



SNC • LAVALIN

ATKINS

Member of the SNC-Lavalin Group

Lessons Learned: Mitigation Project Benefit-Cost Analyses in Riverside County, California

Project Location



Hazards Addressed

Flooding: Special Flood Hazard Areas

Flooding due to Zone AE designations associated with Lake Elsinore

- › BCA Model Used: Full Flood
 - › Based on Flood Insurance Rate Maps (FIRM) and Flood Insurance Study (FIS)
 - › *Recurrence Intervals: 10, 50, 100, and 500*

Flooding: Rainfall

Flooding due to Rainfall occurrences (both low and high-intensity)

- › BCA Model Used: Damage Frequency Assessment (DFA)
 - › Based on historical rainfall data
 - › *Recurrence Intervals: 1, 2, 5, and 100*

Wildfire

This hazard was not addressed, but decreased access to wildfire risk areas during a hazard occurrence can create significant damages to the community



Project Details



Project Type:

- › Full Flood: Elevation
- › Damage Frequency Assessment (DFA): Drainage Improvement

Project Useful Life: 50 Years (FEMA Standard Value)

Level of Effectiveness: 100-year rainfall and flooding recurrence interval

Mitigation Project Cost: \$2,259,663

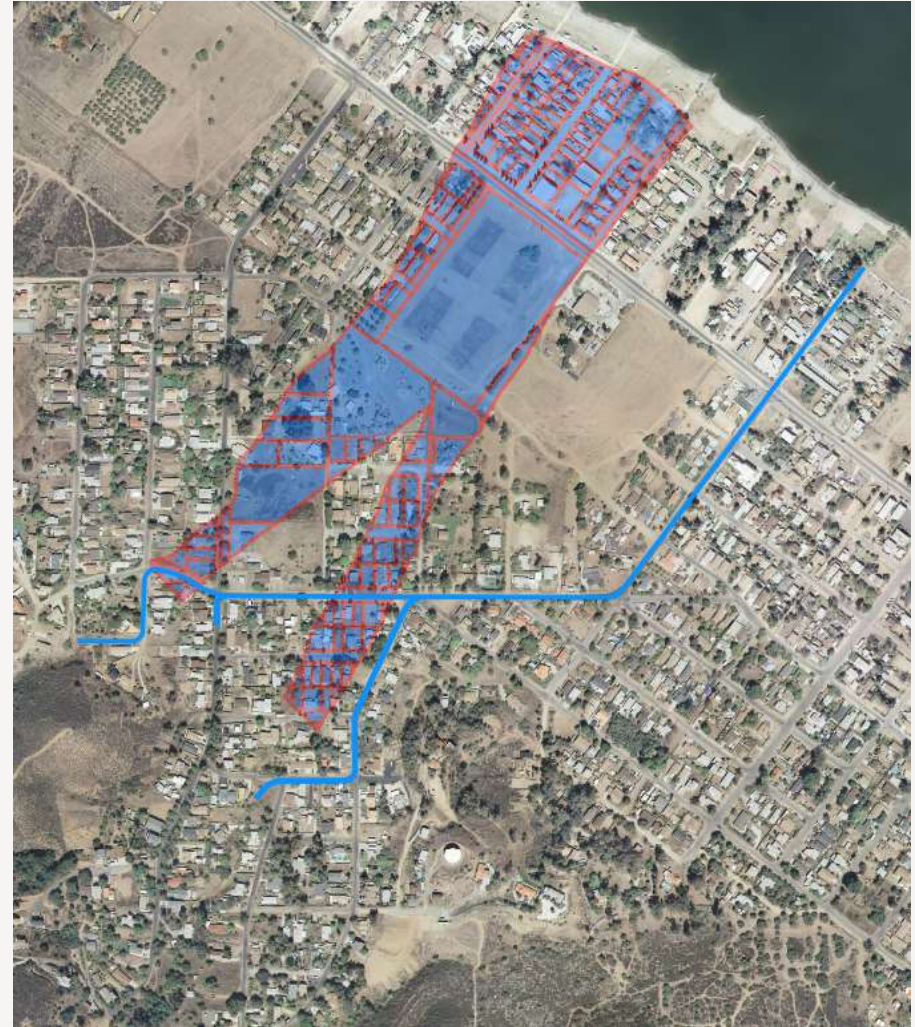
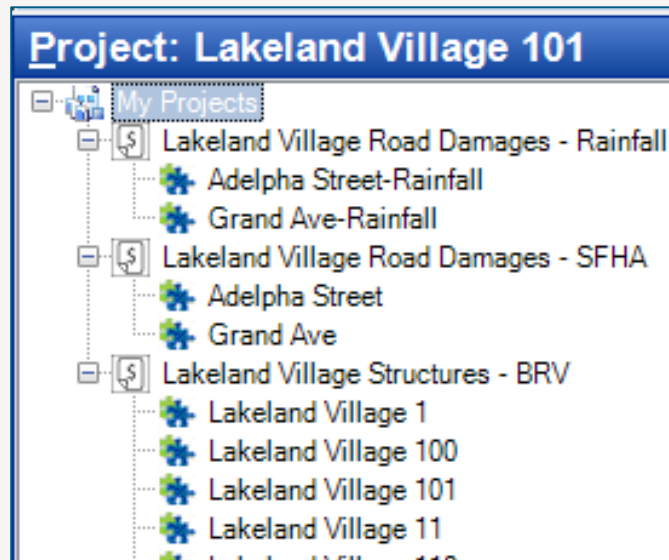
- › Based on construction cost estimate (from Riverside County Flood Control and Water Conservation District)



