Presenters:

- Tommy Moala, Assistant General Manager, Wastewater Enterprise
- Stefani Harrison, Project Manager

Photo: Dec 3, 2014
End of Cayuga Street
25-year storm event
Agenda

1. Overview of Combined Stormwater/Sewer System
2. How Flooding Can Occur
3. Level of Service Goals
4. Citywide Flood Resilience
5. Planned Neighborhood Projects
6. How SFPUC Operations Prepares & Responds
7. What The Public Can Do to Prepare
8. Future Policy Decisions
OVERVIEW
San Francisco’s Combined Sewer System

- **North Point Wet Weather Facility**
  - Avg. DWF: 0 mgd
  - WW Capacity: 150 MGD

- **Oceanside Treatment Plant**
  - Avg. DWF: 12 MGD
  - WW Capacity: 175 MGD

- **Southeast Treatment Plant**
  - Avg. DWF: 58 MGD
  - WW Capacity: 250 MGD

- **Avg. Dry Weather Flow:** 70 MGD
- **Total Wet Weather Capacity:** 575 MGD

- **Total Wet Weather Storage Capacity:** 200+ million gals.
San Francisco’s Combined Sewer System

- Major, Local, & Brick Sewers: 959 miles
- Transport/Storage, Tunnels
  - Force Mains, Outfalls: 52 miles
- Total Miles of Sewers: 1,011 miles

- 27 Pump Stations
- 25,000 Catch Basins

To Treatment Plant

To Bay/Ocean
Investments in Our Collection System

1972
In response to the 1972 Clean Water Act, the SEP is expanded to secondary treatment. All Bayside dry weather flows are consolidated at the SEP.

1982
North Shore (24MG) and Channel Facilities (38MG) completed

TRANSPORT/STORAGE SYSTEM BUILT AS PART of $1.5B CLEAN WATER PROGRAM

1983
Mariposa & 20th Street Facilities (13.9MG) completed

1986
Westside Transport/Storage (60 MG) and South West Ocean Outfall completed

1989
Yosemite Facilities (11.5MG) completed

1991
Sunnydale Facilities (56.2MG) completed

1992
Mariposa & 20th Street Facilities (13.9MG) completed

1993
Lake Merced Tunnel (10MG) completed

1996
Richmond Tunnel (12MG) completed

1997
Islais Creek Facilities (45.1MG) completed
Continued Investments in Our Collection System

1998-2005
With 58% of support, voters approved Proposition H which freezes water and sewer rates at 1998 levels.

2002
Wastewater Improvements that were originally planned to be on the 2002 ballot are removed. Subsequently, a $1.6B bond to make water system improvements is approved by 53% of voters.

2004-2010
The Sewer System Master Plan and Commission workshops evaluated the condition and future needs of the combined sewer system.

2005-2014
The Wastewater (Interim) Capital Improvement Program begins focusing resources on flood control due to heavy storms in 2004 that overwhelmed the combined sewer system.

2010-2016
Urban Watershed Assessment is a comprehensive watershed-based planning process and proposed green & grey solutions to sewer system challenges.

2011-2012
After a validation process the Commission authorizes Staff to proceed with planning and developing the proposed Phase 1 projects of the SSIP, representing $2.7B of total costs ($6.9B).
COLLECTION SYSTEM
ENGINEERING DETAILS
System Background – Catch Basins

- Connection to Sewer
- Curb
- Grate
- Minimum 6 Feet
- Street
- Debris
- Floatables
System Background – Excursions

Excursion: water exiting the system and then re-entering the system:

- Manholes
- Sidewalk vents
- Catch basins
- Plumbing fixtures → Minimize with backflow preventers

Design feature of combined systems

Bubbling/Spray from system is simply air exiting
System Background – Backflow Preventers

- ROOF GUTTER
- ROOF DRAIN
- SIDEWALK VENT
- CURB
- STREET PAVEMENT
- MAIN SEWER
- BUILDING SEWER
- SIDE SEWER

San Francisco Water Power Sewer
HOW FLOODING CAN OCCUR
How Flooding Can Occur

- Large storm (beyond collection system capacity)
- Natural topography
  - Historic waterways
  - Drainage basin size and features
- Land settlement
- System blockage
- High tides
Modeled flooding in large storm event that exceeds capacity of collection system
LEVEL OF SERVICE GOALS
Citywide Challenges to Sewer System

- Aging Infrastructure
- Seismic Reliability
- Combined Sewer Discharges
- Climate Change
- Odors, Noise & Visual
- Environmental Stewardship

Stormwater Management
WWE Goal

*Integrate Green and Grey Infrastructure to Manage Stormwater and Minimize Flooding*

WWE Level of Service

*Control and manage flows from a storm of a 3 hour duration that delivers 1.3 inches of rain*
Terminology: Storm Size
Terminology: Storm Size

<table>
<thead>
<tr>
<th>Storm Return Period</th>
<th>Chance of Storm Occurring in a Given Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-year storm</td>
<td>1/2 = 50%</td>
</tr>
<tr>
<td>5-year storm</td>
<td>1/5 = 20%</td>
</tr>
<tr>
<td>25-year storm</td>
<td>1/25 = 4%</td>
</tr>
<tr>
<td>100-year storm</td>
<td>1/100 = 1%</td>
</tr>
</tbody>
</table>
CITYWIDE FLOOD RESILIENCE
What is Flood Resilience?

