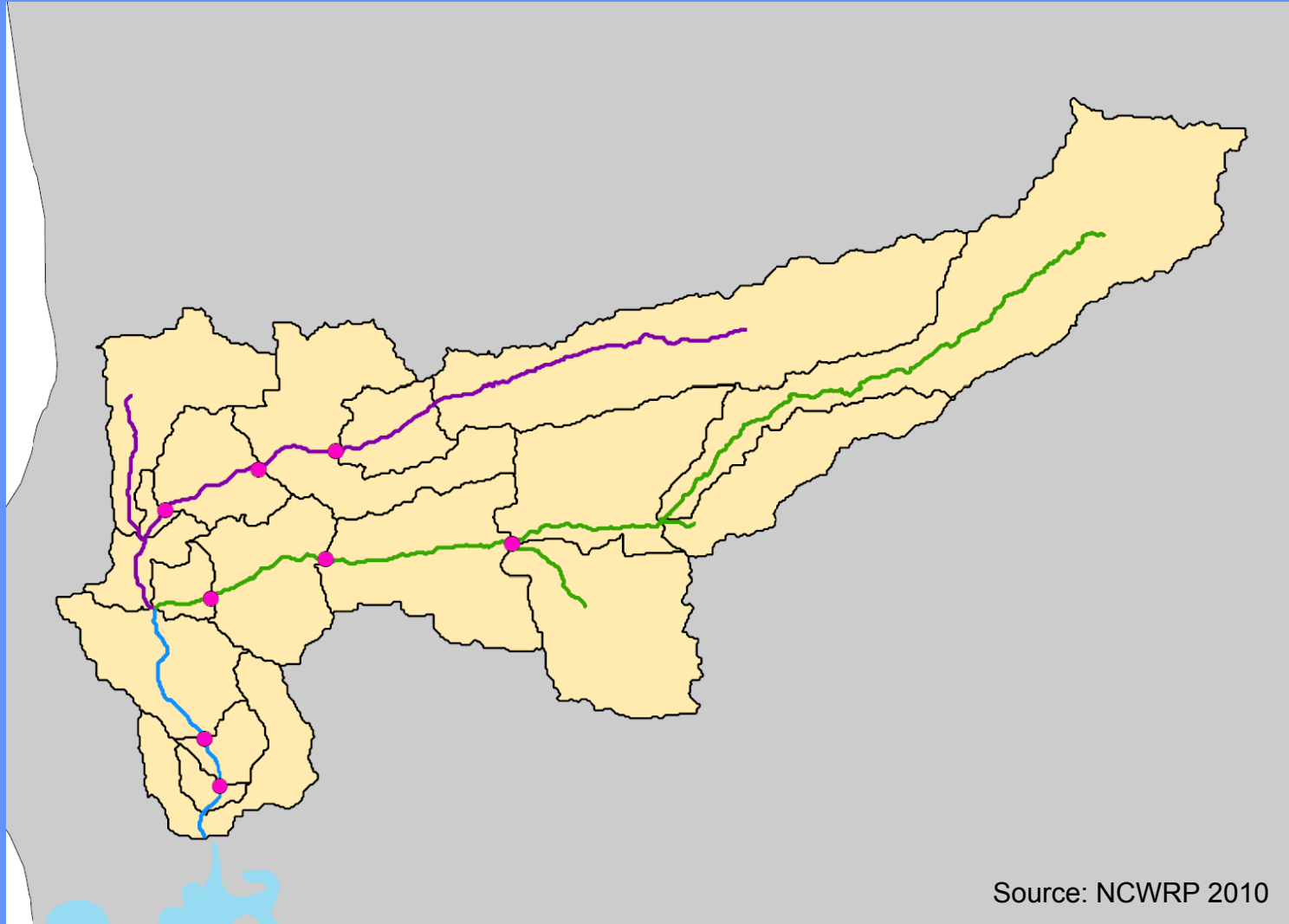
Discharge Measurement



2/27/10 ADCP

Using the ADCP to measure discharge in the Rose Creek flood control channel downstream of the confluence with San Clemente.

