Overcoming Hydraulic Challenges: Case Study of Three Infrastructure Projects in Southern California

Kayla Kilgo, PhD, EIT, ENV SP
Three Projects

infrastructure modifications

LA River – Taylor Yard Park
Santa Paula Creek – New Neighborhood
Las Llajas Channel – Bridge Widening
Los Angeles River

Taylor Yard Park

Taylor Yard – G2 Parcel

Dodger Stadium
Taylor Yard Park
Los Angeles River

2003

2018
Three Concepts

ISLAND
Rhone River Banks
Lyon, France

SOFT EDGE
Isar-plan
Munich, Germany

THE YARDS
River Decks
Bar-le-Duc, France

LA River
LA River — Proposed Island

Existing

Modified
LA River – Proposed Island

11-yr Event

LA River Main Channel

New Channel

Main Channel

Island
## LA River – Vegetation Scenarios

<table>
<thead>
<tr>
<th>Vegetation Scenario</th>
<th>Lower 10 feet &amp; Eastern Bank Manning’s n</th>
<th>New Channel Bottom &amp; Island Surface Manning’s n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal</td>
<td>0.02</td>
<td>0.035</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.045</td>
<td>0.065</td>
</tr>
<tr>
<td>Extreme</td>
<td>0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>
LA River - Velocities

Main Channel Velocity (ft/s)

Island Location

Existing Conditions

11-yr Event Results
LA River - Velocities

Main Channel Velocity (ft/s)

Minimal Roughness
Existing Conditions

Island Location

11-yr Event Results
LA River - Velocities

Island Location

Main Channel Velocity (ft/s)

Minimal Roughness
Existing Conditions
Moderate Roughness

11-yr Event Results
LA River - Velocities

Main Channel Velocity (ft/s)

Island Location

Minimal Roughness

Moderate Roughness

Extreme Roughness

Existing Conditions

11-yr Event Results
LA River – Water Surface Elevations

11-yr Event Results
LA River – Water Surface Elevations

![Graph showing water surface elevations with Island Location marked.](image-url)

- Minimal Roughness
- Existing Conditions
- Right Bank Elevation

11-yr Event Results
LA River – Water Surface Elevations

![Graph showing water surface elevations with annotations for minimal roughness, moderate roughness, existing conditions, and right bank elevation. The graph includes an island location indicator and 11-yr event results.]
LA River – Water Surface Elevations

Island Location

11-yr Event Results
LA River
vegetation choice

Emergent Marsh
Riparian Strand
Riparian Woodland
Infrastructure modifications

Channel Widening ≠ Increased Capacity
Removing Concrete ≠ Increased Capacity
Removing Concrete = Habitat Restoration
New Neighborhood
Santa Paula Creek

Proposed Bridge
Santa Paula Creek – Bridge Location
Santa Paula Creek – Access Ramp
Santa Paula Creek – Bridge Design

232'-0" MEASURED ALONG "A" LINE

116'-0"

BB

EB

Abut 1

Abut 3

Assume class 140 piles at pier, typ.

Assume class 200 piles at pier, typ.

PIER 2

Rock slope protection or slope paving, typ.

Typ.
Santa Paula Creek – Bridge Design

ROCK SLOPE PROTECTION OR SLOPE PAVING, TYP.

232'-0" MEASURED ALONG "A" LINE

116'-0"

ASSUME CLASS 140 PILES AT PIER, TYP.

