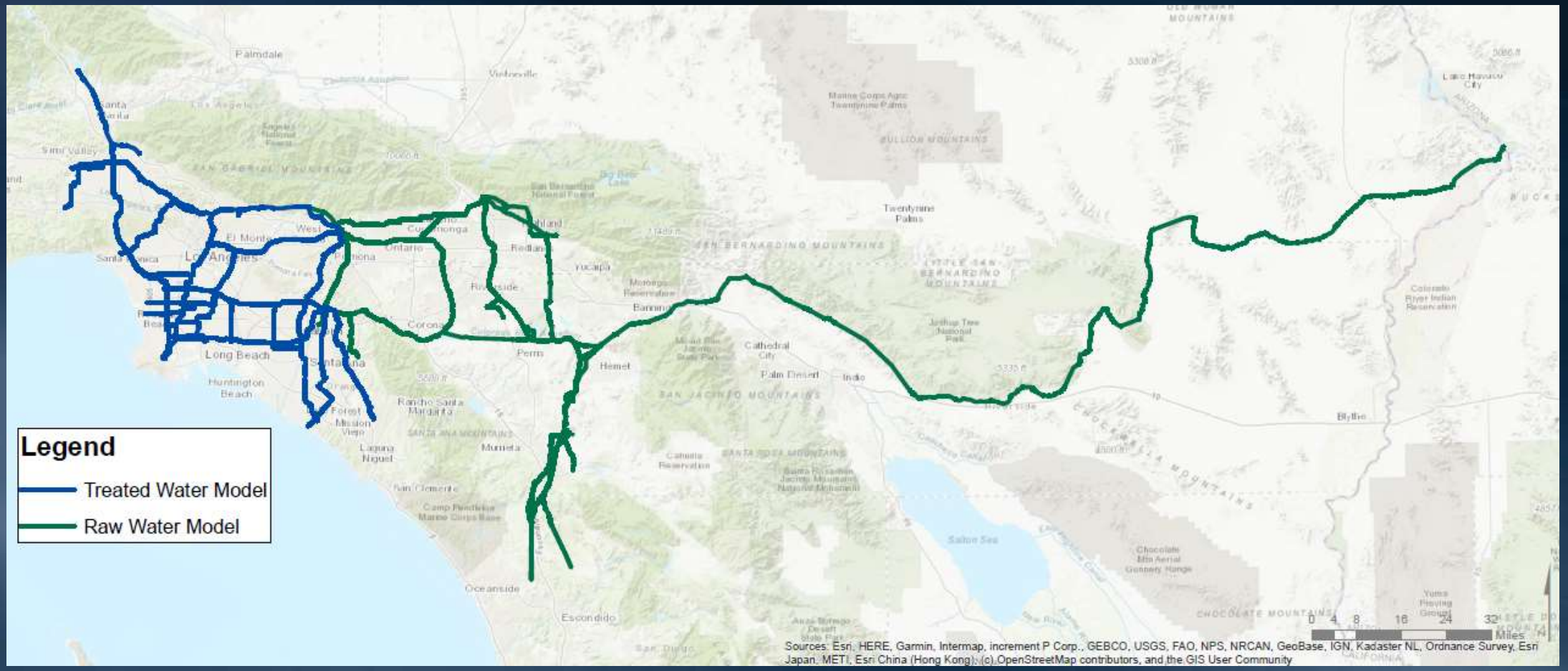
Applications of Hydraulic Modeling

Engineering and Operations Committee
Item 6c
June 7, 2021

Background

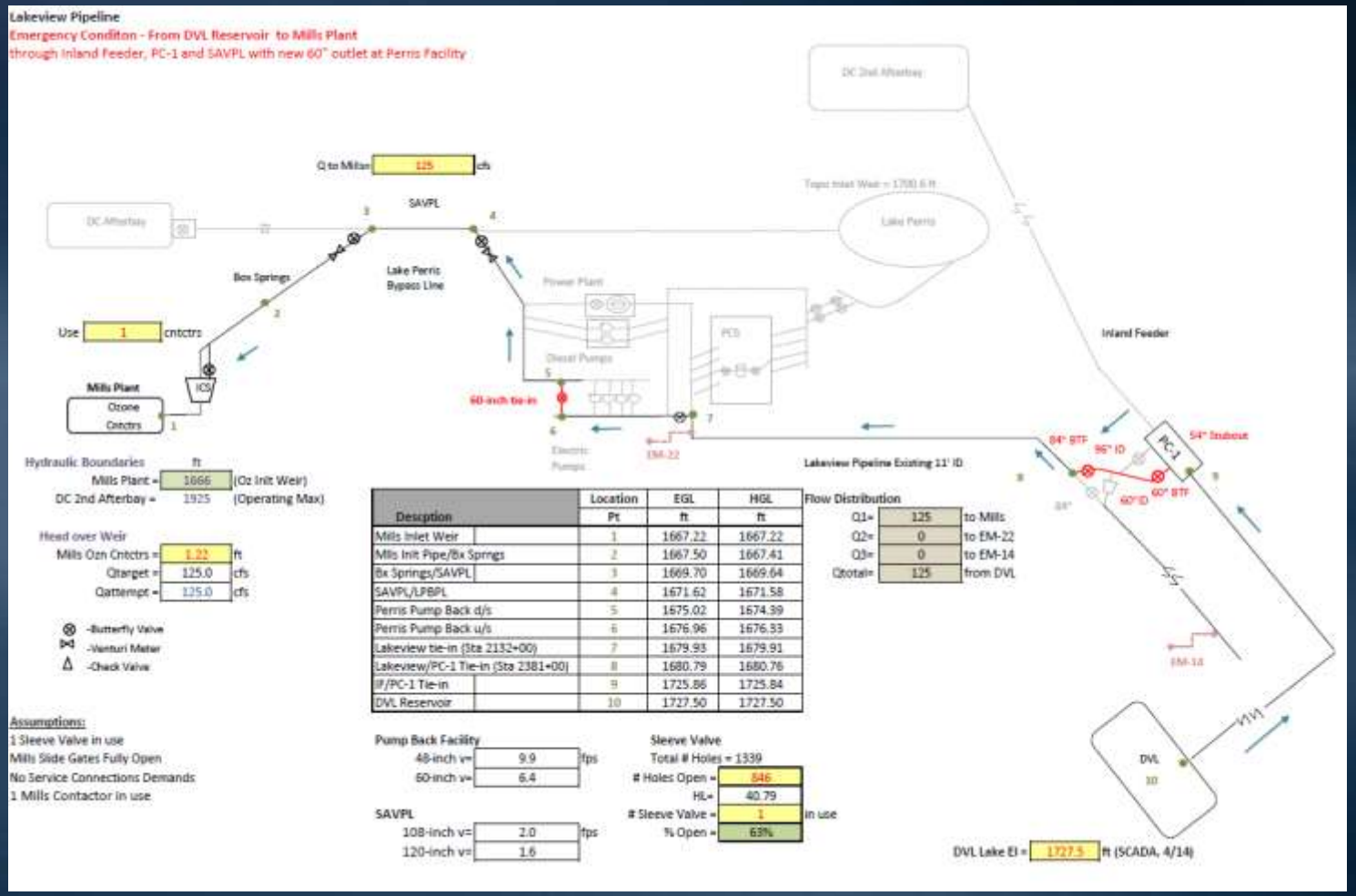
- Types of hydraulic modeling in use at Metropolitan
  - Water distribution
  - Water treatment
  - Overland flow
  - Computational fluid dynamics (CFD)
- What is a water distribution model?
  - A computer model that simulates the hydraulics within the distribution and conveyance system
- Unique aspect of Metropolitan's water distribution model
  - Ability to simulate free surface and pressurized flow conditions simultaneously
  - Ability to simulate various control strategies within a control facility
- Development of the water distribution model
  - Completed in 2017
  - Blended team – consultants and Metropolitan staff

Model Overview



- 1,150 miles pipes/canals
- 380 Service connections
- 920 Valves
- 55 Pressure Control/Hydro facilities
- 18 Relief structures
- 10 Reservoirs
- 375 Blow-off strs.