Combination of Two BCA Models

Why were 2 BCA Models used?

- › Various damages for two different flood sources:
 - › Structures - Full Flood (SFHA Flooding)
 - › Loss of Service
 - › DFA (Rainfall)
 - › DFA (SFHA)



Damages

Flooding: Special Flood Hazard Areas

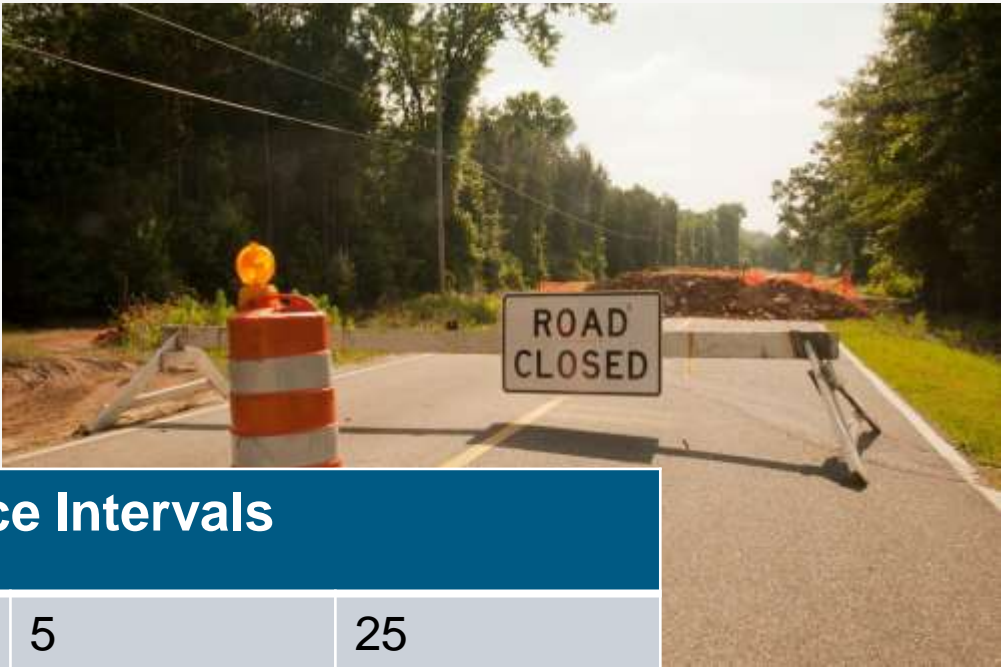
- › Structure Damages
 - › Based on:
 - › *First-Floor Elevation (FFE)s*
 - › *Total Area of Structures*
 - › *Building Replacement Values*



