Emergency Firefighting Water System (EFWS) Planning Study for 2050 Conditions

Capital Planning Committee
June 13, 2022
• Develop a plan to expand emergency firefighting pipelines and water supply sources to all parts of San Francisco, based on estimated 2050 conditions.

• Incorporate results from the Fire Following Earthquake Water Requirements Study (Submitted to BOS 6/30/21)

• Utilize results from the EFWS Seawater Supply Pre-Feasibility Study in the evaluation of new water supplies (Submitted to BOS 6/30/21).
Study Objectives

• Purpose
  • Plan an EFWS to provide post-earthquake firefighting water supply to all parts of San Francisco through 2050

• Goals
  • New pipe networks in areas not currently served
  • Maximize utility for new pipelines via combined potable/EFWS system (PEFWS)
  • Identify water sources to meet expected demands

• Objectives
  • Preliminary layout of pipe networks
  • Recommend a reliability target for system
  • Identify water supply needs and new sources to meet them
  • Estimate cost
Overview

**Existing System**
- EFWS pipelines largely in Eastern portion of City
- 2010 and 2014 ESER Bonds to update existing system
- Limited EFWS water supply from cisterns
- Total supply: approx. 80,000 gpm

**2050 Demands**
- Citywide Coverage
- 255,000 gpm Estimated Demand (75th percentile)

**Improved System**
- Citywide coverage
- Additional water sources to meet demands
- Increased system capacity
- SFFD resources assumed to increase with population growth through 2050
Future Conditions

- **Population:**
  - 2020: 883,000
  - 2030: 960,000
  - 2040: 1,035,000
  - 2050: 1,120,000
  - Source: *Plan Bay Area 2040 (ABAG/MTC)*

- **Building Square Footage in San Francisco:**
  - 2020: 885 million
  - 2030: 1.01 billion
  - 2040: 1.13 billion
  - 2050: 1.25 billion
  - Source: *SF Planning Department and available information on large planned developments.*
San Francisco population - historical and projected

Historical and Projected Population

San Francisco population - historical and projected

- Population (solid line)
- Projected population (dashed line)

Year:
- 1840
- 1860
- 1880
- 1900
- 1920
- 1940
- 1960
- 1980
- 2000
- 2020
- 2040
- 2060

Population:
- 0
- 200,000
- 400,000
- 600,000
- 800,000
- 1,000,000
- 1,200,000
Earthquake Scenario

- Basis: 1906 earthquake event on the San Andreas fault
- Per direction from San Francisco Board of Supervisors

Resolution 422-19:

“FURTHER RESOLVED, That the Board of Supervisors reports that Recommendation No. R1 has not been implemented but will be implemented by no later than December 31, 2021…”

Recommendation No. R1:

“By no later than December 31, [2021], the Mayor, the SFPUC, the SFFD, and the Office of Resilience and Capital Planning should jointly present to the Board of Supervisors a detailed plan to ensure the City is well prepared to fight fires in all parts of San Francisco in the event of a 1906-magnitude (7.8) earthquake.”
Selection of Demand Target

75th Percentile: in a recurrence of the 1906 earthquake, adequate water will be supplied 3 out of 4 times.
A Pattern of Demands
Potential Future System Improvements

1. Pipeline Improvements for Coverage and Capacity
   - Conventional EFWS Pipelines:
     - Extend coverage to areas not currently served
     - Improve water conveyance capacity
   - Potable EFWS (PEFWS) Pipelines
     - High-pressure firefighting supply, modern construction
     - Reliable post-earthquake emergency water for domestic use
     - Maximizes uses under both normal and earthquake conditions

2. Water Supply Sources

3. Other EFWS Improvements
   - Reliability improvements to existing facilities
Other EFWS Improvements

• Enhanced monitoring and control to respond quickly and effectively
  • Seismic valves
  • Motorized / remote operated valves
  • Enhanced SCADA functionality (e.g. pressure monitoring for leak detection)

• Reliability Improvements to Existing Facilities
Potential System Improvements - Pipelines (Map)

Legend

EFWS and PEFWS Pipe Configuration

- Existing Conventional EFWS
- Future Conventional EFWS (unfunded)
- PEFWS Phase 1 (funded)
- PEFWS Phase 2 (unfunded)
- PEFWS Future Phases (unfunded)
Potable EFWS (PEFWS) Pipelines

Post-Earthquake Conditions:

• After an earthquake: Increase pressure and flow to support firefighting.

• After firefighting subsides: Provides seismically reliable emergency water supply.
Water Supply Sources:

• Supply Sources Considered:
  • Lake Merced
  • Seawater
  • In-City Potable Reservoirs
  • Regional Water System Pipelines

• Conventional EFWS:
  • New potable supplies: University Mound, Sutro, Stanford Heights, College Hill
  • Approx. 60,000 gpm new seawater supply to be provided

• PEFWS:
  • Lake Merced, Sunset and University Mound are adequate to meet demands
Results: System Performance

- Meet year 2050 demands from Fire Following Earthquake Water Requirements Study
- Includes improvements to pipelines, water sources, and SFFD resources
- System hydraulics and seismic response modeled to simulate performance
- Performance presented geographically throughout City
Performance of Proposed System

Reliability Score = \frac{\text{Water Supplied}}{\text{Demand}}
Improvement history

Pre – ESER Bond

Post ESER 2010

Legend

High

Low

PRELIMINARY

Post ESER 2014

Post ESER 2020
### Program Cost Estimate

<table>
<thead>
<tr>
<th>Option</th>
<th>Supply to North, West, South Areas</th>
<th>Supply to Conventional EFWS</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Lake Merced / Potable</td>
<td>Potable / Seawater</td>
</tr>
<tr>
<td>Option 1</td>
<td>($M)</td>
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<td>Option 2</td>
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<tr>
<td>Option 3</td>
<td>($M)</td>
<td>Lake Merced / Potable Seawater (Redundant)</td>
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<tr>
<td>Unescalated (2021$)</td>
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<tr>
<td>Escalated - Completion by 2034</td>
<td>Potable / Seawater</td>
<td>$2,945</td>
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<tr>
<td>Escalated - Completion by 2046</td>
<td>Potable / Seawater</td>
<td>$4,072</td>
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</tbody>
</table>

1) Assumes 4% escalation  
2) Conceptual estimate

### Program Schedules

**Completion by 2034**
- Accelerated project start  
- 5-year planning, design and permitting  
- 6-year construction  
- Significant additional City resources required

**Completion by 2046**
- Typical project start schedule  
- 7-year planning, design and permitting  
- 14-year construction
Questions?