Watershed Hydrologic Model



This map shows the different sub-watersheds within Rose Creek Watershed. Each of these areas will contribute a unique amount of water to the stream during a particular storm event. The volume of water each area contributes depends on the rainfall, soil type, land use (urban or rangeland) and its size / shape.

Hydrology – Flood Frequency

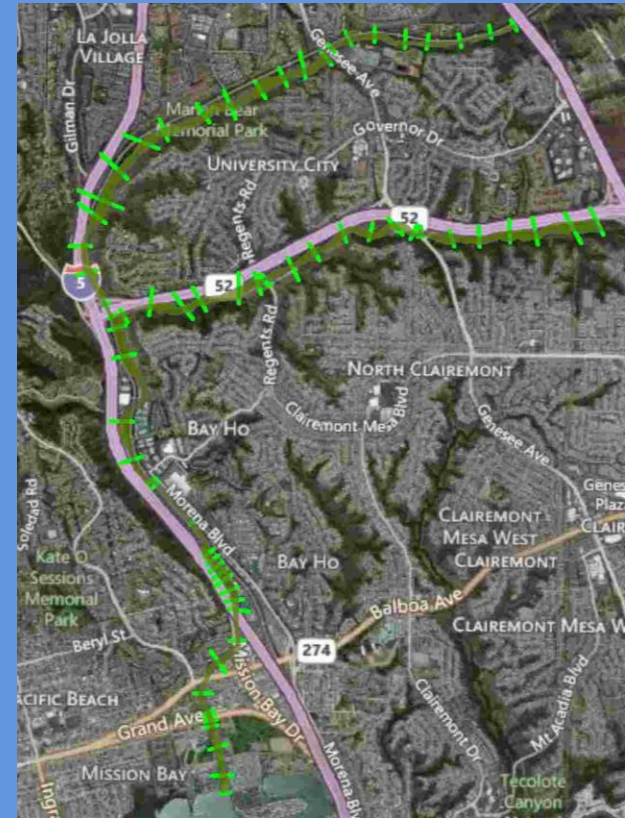
Storm Event	Peak Flows (cfs) (FEMA, 1972)	Peak Flows (cfs) (HSPF Model, 2010)
2-year storm		2,406
5-year storm		3,264
10-year storm	2,700	3,790
25-year storm		4,501
50-year storm	8,100	NA
100-year storm	12,000	NA

CFS = Cubic Feet Per Second

The right hand column shows the peak discharges that resulted from our analysis. These were compared to those calculated by FEMA in the early 1970's. Changes in watershed land use and differences in the methodologies used likely contributed to the observed differences. The values in bold were used for our analysis.