Hydraulic Analysis – Using Spreadsheets

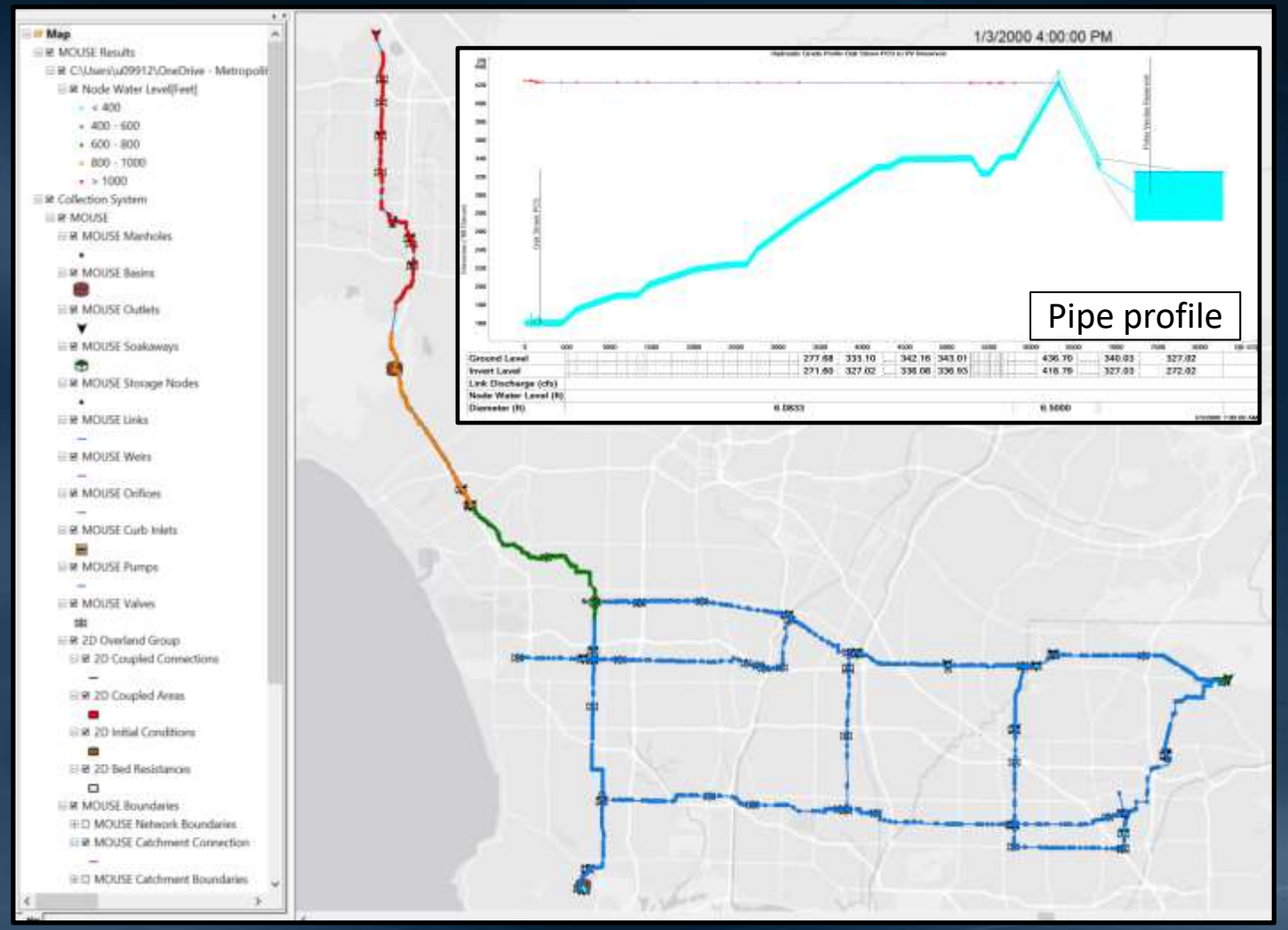


Desction	Location Pt	EGL ft	HGL ft
Mills Inlet Weir	1	1667.22	1667.22
Mills Init Pipe/Bx Springs	2	1667.50	1667.41
Bx Springs/SAVPL	3	1669.70	1669.64
SAVPL/LPBPL	4	1671.62	1671.58
Perris Pump Back d/s	5	1675.02	1674.39
Perris Pump Back u/s	6	1676.96	1676.33
Lakeview tie-in (Sta 2132+00)	7	1679.93	1679.91
Lakeview/PC-1 Tie-in (Sta 2381+00)	8	1680.79	1680.76
IF/PC-1 Tie-in	9	1725.86	1725.84
DVL Reservoir	10	1727.50	1727.50

