SFPUC
WATER SYSTEM IMPROVEMENT PROGRAM

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Engineering Management Bureau

October 2009
It’s About Water

265 million gallons
167 miles
2.5 million people
A Regional System

280 miles of pipelines, 60+ miles of tunnels, 11 reservoirs, 5 pump stations and 2 water treatment plants
The System Needs Upgrading

• Some parts over 100 years old

• But even more pressing......
3 Major Faults

San Andreas Fault

Hayward Fault

Calaveras Fault
WSIP Timing vs. Major Quake

San Francisco Bay Region

<table>
<thead>
<tr>
<th>Earthquake Magnitude</th>
<th>Probability (2003-2032)</th>
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<tbody>
<tr>
<td>6.0</td>
<td>0.80</td>
</tr>
<tr>
<td>6.7</td>
<td>0.62</td>
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<tr>
<td>7.0</td>
<td>0.36</td>
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</tbody>
</table>
Water System Improvement Program

- 86 projects in 7 counties
  - 40 local projects
  - 46 regional projects

- Total Cost: $4.6 Billion
- Completion Date: December 2015
Seismic Reliability LOS Goal

• **Primary Criteria**
  – Restore 2030 Winter Day Demand (229 mgd) within 24 hrs
  – 70% of turnouts in 3 regions to receive flow
  – 90% confidence

• **Secondary Criteria**
  – Restore 2030 Average Day Demand (300 mgd) within 30 days
  – Facilities shall not suffer catastrophic damage
  – Occupied buildings designed for “life safety”
# Program Status

<table>
<thead>
<tr>
<th>Active Phase</th>
<th>Local Projects</th>
<th>Regional Projects</th>
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<tbody>
<tr>
<td>Planning</td>
<td>3</td>
<td>2</td>
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<tr>
<td>Design</td>
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<td>Bid &amp; Award</td>
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<td>10</td>
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<tr>
<td>Construction</td>
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<td>6</td>
</tr>
<tr>
<td>Close – Out</td>
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<td>2</td>
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<td>Completed</td>
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<td>8</td>
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</table>

29 Local and Regional Projects have completed Construction as of June 30, 2009.
Key Seismic Projects

- Alameda Siphons #4  Aug 2009
- BDPL Reliability Upgrade  Jan 2010
- Seismic Upgrade of BDPLs 3 & 4  Mar 2012
- CS/SA Transmission Upgrades  Oct 2010
- HTWTP Long-Term Improvements  Apr 2011
- New Crystal Springs Bypass Tunnel  Dec 2008
BDPL Reliability Upgrade

- $353 Million Tunnel
- $260 Million Pipeline
- 16 miles of pipeline
- 5 mile tunnel under SF Bay
- Seismic reliability
Seismic Upgrade of BDPLs 3 & 4

- $68 Million
- Traverses Hayward Fault
- Replacement of ~1,500 feet of BDPL 3
- Large concrete vault
- Seismic reliability
Seismic Upgrade of BDPL 3&4 Project Area
Cornell Test Facility

North box pulled by 4 actuators to create strike-slip offset of 198 mm (Design offset = 6.5 ft)

Secant pile wall

Precast section

South box fixed to lab structure and modular reaction wall
Alameda Siphon #4

- New pipeline through Sunol Valley alongside existing pipelines
- 3,000 feet of 66 inch steel pipe crossing Calaveras Fault
- Seismic retrofits of existing 3 pipelines as necessary
- Will provide a reliable connection across Hayward fault

Seismic $56.8 Million
Calaveras Dam Replacement

- $308 Million
- Largest reservoir in SFPUC System
- New seismically safe dam
- Naturally occurring asbestos
BDPLs 3&4 Crossover Locations
Lowering Tunnel Boring Machine
New Crystal Springs Bypass Tunnel
HTWTP Long-Term Improvements

- Seismic risks associated with Serra Fault
- Relocation of plant’s Treated Water Reservoirs
- Pipeline improvements in vicinity of Serra Fault
- Interim improvements to address seismic risks
University Mound North Basin Reservoir Upgrades

- One of three terminal reservoirs in San Francisco – serves 35% of city
- Constructed in 1885 and is seismically vulnerable
- Will seismically upgrade to meet SFPUC service level goals

Seismic $76.2 Million
Incremental Protection
Hayward Event – Total System (27% probability)
Enhancement of Incremental Protection

Key
• Implementation of Repair and Readiness program
• Aggressive implementation of key projects
  – Alameda Siphon
  – Irvington Tunnel
  – BDPL 5
  – Hayward Fault crossing
  – BDPL Cross overs
  – HTWTP upgrade
General Observations

• NGA has not been used – SFPUC design is conservative
• In cooperation with USGS:
  – LIDAR studies to verify existing & locate potential faults
  – San Andreas fault paleoseismic & location studies
  – San Andreas Reservoir sediment survey for fault trace
  – Near fault accelerometers at Hayward fault
• Comprehensive fault offset studies
• Cooperative Agreements with Caltrans to speed completion of Hayward Fault crossing
LIDAR overlay to Google Earth
THE END

www/sfwater.org/wsip