Incorporate Climate Change Adaptation in Municipal Scale, Urban Watershed Planning at the City of Mountain View

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Lisa Au, PE

Floodplain Management Association Conference
September 7, 2017
Mountain View – City:
- 12 square miles
- 75,000 residents

Mountain View – Watersheds:
- Urbanized watershed
- Permanente Creek
- Stevens Creek
- Adobe Creek (Palo Alto)
- San Francisco Bay
Shoreline Regional Park Community
North Bayshore Area

Palo Alto

North Bayshore Area

Mountain View

Moffett Field
NASA Ames Research Center
North Bayshore Area Watershed Management Objectives

- Flood protection to businesses in North Bayshore Area
North Bayshore Area
Watershed Management Objectives

- Landfill leachate collection for groundwater protection
North Bayshore Area
Watershed Management Objectives

- Tidal marsh and wetland management
North Bayshore Area
Watershed Management Objectives

- Tidal marsh and wetland management – Charleston Slough

City Management Objectives
- Compliance with BCDC tidal marsh restoration permit requirement
- Maintain water supply to Sailing Lake
- Flood protection for the City and Palo Alto Flood Basin
North Bayshore Area
Watershed Management Objectives

- Future coastal flood risk
Shoreline Sea Level Rise Study

- Prepare technical analysis to evaluate and map SLR flooding (geotechnical, coastal, creeks, interior drainage)
- Identify flood protection improvement projects
- Estimate project cost
- Develop Capital Improvement Program
• Level of Sea Level Rise (SLR) from 2000 to 2067
  Low SLR = 8 inches (1% still water level = 11.3’ NAVD)
  High SLR = 31 inches (1% still water level = 13.2’ NAVD)

• Three levels of protection for each project
  – Low SLR
  – Low SLR *Plus* foundation for future High SLR project
  – High SLR

• Capital Improvement Program with 12 projects
  CIP Cost = $43 – $57 million
1. Charleston Slough and Palo Alto Flood Basin Levee Improvement
2. Coast Casey North Levee Improvement
3. Landfill Erosion Protection
4. Lower Permanente Creek Levee and Floodwall Improvements
5. Golf Course Facilities High Ground Augmentation
6. Lower Stevens Creek Levee Improvements
7. Coast Casey Pump Station Improvements
8. Lower Permanente Creek Storm Drain Improvements
9. Sailing Lake Access Road Improvements
10. Sailing Lake Intake Pump Station Modification
11. Charleston Slough Tide Gates Improvement
12. Sea Level Rise Assessment
Implementation

- North Bayshore Precise Plan
  Land use planning considered future residual flood risk
Implementation

• South Bay Salt Pond Restoration Project
Implementation

1. Charleston Slough and Palo Alto Flood Basin Levee Improvement
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12. Sea Level Rise Assessment

South Bay Salt Pond Restoration Project (City, CSCC, USFWS)
 Implementation

- Stevens Creek Levee Improvement Project (City, SCVWD)
  1. Charleston Slough and Palo Alto Flood Basin Levee Improvement
  2. Coast Casey North Levee Improvement
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Implementation

- Permanente Creek Flood Protection Project (SCVWD)
  1. Charleston Slough and Palo Alto Flood Basin Levee Improvement
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Implementation

- Charleston Slough Tidal Marsh Restoration (City)
  - Restoration
  - Water Supply
  - Flood Protection

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12. Sea Level Rise Assessment
Implementation

• Palo Alto Flood Basin (City, Palo Alto, SFCJPA, SCVWD)

1. Charleston Slough and Palo Alto Flood Basin Levee Improvement
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Shoreline Sea Level Rise Study
Capital Improvement Program

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12. Sea Level Rise Assessment
• Urbanization encroachment into creek floodplains
• Capacity limitations in Permanente and Stevens Creek
• Lack of drainage system at the upper watershed
• Cross pipe (bubble up) system in downtown area
• Aging urban drainage system with capacity bottlenecks
• Water quality
Storm Water Master Plan

- Existing flood risk evaluation
- Improvement needs
- Green infrastructure
- Future vulnerability
  - Detail creek analysis
  - Interior drainage coupling
  - Sea Level Rise scenarios
  - Precipitation change scenarios
North Bayshore Area
Water Bodies

- Palo Alto Flood Basin
- Pond A1
- Pond A2W
- Charleston Slough
- Sailing Lake
- Coast Casey Detention Basin
- Permanente Creek
- Stevens Creek
Moving Forward

- Regional collaboration
- Sea Level Rise projection
- Policies
- Anticipated flood risk management needed vs funding
- How safe is safe enough: Manage residual flood risk

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Thank You!