Damages

Flooding: Rainfall

- › Loss of Service
 - › Roads
 - › Road Damage
 - › Road Closures
 - › Landscaping
 - › Lost Wages



Type	Recurrence Intervals			
Rainfall	1	2	5	25
SFHA	10	50	100	

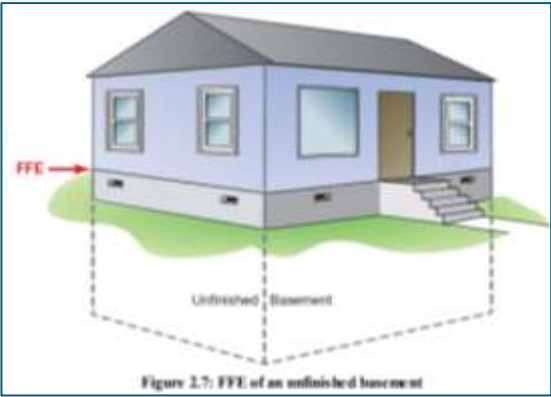
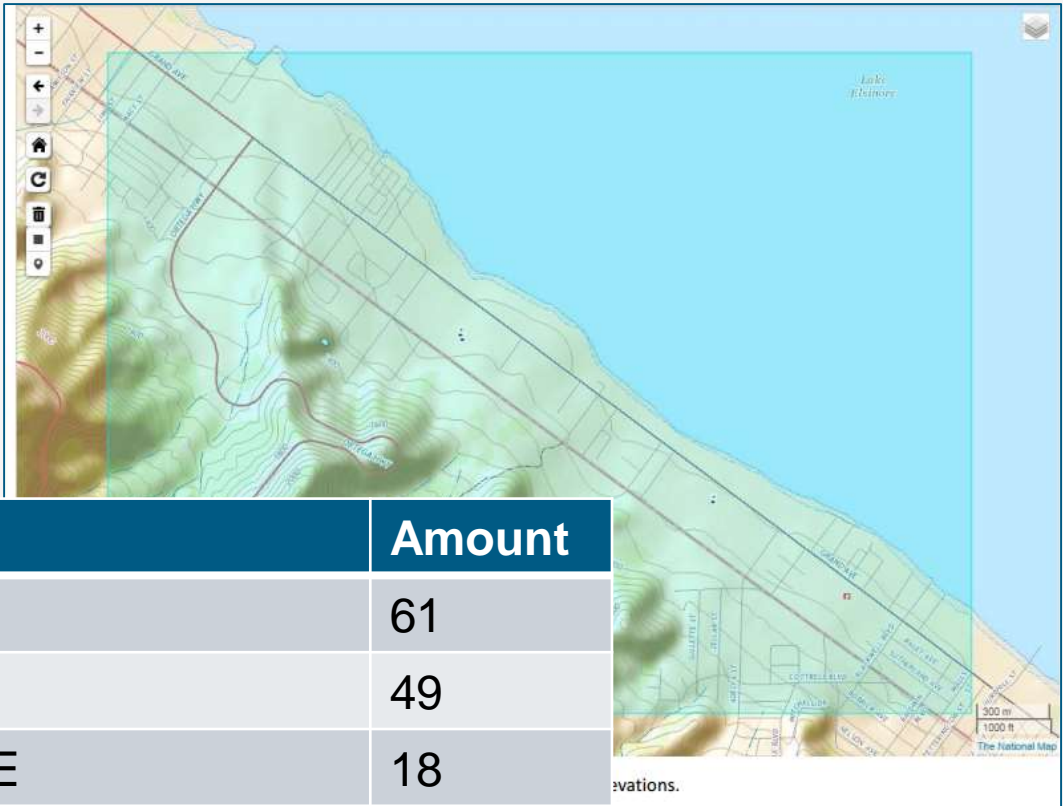