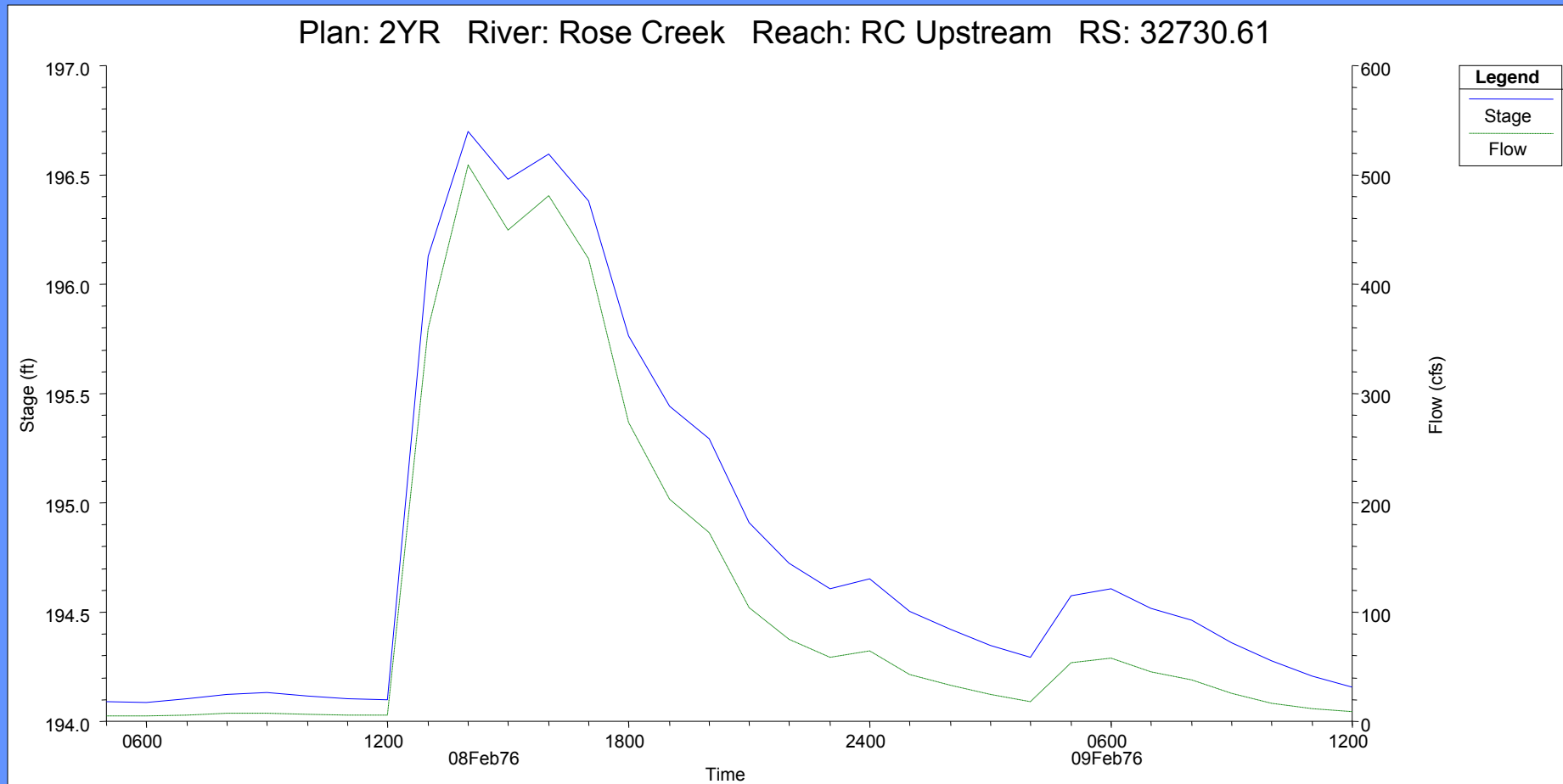
Existing Conditions Hydraulic Model

- Rose Creek and San Clemente Creek (I-805 to Mission Bay)
- 64 Surveyed Cross Sections at 500 to 1000ft spacing
- Hydraulic roughness was estimated in the field based on vegetation and channel morphology



Hydraulic Model Results

- Duration of inundation – Implications for future restoration efforts



This is an example of the type of data that is output from the hydraulic model. With a comparison to the surrounding topography, it tells us the extent and duration the flow will inundate adjacent floodplains for a given storm event. This is very important when designing a stream restoration project for ecological function and flood reduction (attenuation / storage).