- Spreadsheets/hand calculations
- Simple multiple pipe analysis
- Steady state conditions

Hydraulic Analysis – Using the Hydraulic Model

- Current Capabilities
  - Network analysis
  - Dynamic conditions
  - Multiple scenarios
  - Water quality analysis



Model Utilization

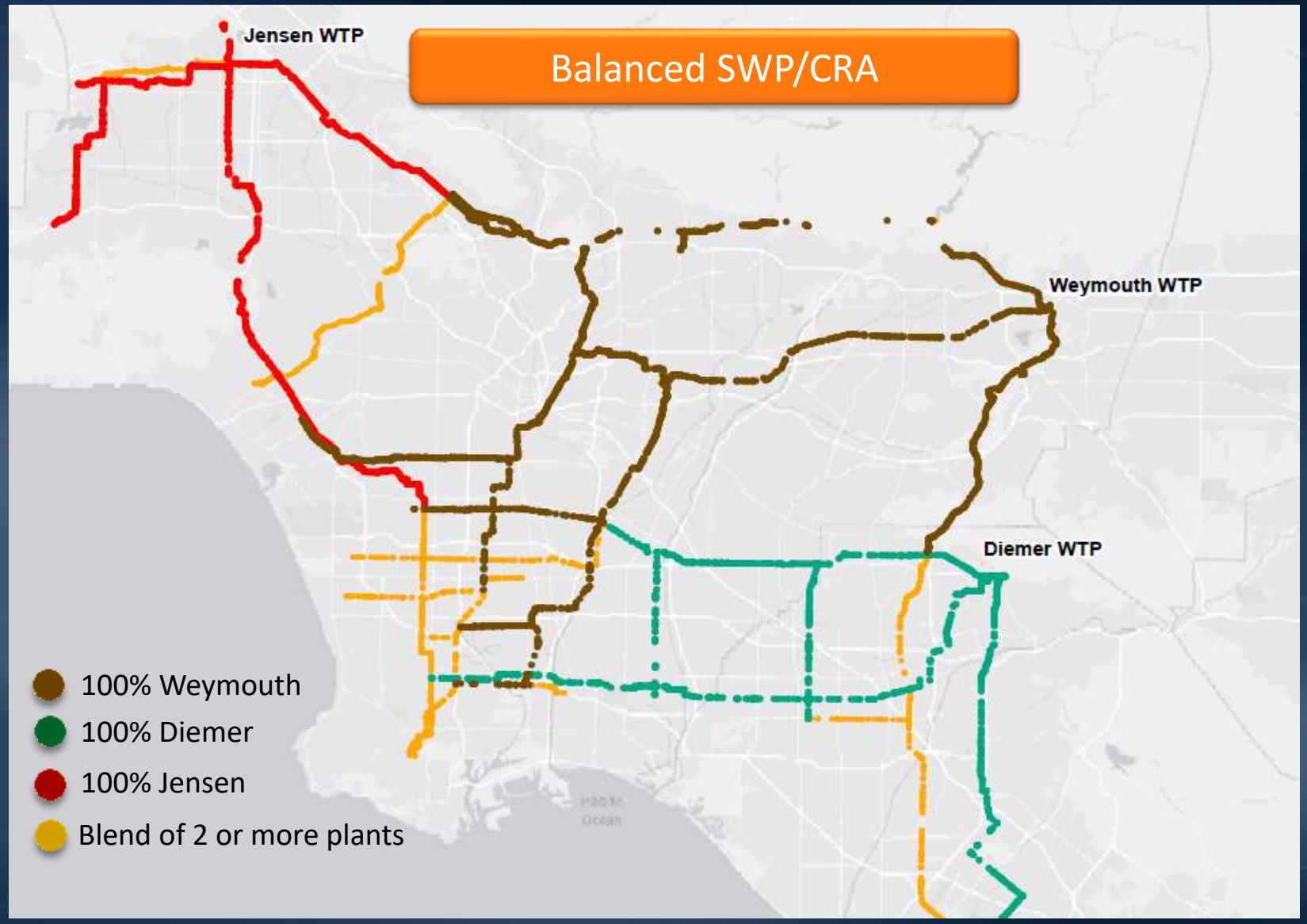
- Water Resources
  - Evaluate long-term change in supply or demand conditions
  - Evaluate emergency storage requirements
  - Determine delivery extents from treatment plants
- Engineering
  - Sizing of new pipes, pump stations, hydro and control facilities
  - Determine post-rehabilitation pipe size
- Operations
  - Troubleshoot system operation
  - Evaluate deliveries during unique operating conditions
  - Conduct ‘real-time’ water quality analysis
  - Evaluate pipeline dewatering strategy