Damages: Full Flood Module

Full Flood Damage Resources

Structure Damages

- › First Floor Elevations
 - › USGS Contour Maps
 - › Estimated Slab Heights (based on structure photos)
 - › Structures with FFE higher than the 100-year RI were not included in the Full Flood estimation



Structures	Amount
Homes in Project	61
Homes in SFHA	49
Homes above the BFE	18
Total Homes that can receive damage	31



Damages: Full Flood Module

Full Flood Damage Resources

Structure Damages

- › *Total Areas of Structures*
- › *Based on: realtor websites such as Trulia and Zillow*
- › *Tax Cards (where available)*

Home Details

Overview

Single-Family Home	1.1 acres lot size
4 Beds	2,833 sqft
3 Baths	
Built in 1993	

Address

4 beds • 3 baths • 2,833 sqft • 1.1 acres lot size • Single-Family Home



Damages: Full Flood Module

Full Flood Damage Resources

Structure Damages

- › Building Replacement Values
- › *RS Means*



Save and Go Back

Structure Information

Total size of building (sf) * (For nonresidential building, input square footage for the first floor only. If a Library Depth Damage Function is used, see Help)

Value of building (BRV) (\$/sf) *

Total value of building (BRV)

Demolition damage threshold (%)

Street Maintenance Details

Street maintenance budget (\$)

Miles of street (miles)

Length of road (miles)

Total Reduced Street Maintenance Costs

Is the building Residential? * ☒ Yes ☐ No

Residential Structure Details

Select Building Type *

☒ One Story ☐ Mobile Home

☐ Two or More Stories ☐ Other

☐ Split Level

Select foundation type *

Mobile Home Type

Does the building have a basement? *

☐ Yes ☒ No

Select Obstruction Type (Coastal A or V Zones)