The capacity to anticipate risk, limit impact, and recover quickly when damage occurs from flooding events.

Flood Resilience Study Goals

- **Infrastructure (long term):** develop a risk-based framework to identify and prioritize capital investments

- **Other flood risk reduction measures (short and long term):**
  - Provide “safety net” beyond what the collection system can manage, such as providing grants and promoting flood insurance
  - Create a partnership between SFPUC, residents, businesses, other City Departments.
The Flood Resilience Effort Will:

• Provide flood risk information to evaluate our Level of Service goal for stormwater management
• Build on the Urban Watershed Assessment
• Develop a prioritized list of construction projects
• Create partnerships with stakeholders to do their part
• Set the stage for a flood-resilient San Francisco
Early Flood Resilience Projects

• Concurrent with Flood Resilience planning, SFPUC is dedicating resources to expedite construction projects:
  • In at least 5 critical areas that are subject to flood risk
  • To help manage/reduce floodwater

• Limitations: *No project would eliminate all flooding in all storms.* After any project is implemented:
  • The Level of Service goal would be met in the project area.
  • The large storms that caused flooding in December 2014 would still cause flooding, but likely less severe.
PLANNED NEIGHBORHOOD PROJECTS – FOLSOM AREA
Large Drainage Basin Flows Under Folsom Neighborhood
17th/Folsom Area Vicinity Map
Sewer main profile along 17th Street

17th & Folsom
Dozens of projects were evaluated

SFPUC narrowed to 3 top project concepts:

<table>
<thead>
<tr>
<th>Description</th>
<th>Connector Tunnel to Potential Channel Tunnel</th>
<th>17th/18th/Treat/Division Sewer Expansion</th>
<th>Underground Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conveyance:</td>
<td>Conveyance:</td>
<td>Conveyance:</td>
<td>Storage:</td>
</tr>
<tr>
<td>• 17’ diameter tunnel to potential future Channel Tunnel</td>
<td>• Expand existing collection system</td>
<td>• 1.5 mile open cut, 42 months</td>
<td>• Acquire easements/properties</td>
</tr>
<tr>
<td>• Construction impacts mostly at shaft locations</td>
<td>• (incl. half the width of Division Street for 12 months)</td>
<td></td>
<td>• Install 2.5 MG storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Clean basin after each major storm event.</td>
</tr>
<tr>
<td>Cost</td>
<td>$260M</td>
<td>$200M</td>
<td>$110M (excludes real estate)</td>
</tr>
<tr>
<td>Earliest Completion</td>
<td>2024</td>
<td>2022</td>
<td>2020</td>
</tr>
</tbody>
</table>

All project concepts present unique challenges and tradeoffs.
Folsom Area Project Implementation Steps

- Concept development and feasibility evaluation
  - Estimation of project costs
  - Real estate / inter-agency discussions
  - Refinement and comparison of alternatives (Triple Bottom Line analysis)
- Environmental review
- Design
- Bid/Award
  - Contract preparation
  - Contract advertisement / bid
  - Contract award / Commission approval
- Construction
- Lengthy process (*earliest implementation: 2020-2024*)
Interim Project: Temporary Flood Barriers at 17th/Folsom

- 500 feet purchased (1.5 blocks)
- To be deployed on sidewalk
- Only protects certain properties
- Worked with Mayor’s Office of Disability, Public Works, and MTA
PLANNED NEIGHBORHOOD PROJECTS – WAWONA
Wawona Area Vicinity Map

Contributing Area

Flow path to 15th/Wawona located in Canyon-like depression
Wawona Preliminary Evaluation for Long-Term Capital Improvements
Wawona Area Project Concept for Stormwater Detention

- New Stormwater Pipe
- New Stormwater Inlet

Arden Wood Basin
Wawona Area Project Concept for Stormwater Detention

Description:
• Install new inlets & pipes to collect water from surface
• Install large pipe or micro-tunnel
• Convert Arden Wood Basin to floodwater detention basin in large storms

Key Considerations:
• Arden Wood property coordination
• Geotechnical/structural feasibility
• Utility relocation
• Environmental mitigations

Project Cost / Implementation:
~ $23 M / 2020
PLANNED NEIGHBORHOOD PROJECTS – CAYUGA
Cayuga Area Vicinity Map

Legend
- Orange: Drainage area flowing through collection system under Foot of Cayuga area (2,800 ac)
- Green: Large sewer mains under Foot of Cayuga area

1. Flow from Glen Park branch
2. Flow from Cayuga branch
3. Flow from Alemany branch
Sewer Main Profile Along Cayuga St
10-year storm

10% chance of occurring in a given year
Surface Inundation Today, Cayuga Area
(Design Storm Simulations)

5-year storm
(20% chance)

10-year storm
(10% chance)

25-year storm
(4% chance)
### Recent storms causing flooding

<table>
<thead>
<tr>
<th>Storm Date</th>
<th>Cayuga</th>
<th>Folsom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec 3 &amp; 11, 2014</td>
<td>X (25-year)</td>
<td>X</td>
</tr>
<tr>
<td>Dec 2, 2012</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Apr 12, 2012</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Jan 18, 2010</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Oct 19, 2009</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Feb 25, 2004</td>
<td>X (100-year)</td>
<td>X</td>
</tr>
</tbody>
</table>
The City is evaluating a project on Cayuga St.

