Incremental Flood Risk Reduction

• Phased implementation of measures that minimize potential flood-related damages to structures, including homes and businesses, and infrastructure, including roads and critical services such as water and power generation, hospitals and emergency response

• (see Unified HMA Guidance, Part IX, A.10, Phased Projects)
Incorporated June 29, 1927

- Population 23,309 - 2018 SoCal Assoc of Gov
- Median Home Value $1.86 Million – 2017 OC Register
- Retail Sales $353 Million -2017 SCAG

9.8 sq mi
Downtown Laguna Beach - 90 acres
Laguna Beach, California

South Orange County Resort Town/Beach Town
Beautiful views
Iconic beaches
Beautiful resorts

- Montage Laguna Beach Resort - AAA Five Diamond 2018
- Surf & Sand Resort – AAA Four Diamond 2018
# Ideal Weather

## Climate data for Laguna Beach, California

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Record high °F (°C)</strong></td>
<td>89 (32)</td>
<td>92 (33)</td>
<td>92 (33)</td>
<td>97 (36)</td>
<td>100 (38)</td>
<td>102 (39)</td>
<td>104 (40)</td>
<td>100 (38)</td>
<td>108 (42)</td>
<td>104 (40)</td>
<td>100 (38)</td>
<td>90 (32)</td>
<td>108 (42)</td>
</tr>
<tr>
<td><strong>Average high °F (°C)</strong></td>
<td>68 (20)</td>
<td>68 (20)</td>
<td>69 (21)</td>
<td>72 (22)</td>
<td>73 (23)</td>
<td>75 (24)</td>
<td>79 (26)</td>
<td>80 (27)</td>
<td>80 (27)</td>
<td>77 (25)</td>
<td>72 (22)</td>
<td>67 (19)</td>
<td>73 (23)</td>
</tr>
<tr>
<td><strong>Average low °F (°C)</strong></td>
<td>44 (7)</td>
<td>45 (7)</td>
<td>47 (8)</td>
<td>50 (10)</td>
<td>54 (12)</td>
<td>58 (14)</td>
<td>61 (16)</td>
<td>60 (16)</td>
<td>59 (15)</td>
<td>54 (12)</td>
<td>48 (9)</td>
<td>43 (6)</td>
<td>52 (11)</td>
</tr>
<tr>
<td><strong>Record low °F (°C)</strong></td>
<td>21 (−6)</td>
<td>27 (−3)</td>
<td>28 (−2)</td>
<td>31 (−1)</td>
<td>33 (1)</td>
<td>37 (3)</td>
<td>30 (−1)</td>
<td>38 (3)</td>
<td>40 (4)</td>
<td>33 (1)</td>
<td>28 (−2)</td>
<td>24 (−4)</td>
<td>21 (−6)</td>
</tr>
<tr>
<td><strong>Average precipitation inches (mm)</strong></td>
<td>2.75 (70)</td>
<td>2.96 (75)</td>
<td>2.58 (66)</td>
<td>0.84 (21)</td>
<td>0.25 (6.4)</td>
<td>0.13 (3.3)</td>
<td>0.04 (1.0)</td>
<td>0.12 (3.0)</td>
<td>0.35 (8.9)</td>
<td>0.47 (12)</td>
<td>1.23 (31)</td>
<td>1.84 (47)</td>
<td>13.56 (344)</td>
</tr>
</tbody>
</table>

Source: The Weather Channel[^47]
Common Visitor Attractions - Annual Festivals

1. Laguna Beach Music Festival: February 6-10, 2019
2. Fete de la Musique: June 15, 2019
3. Laguna Art-A-Fair: June 28 –September 1, 2019
4. Sawdust Art Festival: June 28 –September 1, 2019
5. Festival of Arts Fine Art Show: July 5 – August 31, 2019
6. Pageant of the Masters: July 7-August 31, 2019
7. Laguna Dance Festival: October 2019
8. Laguna Beach Plein Air Painting Invitational: October 5-13, 2019
9. Art & Nature: November 7-10, 2019
Pageant of the Masters
Over 100 restaurants in Laguna Beach with approximately 50 located in the 90 acre downtown area.
So, Why Is This Info Relevant to Flood Control?