Hydraulic Model Results

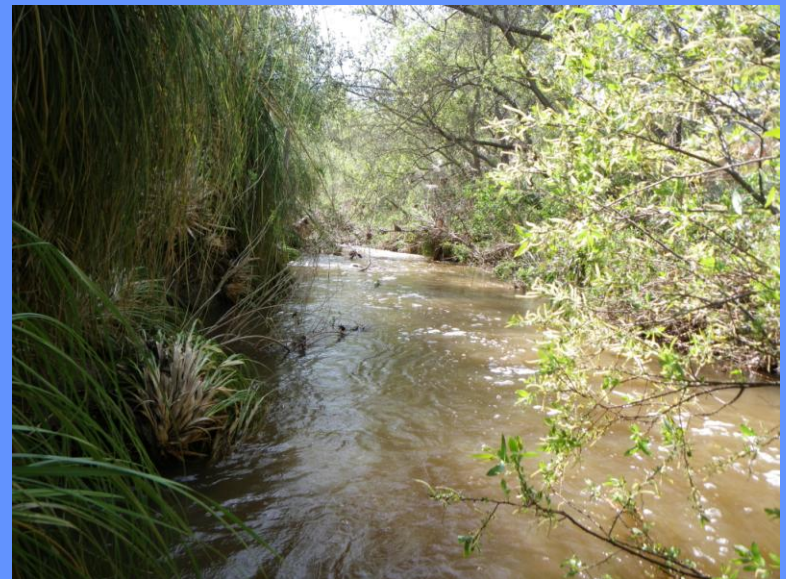
Inundation Mapping



Using the modeled water surface elevation and the surrounding topography, we can map the extent of inundation for a given flow event. This is especially useful when determining what plant pallets are suitable for a given restoration project.

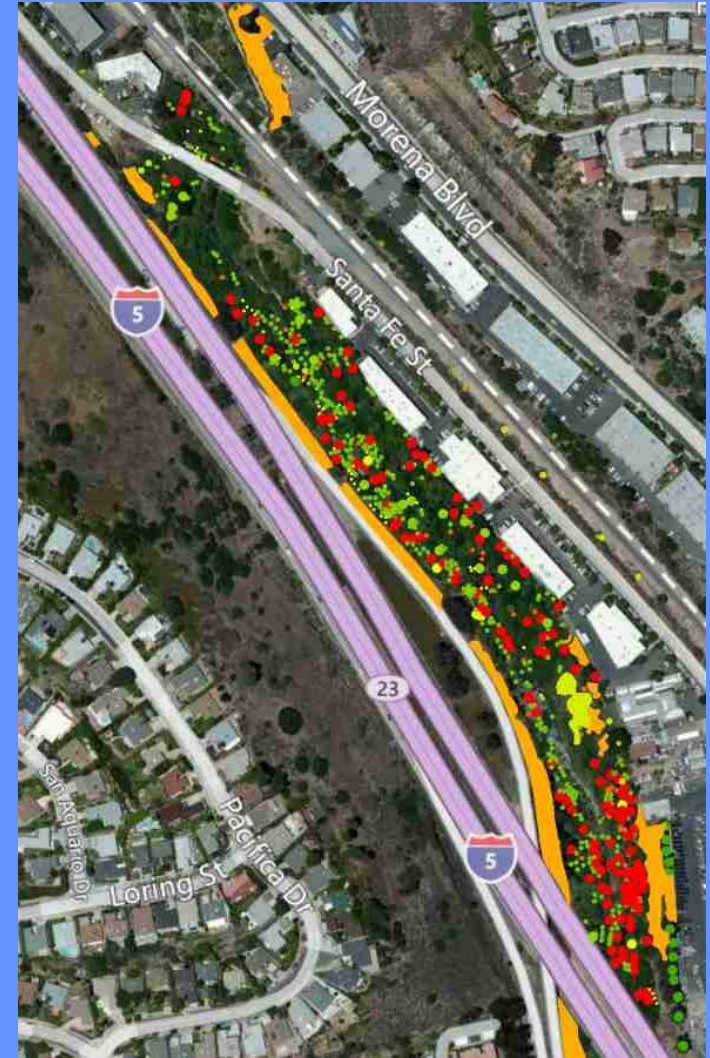
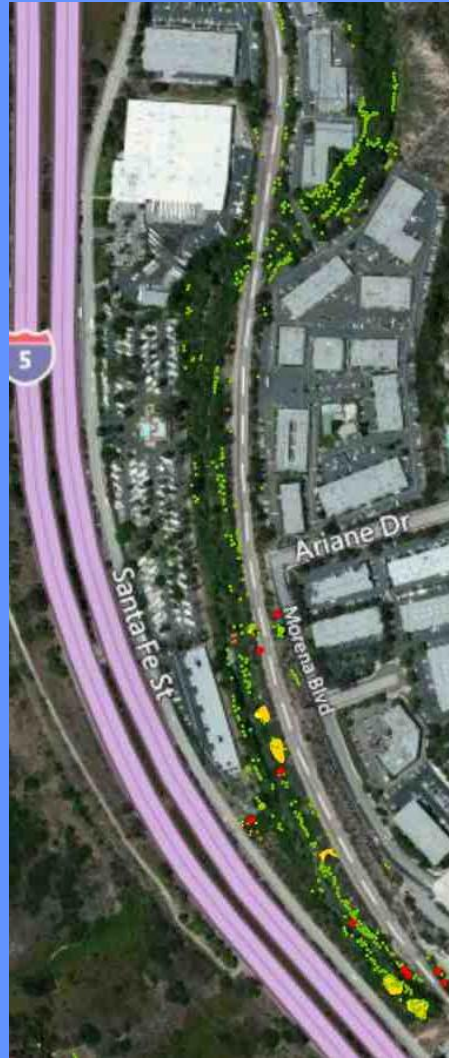
Vegetation Management Plan