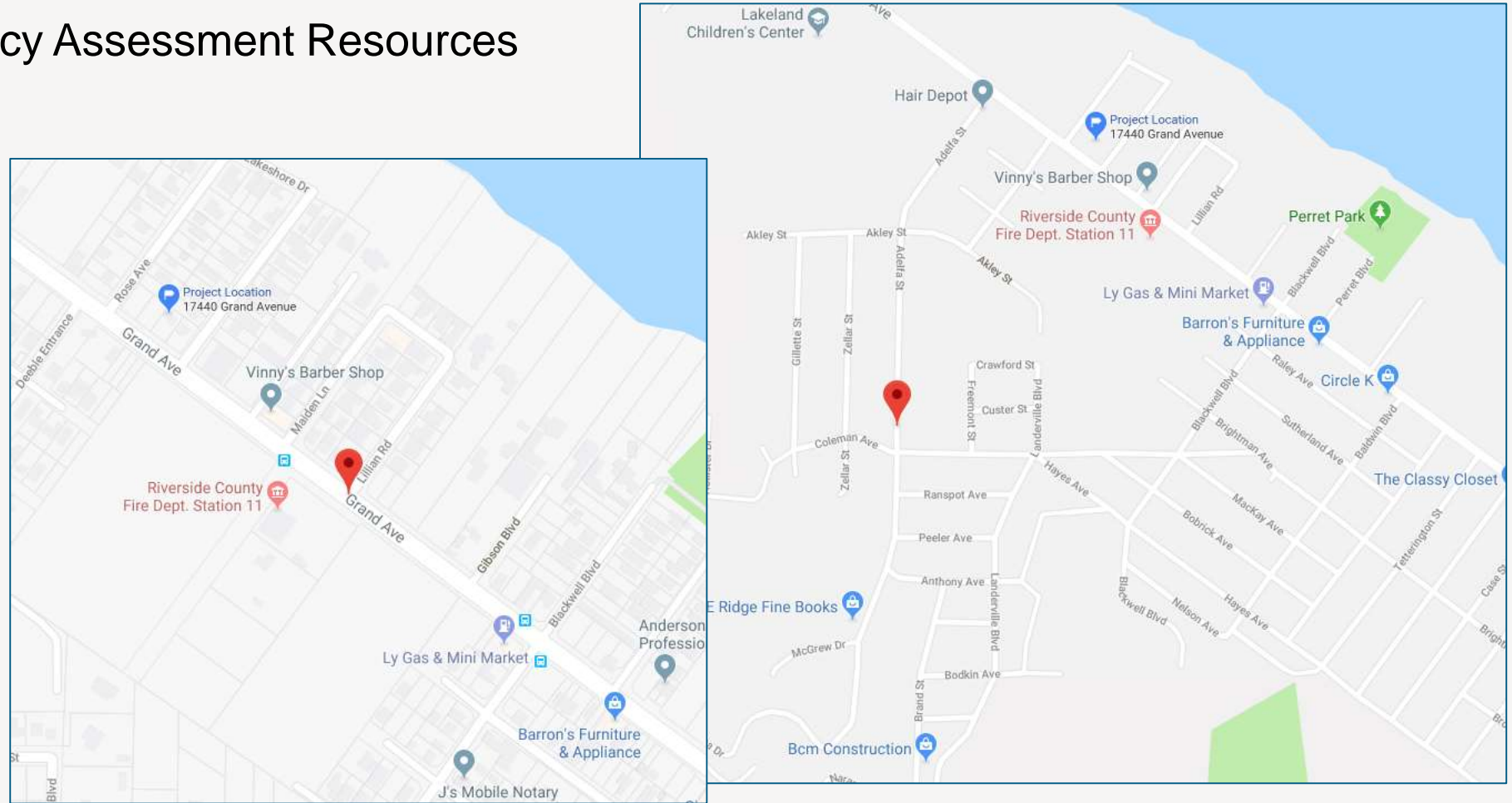
☐ With Obstruction ☐ Without Obstruction

Damages: Damage Frequency Assessment (DFA)

Damage Frequency Assessment Resources

Road Damages

- › Road Damages
- › Road Closure
- › Landscaping
- › Lost Wages



Damages: Damage Frequency Assessment (DFA)