A FEMA Regulatory Floodway Spans Downtown Area
Laguna Canyon Channel Watershed

Area - 5,900 acres, Area - 9.2 sq. miles

Laguna Canyon Channel – 13,800lf Improved

Q100 = 8,000 cfs
Downtown Laguna Beach Extensive Flood History

March 1983
History of Downtown Flooding

1. February 6, 1937 – 2 day storm 5.59 inches rainfall
2. March 3, 1938 – 2 day storm 5.05 inches rainfall
   • $20,000 (1938) damage u/s of Forest Ave
   • Improved channel conveyed flow from Forest to ocean outfall
3. February 17, 1941 – 1 day storm 2.63 inches rainfall
4. December 5, 1966 – 6 day storm 4.76 inches rainfall
5. February 24, 1969 – 24 hours of rain caused flooding after 16.69 inches recorded for the month prior
6. January 1978 – 3 day storm produced 3.43 inches of rain
7. March 1, 1983 – downtown streets flooded with mud
8. January 4, 1995 - 10-yr storm waist deep flooding downtown
10. January 7, 1997 – downtown streets flooded with mud
11. December 7, 1997 – 1 day storm 7.2 inches downtown flooded
12. January 23, 1998 – 1 day 2.73 inches
13. December 22, 2010 – 1 day 9 inches rainfall w/ 3.44 inches in 6-hours (100-yr storm)
   • 90 homes and 70 businesses damaged
   • $12M (2010) in damage to public infrastructure
Why Has the Flooding Problem Persisted For So Long?

FIRM Panel 06059C0416K
“Send money and food here to Laguna Beach, for all the suffering millionaires.”

This happens every few years...... By golly, we uh, we accept the risks to live in paradise.”
Summer Construction Moratorium

No Public Works Construction Memorial Day to Labor Day
Let’s go back – Laguna Beach 1902
Laguna Beach 1918

Main Beach 1918
Right-of-Way?

Laguna Canyon Channel - 1928
Right-of-Way?

Laguna Canyon Channel - 1928
Right-of-Way?

No Easement or R/W Noted for the LCC
Right of Way?

Lack of Right-of-Way in the Downtown Area Has Severely Limited Options for Feasible Flood Control Solutions
Rapid Growth

Main Beach and Downtown Laguna Beach 1930’s

- 1930 Population: 1,981
- Population grew more than 5-fold in 10 yrs
The Only Road Between LA and SD In 1938

- Rapid Development of Laguna Beach before City Incorporated
- In 1938 Franklin Roosevelt motorcade came to Laguna Beach
Downtown Laguna Beach 2019
Increments of Flood Risk Reduction- Detailed by the Flood Mitigation Task Force

• 1928 – 2,000 lf of channel constructed from the ocean to Beach Street
• 1950s, 1960s – 8,000 lf of channel had been constructed from Forest Ave. to Big Bend
• 1969 USACOE recommended guiding development by controlling the use of the floodplain through zoning, subdivision regulation, building codes, health codes, flood protection works, or a combination thereof
• The study noted that many of the homes in Laguna Canyon had been constructed or improved with floodproofing measures
• 1980 – City adopted a flood damage prevention ordinance (Zoning Code 25.38) that allowed residents to qualify for subsidized flood insurance
• 1983 - 2,500 lf of channel was constructed from Big Bend to the Dog Park

All existing improvements to the LCC were constructed between 1928-1983
January 10, 1995 Storm
Increments of Flood Risk Reduction

• 1996 – Zoning Code 25.38.055 was implemented to require structures within the Downtown Specific Plan Area to include flood proofing measures such as flood shields
  • Remodel projects of less than 50% of the market value of a building, but more than $5,000 shall dedicate 5% of the remodel cost to specified flood proofing measures

1995-1996
Flood Proofing Measures – Flood Shields

Steel U-Channel to hold flood shield
Commission by City Council:

Review relevant data and past proposals and endorse measures that could be undertaken by the City or recommended to the County and/or Caltrans to be better prepared for the next flood.
26 Task Force Recommendations

1. Request Caltrans to increase capacity of PCH culvert to 1,050 cfs
2. Evaluate boardwalk bulkheads to ensure they will breakaway in flood
3. Add a pier nose to entry of culvert at Beach Street to smooth entry to slightly increase capacity before overtopping
4. Investigate options such as adding temporary K-rails on Broadway west of Beach Street to allow Broadway to become an auxiliary flood channel
5-9 Reduce u/s flow impediments
10 Restore u/s open space
11 Increase u/s basin capacity
12-17 Enhance early warning system(s)
18-22 Encourage preparation by residents and business owners
22-26 Resident and business floodproofing recommendations

Zero Recommendations to Improve the LCC to Achieve 100-yr Flood Containment
Noted History of Studies and Improvements

- 1928 – 2,000 lf of channel constructed from the ocean to Beach Street
- 1950s, 1960s – 8,000 lf of channel had been constructed from Forest Ave. to Big Bend
- 1969 USACOE recommended guiding development by controlling the use of the floodplain through zoning, subdivision regulation, building codes, health codes, flood protection works, or a combination thereof
- The study noted that many of the homes in Laguna Canyon had been constructed or improved with floodproofing measures
- 1972 – USACOE informed the county that they “found no economically feasible structural solution to the floodplain problem in Laguna Canyon”
- 1973 – County of Orange imposed zoning restrictions on the county portion of Laguna Canyon despite rejections from residents
- 1973 – County of Orange studied 8 alternatives to resolve flooding. One alternative recommended construction of a 280 ac-ft jurisdictional dam near the intersection of El Toro Road and Laguna Canyon Road
- 1975 – an EIR of the 8 alternatives concluded that flood control in Laguna Canyon “did not appear to be of the utmost priority” and recommended that the no project alternative “should be give serious thought in view of economic considerations”
Noted History of Studies and Improvements

• 1975 - The EIR study also concluded that floodplain zoning restrictions would make development difficult and property owners could instead be encouraged to obtain flood insurance
• 1980 – City adopted a flood damage prevention ordinance (Zoning Code 25.38) that allowed residents to qualify for subsidized flood insurance
• 1981 - County of Orange chooses a channelization only alternative to improve the floodplain
• 1983 - 2,500 lf of channel was constructed from Big Bend to the Dog Park
• 1985 - County of Orange commissioned a Multiple Channel Study by Fuscoe, Lundgren, Williams, and Short which recommended a “Grand Solution” to increase flood conveyance in the downtown area to construct multiple parallel channels with a total conveyance capacity of 8,890 cfs; which was sufficient to convey the 100-yr storm. Projected cost of the project in 1985 was $31M
• 1988 – Keith Companies prepared a study of the downtown area and recommended 3-alternatives to increase flood conveyance downstream of Beach Street. The 3-alternatives would provide an increase in conveyance capacity, but not obtain full 100-yr capacity. This was an incremental improvement recommendation
Noted History of Studies and Improvements

- 1991 – City Council did NOT certify an EIR to construct a 2-10’x8’ RCB from the ocean to Beach Street with an alignment in Broadway
- Instead requested a study of alternatives to implement u/s that could reduce the need for the proposed channel improvements downtown
- 1993 – County of Orange recommended construction of a 5.5 ac-ft detention basin near El Toro and Laguna Canyon Road to resolve flooding in a 1.5 mile stretch of the upper canyon and improve flooding downstream statistically from a 2-yr return interval to a 5-yr return interval
- 1995 Boyle Engineering recommended construction of upstream detention basins 500 ac-ft to obtain 10-yr protection downtown and 1,600 ac-ft to obtain 100-yr protection downtown. These were determined to be environmentally infeasible.
- 1996 – Zoning Code 25.38.055 was implemented to require structures within the Downtown Specific Plan Area to include floodproofing measures such as flood shields
- Remodel projects of less than 50% of the market value of a building, but more than $5,000 shall dedicate 5% of the remodel cost to specified floodproofing measures
- 1997 – Laguna Canyon Channel Draft Detailed Project Report was commissioned by USACOE and prepared by CH2MHill
Noted History of Studies and Improvements