- Location: From Rousseau to I-280 where flooding is most pronounced

Photo: Feb 25, 2004
End of Cayuga Street
100-year storm event
Project Concept for Re-grading at the End of Cayuga
Description:

- Re-grade/depress Caltrans property at I-280 to detain excess surface water.
- Build wall to support I-280 berm & reduce water running onto freeway
- Connect drain to College Hill Tunnel

Key Considerations:

- Caltrans coordination
- Geotechnical/structural feasibility
- Utility relocation
- Ensuring freeway flooding doesn’t get worse

Project Cost / Implementation:

~ $12 M / 2019
• This project would reduce the depth of flooding at the bottom of Cayuga in any storms where flooding occurs (25-year storm and larger).

• No capital improvement could be built that would eliminate flooding in all storms.
STORM PREPARATION AND RESPONSE
Storm Preparation and Response

- Catch Basins
- Crew Deployment
- Sandbags
- SF311
Storm Preparation and Response: Catch Basins

- ~25,000 Catch Basins in collection system
- Our goal is to clean 5,000 catch basins annually
  - In 2015, we cleaned 8,600 catch basins
- We monitor every catch basin throughout the year
- Crews clear catch basins in flood-prone areas prior to any storm and monitor them during event
Storm Preparation and Response: Crew Deployment

- Treatment Plant staffing
- Collection System Staffing
  - Triggers
  - Zones
  - Partnership with SFPW
- Deployment of Flood Barriers at 17th/Folsom
Storm Preparation and Response: Sandbags

• “Sandbag Saturdays” Distribution in 2015
  • Partnership with SFPUC & SF Public Works
  • Multiple locations in SF
• SFPUC team delivered 1,755 sandbags to residents/businesses in flood-prone areas
• Sandbags available at SFPW yard
Storm Preparation and Response: SF311

- All immediate sewer issues (flooding, backups, etc.) should be reported to 311
- By phone, SF311 website or app
WHAT THE PUBLIC CAN DO TO PREPARE
Plan, Prepare, Protect

- Elevate belongings
- Maintain sewer pipes/laterals
- Help keep catch basins clean – call 311
- Maintain roof drains and downspouts
- Obtain sandbags prior to major rain events
Floodwater Grant Program

- Backflow preventers
- Doorway barriers
- Flood walls
- Special projects
- Project costs (permits, encroachment fees)
### SFPUC Floodwater Grant Program
#### Example Concepts for Special Projects

**Summer 2015**

<table>
<thead>
<tr>
<th>If flooding concern is related to</th>
<th>Item</th>
<th>Availability</th>
<th>Photo</th>
<th>Advantages and Limitations</th>
<th>Installed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overland flow onto a property/parcel from sidewalk or public right of way.</td>
<td>Walls</td>
<td></td>
<td></td>
<td><strong>ADVANTAGES:</strong> Continuous protection</td>
<td>General Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>LIMITATIONS:</strong> Grant only covers walls facing public right of way <em>(not facing an adjacent property)</em></td>
<td></td>
</tr>
<tr>
<td>Low overland flow through pedestrian or garage door</td>
<td>Raised Floors</td>
<td></td>
<td></td>
<td><strong>ADVANTAGES:</strong> Continuous protection</td>
<td>General Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>LIMITATIONS:</strong> Limited height, reduces headspace, construction may be difficult and/or costly</td>
<td></td>
</tr>
<tr>
<td>Low overland flow through a pedestrian door</td>
<td>Raised Sidewalk/Berm/Threshold</td>
<td></td>
<td></td>
<td><strong>ADVANTAGES:</strong> Continuous protection</td>
<td>General Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>LIMITATIONS:</strong> Limited height, commercial Americans with Disabilities Act (ADA) restrictions</td>
<td></td>
</tr>
</tbody>
</table>
FEMA Flood Insurance

- Available for SF residents and businesses at affordable rates
- SFPUC conducted training for SF insurance agents
- Contact risk.management@sfgov.org
Resources for the Public

http://www.sfwater.org/StormPrep
FUTURE POLICY DECISIONS
Future Policy Decisions

- SFPUC’s Flood Resilience Study:
  - Will characterize impacts of flooding & project costs for different levels of stormwater management
  - Findings will be used to evaluate our Level of Service goal for stormwater management
- Modifying or increasing level of service goals will have significant cost implications for ratepayers
- Additional information at a future Commission workshop in the Spring
Thank you

QUESTIONS