Flood Planning/Design Transition in the Johnson Lane Area of Douglas County: Using a Planning-Level FLO-2D Model to Inform Road Improvement Design

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Overview

• The Project Watershed:
  – Within Douglas County
  – Alluvial fan of Pine Nut Mountains
  – Drains to the Carson River

• Chronic flooding and high sediment loading

• Douglas County and the Carson Water Subconservancy District commissioned the Johnson Lane Area Drainage Master Plan, completed by JE Fuller in July 2018
Overview

- JE Fuller created a FLO-2D model to identify existing flood conditions and regional flood control solutions over a 15 square mile area.
- The model applied a 10 ft by 10 ft grid cell size.
Project Location

- 1 mile length of Johnson Lane from Vicky Lane to Heybourne Road
Project Goals

- Remove Johnson Lane from the 25-year floodplain
- No increase in 25-year or 100-year peak water surface elevations or flow rates on surrounding properties
- Avoid utilities
**Project Challenges**

- Runoff drains to the north on private property as shallow and distributed flows
- Culvert conveyance will concentrate flows
Alternatives Analysis

Baseline with Raised Road Profile:
- Raise Johnson Lane by 1 foot

Alternative 1:
- Convey flow in a channel along the south side of Johnson Lane
- Install a culvert at the Heybourne Road intersection
- Improve the channel along private property north of Johnson Lane along Heybourne Road
**Alternatives Analysis**

**Alternative 2:**
- Convey flow in a channel along the south side of Johnson Lane
- Convey flow at Johnson Lane through multiple culverts
- Install “linear detention basins” along the north side of Johnson Lane to promote flow dispersion
1. Obtain approximate 25-year, 24-hour peak flows over Johnson Lane and through existing drainage facilities using FLO-2D results

2. Preliminarily design facilities using normal depth and FHWA culvert analysis
Alternative Design Development

3. Generate proposed conditions FLO-2D models for Alternatives 1 and 2 by modifying the grid (to simulate road raising, channels and detention basins) and inserting rating curves (to simulate culverts)

4. Run FLO-2D models for the 25-year, 24-hour and 100-year, 6-hour events

5. Compare proposed conditions models to existing conditions

6. If the model results show an increase in flow or water surface elevations on upstream or downstream properties, revise design
Results

• 25-year, 24-hour event
• Existing Conditions minus raised Johnson Lane

Orange = Increases
Green = Decreases
Results

- 25-year, 24-hour event
- Existing Conditions minus Alternative 1

Orange = Increases
Green = Decreases
Results

• 100-year, 6-hour event
• Existing Conditions minus Alternative 1

Orange = Increases
Green = Decreases
Results

- 25-year, 24-hour event
- Existing Conditions minus Alternative 2

Orange = Increases
Green = Decreases
Results

- 100-year, 6-hour event
- Existing Conditions minus Alternative 2

Orange = Increases
Green = Decreases
Next Steps

- Revise the preliminary design after receiving easement input from Douglas County
- FLO-2D utilizes user-input rating curves for culvert conveyance and will need to be refined during final design
Questions?