Contact Information

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City of Mountain View
Supplemental Information
1. Charleston Slough and Palo Alto Flood Basin Levee Improvement (approx. 6,600')

Potential Palo Alto Flood Basin Levee Improvement Alternative Alignment (approx. 16,000')

11. Charleston Slough Tide Gates Improvement
1. Charleston Slough and Palo Alto Flood Basin Levee Improvement
2. Coast Casey North Levee Improvement
7. Coast Casey Pump Station Improvements
9. Sailing Lake Access Road Improvements
10. Sailing Lake Intake Pump Station Modification

4. Lower Permanente Creek Levee and Floodwall Improvements
8. Lower Permanente Creek Storm Drain Improvements
5. Golf Course Facilities High Ground Augmentation

6. Lower Stevens Creek Levee Improvements
Shoreline Sea Level Rise Study
Flood Vulnerability
## Project Implementation Timeline

<table>
<thead>
<tr>
<th>Project</th>
<th>Cost in 2012 dollars</th>
<th>Estimated Duration</th>
<th>Cost by year, dollars inflated to time of implementation ($)M:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Charleston Slough and PAFB Levee Improvement</td>
<td>$13,077,000</td>
<td>$15,532,000</td>
<td>$16,047,000</td>
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<tr>
<td>2. Coast Casey North Levee Improvement</td>
<td>$3,066,000</td>
<td>$3,541,000</td>
<td>$3,658,000</td>
</tr>
<tr>
<td>3. North Lagoon Erosion Protection</td>
<td>$1,806,000</td>
<td>$2,541,000</td>
<td>$3,658,000</td>
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<tr>
<td>4. Perinsomence Creek Levee and Floodwall Improvements</td>
<td>$325,000</td>
<td>$325,000</td>
<td>$325,000</td>
</tr>
<tr>
<td>5. Golf Course Facilities High Ground Augmentation</td>
<td>$2,626,000</td>
<td>$2,626,000</td>
<td>$2,626,000</td>
</tr>
<tr>
<td>6. Lower Sliver Creek Levee Improvements</td>
<td>$2,750,000</td>
<td>$2,750,000</td>
<td>$2,750,000</td>
</tr>
<tr>
<td>7. Great Cliff Pumps Station Improvements</td>
<td>$2,156,000</td>
<td>$2,156,000</td>
<td>$2,156,000</td>
</tr>
<tr>
<td>8. Hulu Slough Access Road Improvements</td>
<td>$170,000</td>
<td>$170,000</td>
<td>$170,000</td>
</tr>
<tr>
<td>9. Hulu Slough Intake Pump Station Improvements</td>
<td>$861,000</td>
<td>$861,000</td>
<td>$861,000</td>
</tr>
<tr>
<td>10. Charleston Slough Tule Grove Improvement</td>
<td>$5,400</td>
<td>$5,400</td>
<td>$5,400</td>
</tr>
<tr>
<td>11. SL Assessment</td>
<td>$500,000</td>
<td>$500,000</td>
<td>$500,000</td>
</tr>
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# Shoreline Sea Level Rise Study
Comparison of SLR Projections

## Table 3. Comparison of SLR scenarios for NRC 2012 and the South San Francisco Bay Shoreline Study, Years 2017 to 2067

<table>
<thead>
<tr>
<th>Source</th>
<th>SLR Relative to 2000</th>
<th>2000</th>
<th>2017</th>
<th>2067</th>
<th>2067</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRC 2012 low-range, no subsidence</td>
<td>0</td>
<td>0.8 in</td>
<td>8.3 inches</td>
<td>7.5 inches</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2.0 cm)</td>
<td>(20 cm)</td>
<td>(19 cm)</td>
<td></td>
</tr>
<tr>
<td>NRC 2012 mid-range, no subsidence</td>
<td>0</td>
<td>2 in</td>
<td>16 inches</td>
<td>13 inches</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.6 cm)</td>
<td>(39.7 cm)</td>
<td>(34 cm)</td>
<td></td>
</tr>
<tr>
<td>NRC 2012 high, no subsidence</td>
<td>0</td>
<td>5 inches</td>
<td>31 inches</td>
<td>26 inches</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(12.1 cm)</td>
<td>(78 cm)</td>
<td>(66 cm)</td>
<td></td>
</tr>
<tr>
<td>Shoreline Study (assumes no subsidence)</td>
<td>0</td>
<td>4 inches</td>
<td>29 inches</td>
<td>26 inches</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9.2 cm)</td>
<td>(74.2 cm)</td>
<td>(65 cm)</td>
<td></td>
</tr>
</tbody>
</table>
### Table 1: Summary of Creek Flood Design Criteria from Different Agencies

<table>
<thead>
<tr>
<th>Agencies</th>
<th>SCVWD (San Francisquito Creek JPA)</th>
<th>Permanente Creek</th>
<th>Stevens Creek</th>
<th>USACE Shoreline Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Flow</td>
<td>max (1% flow 10% tide, 10% flow 1% tide)</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Design Tide</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Coincidence or Discrete Probability</td>
<td>Discrete</td>
<td>Discrete</td>
<td>Discrete</td>
<td>Coincidence</td>
</tr>
<tr>
<td>How conservative?</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
Implementation

• Palo Alto Flood Basin (City, Palo Alto, SFCJPA, SCVWD)

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