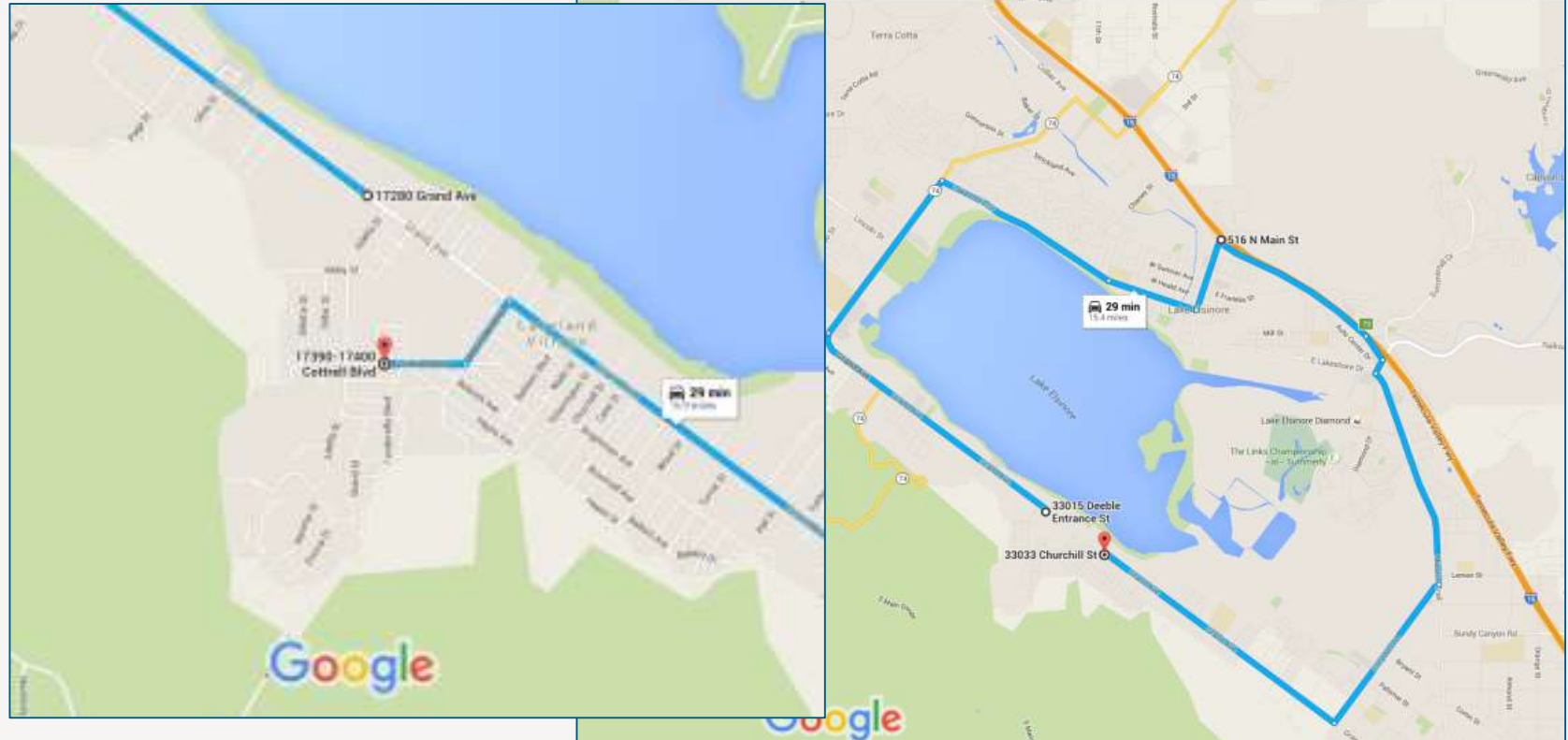
Damage Frequency Assessment Resources

Road Damages

- › Road Closures
- › Costs associated with:
 - › *Time Closed*

Lake Elsinore, CA 92530 to 33033
CA 92530

Drive 15.4 miles, 29 min



Damages: Damage Frequency Assessment (DFA)

Damage Frequency Assessment Resources

Road Damages

- › Landscaping
 - › Costs associated with:
 - › *Removal of Sediment and Silt*
 - › *Repair of Sediment and Silt*
 - › *Lawn Restoration: supplemental nutrient treatments*



Damages: Damage Frequency Assessment (DFA)

Damage Frequency Assessment Resources

Road Damages

- › Lost Wages
 - › Costs associated with:
 - › *Loss of Public Bus Transportation*