- Removing invasive species and replanting with natives
- Between San Clemente/Rose Creek confluence and I-5
- Managed understory will have lower hydraulic roughness
- Provides benefits for ecology and flood control



Vegetation Management Plan

Non-Native Invasive Species



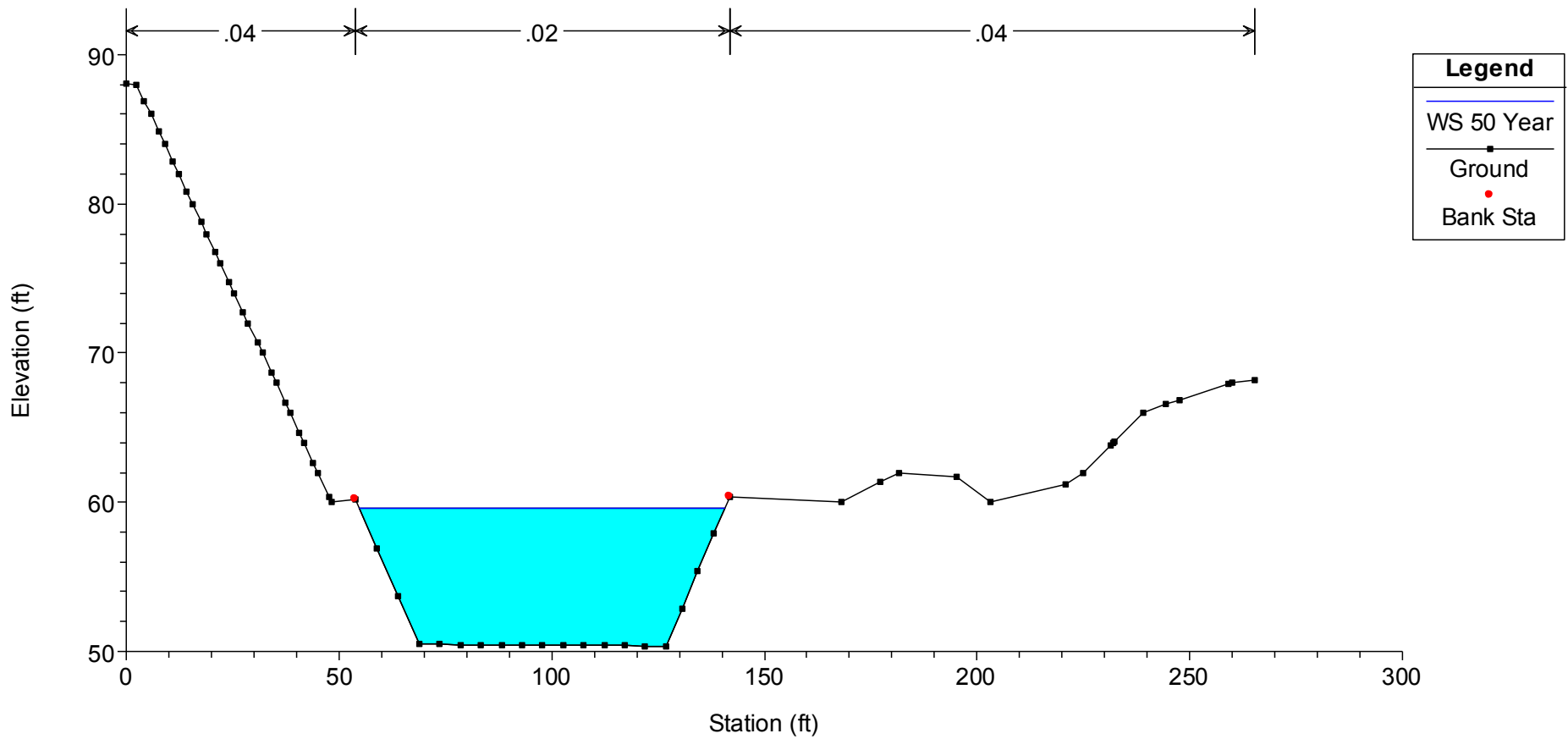
Locations with a high density of invasive non-native species will be the focus of the vegetation management plan. Pampas Grass are indicated by green circles and Brazilian Pepper trees are indicated by red circles.