Planning – Treatment Plant Delivery Capabilities

Question:

- What is the extent of water deliveries from a treatment plant into the distribution system?
  - Under normal conditions
  - Under high SWP allocation
  - Under low SWP allocation

Planning – Treatment Plant Delivery Capabilities



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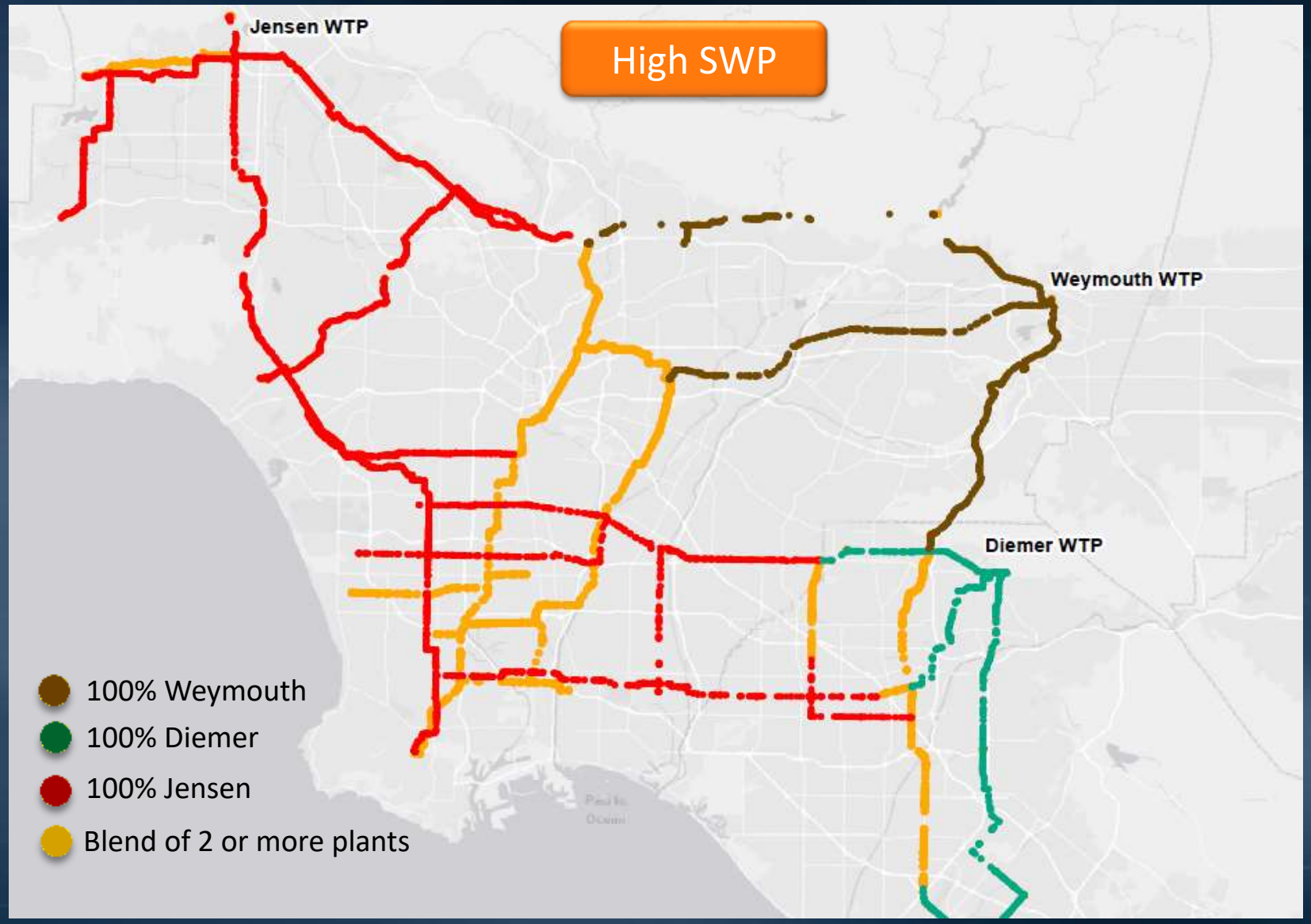