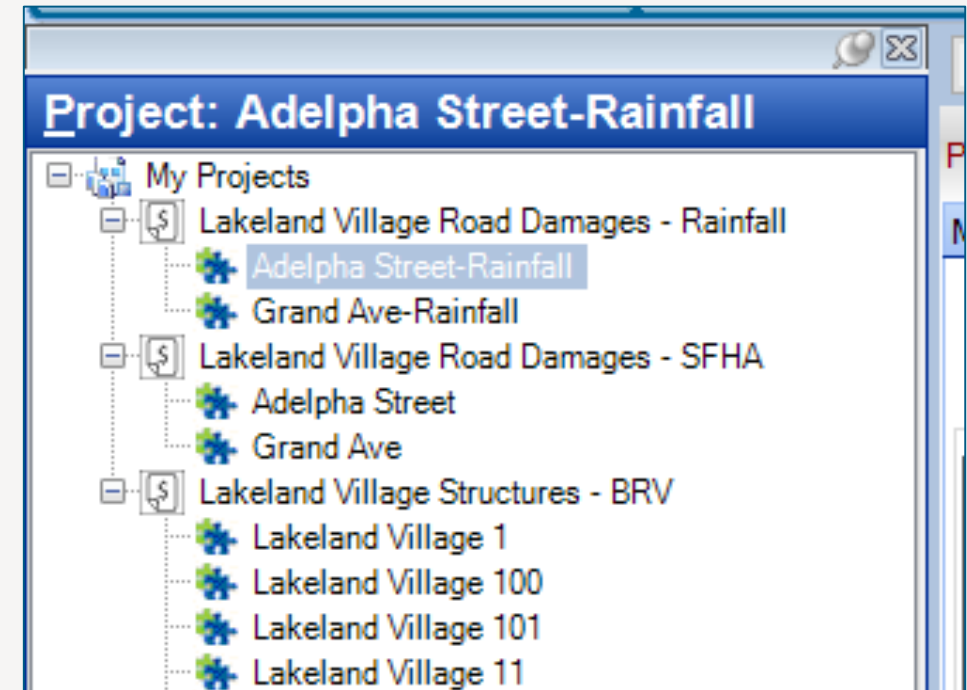


CA Minimum Wage (2017): \$10.50

Combination of Two BCA Models

To correctly assess the damage 2 BCA Models were used:

- › Full Flood
- › Damage Frequency Assessment (DFA)
 - › Aggregate Benefits was used to estimate Benefit Cost Ratio (BCR)



Project Results

Full Flood Model: Benefits

- › Structure Damages

DFA Model: Benefits

- › Loss of Service
 - › Roads
 - › *Road Damage*
 - › *Road Closures*
 - › *Landscaping*
 - › *Lost Wages*

BCA Benefits

Type	Benefits
SFHA structural	\$798,062
SFHA roads	\$337,055
Rainfall roads	\$1,152,322
TOTAL	\$2,287,439



Project Results

Aggregate BCR

Benefits	\$2,287,439
Cost	\$2,259,663
BCR	1.0122921

Final BCR: 1.01



Lessons Learned

Organization

- › Compose a memo/short document describing the BCA Methodology
- › Include citation of:
 - › *Data Used*
 - › *Reason for data*
 - › *Resource, guidance, data, etc.*

DFA Assumptions

Loss of Service Type: Roads: Adelfa Street and Grand Avenue – both for rainfall events and flood hazard occurrences within the Special Flood Hazard Area.

Estimated Number of One-Way Traffic Trips per Day: Riverside County Annual Daily Traffic counts.

- Grand Avenue – 15,532 trips per day (2013)
- Adelfa Street – 1,780 trips per day (2009)

Additional Time per One-Way Trip:

- Adelfa Street: 29 minutes (see attached)
- Grand Ave: 29 minutes (see attached)

Number of Additional Miles:

- Adelfa Street: 15.9 miles (see attached)
- Grand Ave: 15.4 minutes (see attached)



Lessons Learned

Documentation

- › Include Pictures of Flooding: Structures and Infrastructure
- › Picture documentation



Lessons Learned

Comprehensive

- › What problems does that particular community/project area face?
 - › Work with Planning Commission
 - › State Agencies
 - › Economic Departments
 - › Certain requirements regarding landscaping, buildings, infrastructures

Know the community, think holistically



Lessons Learned

Communication

- › FEMA Region
- › State
- › Community
 - › *Staff*
 - › *Other Agencies/Positions within community*
 - › *Everyone has knowledge to bring to the table*
- › Adjacent Communities
- › Communities who have had similar issues



Contacts

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Questions?