Hydraulic Roughness

Rose_SC_Ck

Plan: FEMA_50_100_yr

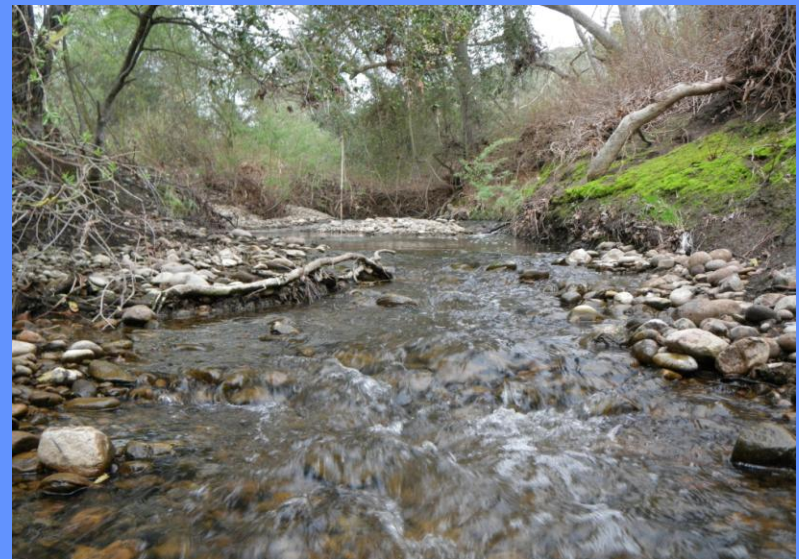
4/11/2010



Differences in vegetation density and channel composition along Rose Creek affect how efficiently water is conveyed through the channel. Values for this hydraulic “roughness” were estimated along each of the surveyed cross sections based on observation (roughness values appear along top of graphic) .