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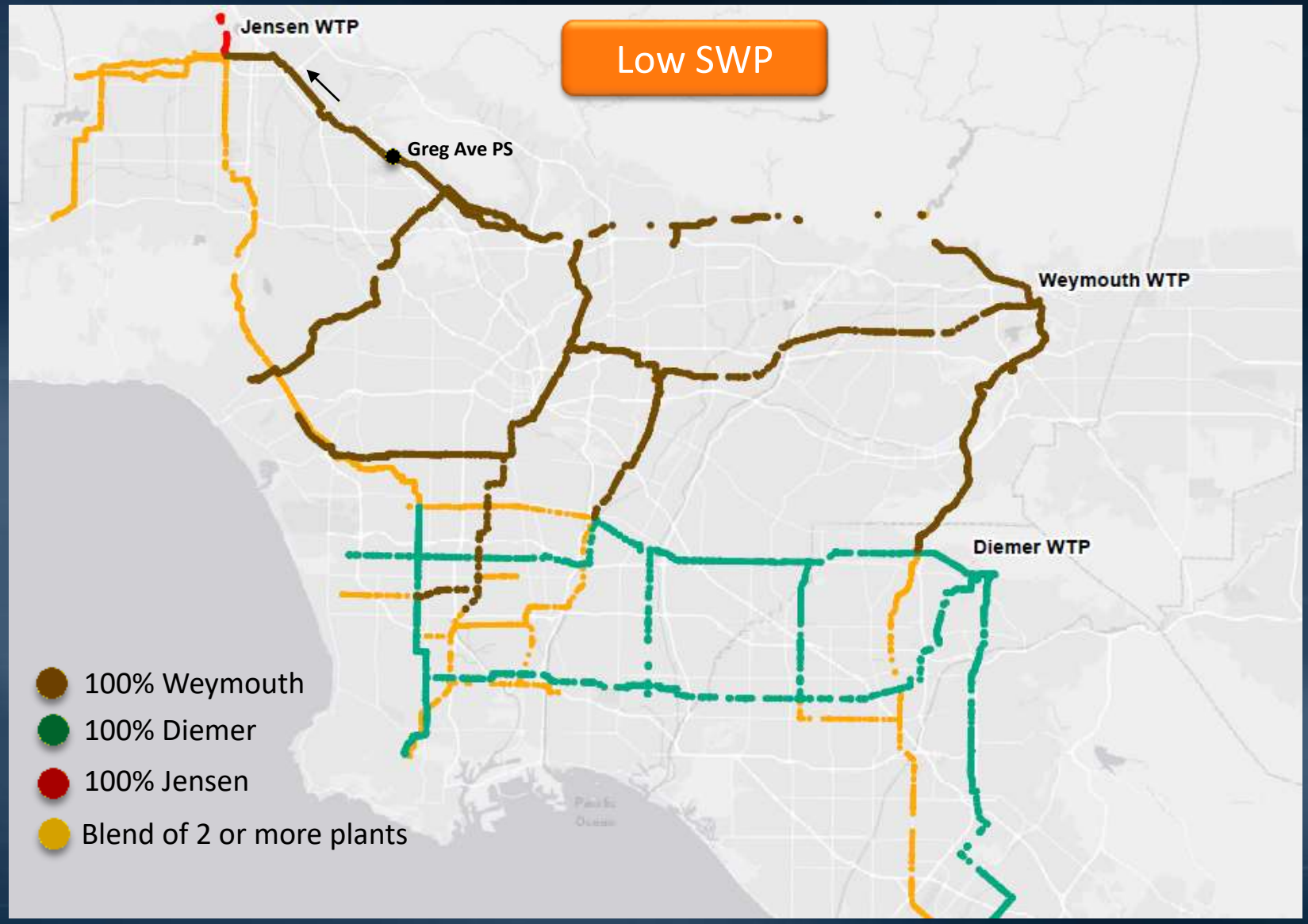