- 1998 – Broadway/Coast Highway Flood Overflow Improvements Alternatives study was prepared by John M. Tettemer
- 2002 USACOE conducted the 2002 Broadway 2,200 cfs Channel Study – determined that the cost/benefit ratio was favorable to justify construction of a 14x9 RCB channel with 2,200 cfs capacity within Broadway. Estimated cost in 2002 was $6M
- The USACOE was to be the lead agency for design and construction. Costs were to be split 75% USACOE and 25% local agency(s).
- City council rejected the proposal
- Study of the Broadway channel alignment was abandoned
- 2009 a design contract for channel rehabilitation from the ocean to Beach Street was awarded
- The rehabilitation improvements were not constructed
• By the 1970s the capacity limitations of the Beach Street transition were known.
• All improvements to the LCC after 1928 were constructed in the u/s reach of the channel in Laguna Canyon.

County of Orange owns reach u/s of Beach Street
2017 the City of Laguna Beach hired Dudek to study design alternatives to increase the conveyance capacity from Beach Street to the ocean to 2,200 cfs.

Dudek conducted a state of the art study using gage data from the January 10, 1995 storm event and rain on grid in a 2D hydraulic model to evaluate the downtown floodplain.

3 alternatives were developed:

- Alt 1 $0.6M improves Beach Street transition structure to achieve 33% increase in capacity at Beach Street from 750 cfs capacity to 1,000 cfs.
- Alt 2 (2A & 2B) $4.3M construct 11x6 RCB down Ocean Ave to increase conveyance capacity to 2,400 cfs.
- Alt 3 $6M to construct an 8’x6’ RCB down Broadway and an 8’x6’ RCB down Ocean Ave to increase conveyance capacity to 2,400 cfs.
Alternative 2A
Alternative 3
January 10, 1995 Storm - Exist Cond
January 10, 1995 Storm Footage

January 10, 1995

10-yr to 25-yr Return Interval
1995 Storm Photo Validation
Existing Conditions (OC 100-Yr Storm)
Incremental Flood Risk Reduction

- 2018 City of Laguna Beach selected Alternative -1 and hired Dudek to design the Beach Street Transition Structure improvements and to rehab the failing portions of the channel downstream
- 2018 City approved Beach Street Transition Structure Construction Docs
- October 2019 full County of Orange design approval expected
- O&M department approval pending
First Phase Project
The Bottleneck

Capacity Limited to 750 cfs
First Phase Improvements
U/S Reach Partially Underneath Buildings

More Buildings Constructed After 1928
Beach St. Transition Structure Reconstruction

Estimated Construction Cost: $621K
January 10, 1995 Storm XPSWMM Model

- LCC Exist Capacity ~ 7yr
- Jan. 10, 1995 Storm ~ 2,400 cfs
- Beach St. Transition Structure Capacity ~ 750 cfs - WSPG
- Phase-1 Beach St. Transition Structure Imp ~ 1,000 cfs - WSPG
- 33% Improvement in Flow Capacity
Alternative 1 - 1995 Storm Event Difference Map

• Flooding depth reductions up to 1.5ft
The Next Increment in Flood Risk Reduction

Address the Bottleneck
The Next Increment in Flood Risk Reduction

Address the Bottleneck
Future Increment in Flood Risk Reduction

Alt. 2A
Future Increment in Flood Risk Reduction

Alternatives 2A and 2B Modified
Exist Alignment Infeasible

Buildings Constructed After 1928
January 10, 1995 Storm - Alt 2B
Incremental Flood Risk Reduction

Over the years since 1928 the City of Laguna Beach has taken small steps of incremental flood risk reduction in Downtown Laguna Beach – Eventually the parallel facility alternative will no longer be infeasible.
Thank You