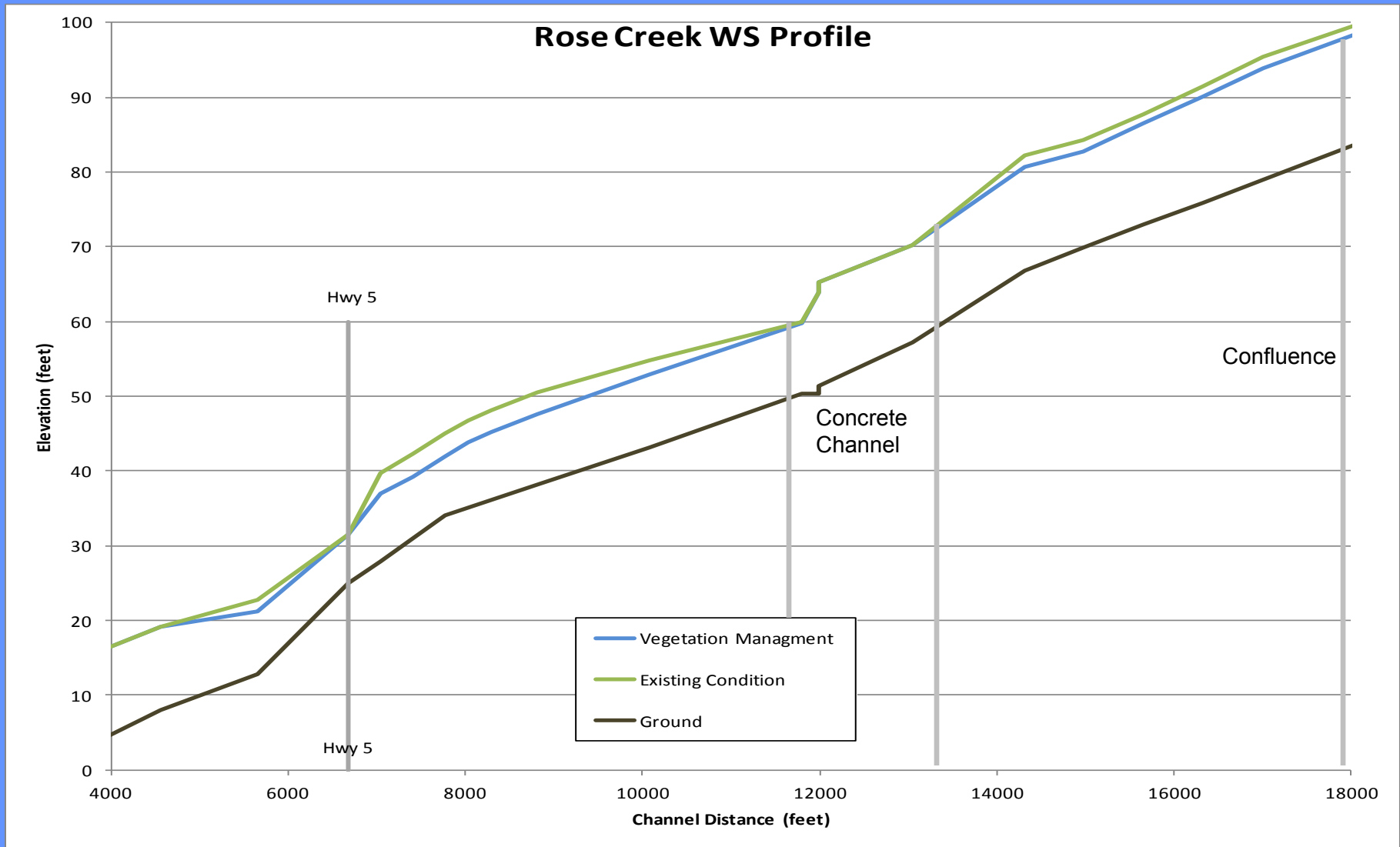
Hydraulic Roughness

- Existing hydraulic roughness was estimated based on field observations of vegetation and channel morphology
- New hydraulic roughness values were estimated assuming an open Sycamore-Oak-Willow canopy with limited understory



Vegetation thickness, channel meander, and bed composition all play a factor in hydraulic roughness. An open un-vegetated straight channel section with a gravel bed could have a Manning's n value of 0.04, whereas, a sinuous section with a thick stand of invasive plants could be as high as 0.1.

Effect of Vegetation Management



A water surface profile of the 100 year storm event indicates that the proposed vegetation management plan could lower the water surface of the 100 year storm event by as much as 3 feet just upstream of I-5. This represents a significant reduction in flood risk in the project area.

Effect of Vegetation Management

Inundation Mapping



Inundation mapping of the 100 year storm shows that the suggested vegetation management plan will have a significant impact in **reducing flood risk** between the confluence and I-5. Please note that the above images are only to be used to demonstrate the effect of the vegetation management plan and **do not represent FEMA flood extents**

Thank You!



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