ASSUME CLASS 200 PILES AT PIER, TYP.
Santa Paula Creek – Bridge Design
Santa Paula Creek – Bridge Design

Proposed Bridge
Santa Paula Creek – Bridge Design
Santa Paula Creek – Bridge Design
Santa Paula Creek – Bridge Design
Santa Paula Creek – Downstream Bridges

Railroad Bridge

Telegraph Road Bridge
Santa Paula Creek – Downstream Bridges

- Railroad Bridge
- Telegraph Road Bridge
- Proposed Bridge
- Santa Paula Freeway Bridge

Water Surface Elevation

Stations along the Channel
Santa Paula Creek

Scenarios

Existing Conditions
No Bridge

Proposed Bridge
No Undercrossing

Proposed Bridge + Right Bank Wall
With Western Bank Undercrossing
Santa Paula Creek – Water Surface Elevations

100-yr Event Results
Santa Paula Creek – Water Surface Elevations

100-yr Event Results

Model Station (m)

WSE (ft)

Proposed Bridge Location

Existing Conditions

Proposed Bridge
Santa Paula Creek – Water Surface Elevations

Proposed Bridge Location

WSE (ft)

Model Station (m)

100-yr Event Results

- Existing Conditions
- Proposed Bridge
- Right Bank Wall Alternative
Santa Paula Creek - Velocities

100-yr Event Results

Proposed Bridge Location

Model Station (m)
Santa Paula Creek - Velocities

100-yr Event Results
Santa Paula Creek - Velocities

Proposed Bridge Location

Model Station (m)

Velocity (ft/s)

100-yr Event Results

19+50 19+70 19+90 20+10 20+30 20+50 20+70 20+90 21+10 21+30 21+50

- Proposed Bridge Location
- Existing Conditions
- Proposed Bridge
- Right Bank Wall Alternative

100-yr Event Results
Design
Santa Paula Creek

Right Bank Wall Alternative
Localized hydraulic impacts
250 feet upstream
60 feet downstream
Bridge Widening

Las Llajas Channel

Cochran Street Bridge

Las Llajas Channel
Bridge Widening

Las Llajjas Channel

2013

2019
Las Llajas Channel – Original Plans

40 feet of grouted rip-rap
Las Llajas Channel – Modified Plans

24 feet of grouted rip-rap
24 feet of ungrouted rip-rap
16 feet of concrete
Las Llajas Channel

- Portland Cement Concrete (PCC)
- Water line (paved with PCC)
- Grouted Rip-Rap
Las Llajas Channel
Scenarios

Pre-Construction

Originally Proposed Construction

Current Conditions (Modified Construction)

Current Conditions + Requested Rip-Rap
Las Llajas Channel – Water Surface Elevations

100-yr Event Results
Las Llajas Channel – Water Surface Elevations

100-yr Event Results
Las Llajas Channel – Water Surface Elevations

100-yr Event Results
Las Llajas Channel – Water Surface Elevations

<table>
<thead>
<tr>
<th>Model Station</th>
<th>Originally Proposed</th>
<th>Grouted Rip-Rap</th>
<th>Concrete</th>
<th>Bridge Span</th>
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</thead>
<tbody>
<tr>
<td>2+60</td>
<td></td>
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</tr>
<tr>
<td>2+80</td>
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<tr>
<td>4+00</td>
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</tbody>
</table>

WSE (ft)

100-yr Event Results

- Originally Proposed
- Pre-Construction (Received Files)
- Current Conditions
- Requested Riprap
Las Llajas Channel – Velocities

100-yr Event Results
Las Llajas Channel – Velocities

Graph showing channel velocities at various model stations.

- Originally Proposed
- Pre-Construction (Received Files)

100-yr Event Results
Las Llajas Channel – Velocities

Channel Velocity (ft/s)

Model Station

Originally Proposed Pre-Construction (Received Files) Current Conditions

100-yr Event Results
Las Llajas Channel – Velocities

Channel Velocity (ft/s)

Model Station

100-yr Event Results

- Originally Proposed
- Pre-Construction (Received Files)
- Current Conditions
- Requested Riprap
Recommendations for pre-construction velocities

59 feet rip-rap needed instead of 24 feet
(one Manning’s n value as requested)

21.5 feet rip-rap needed instead of 24 feet
(differing Manning’s n values for grouted vs. ungrouted and size)
Questions?

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