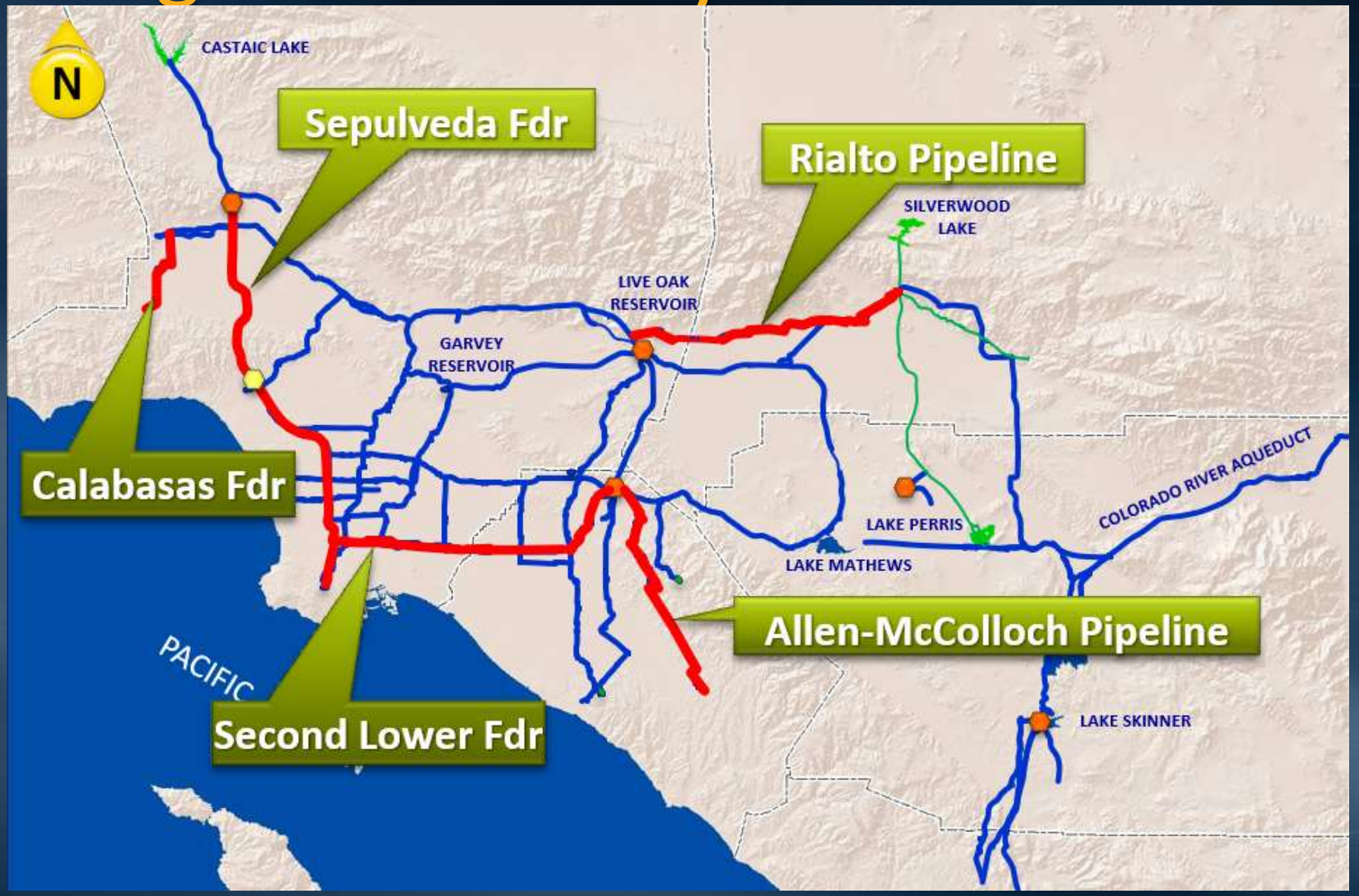


Engineering – Analyze Impact of PCCP Relining

Question:

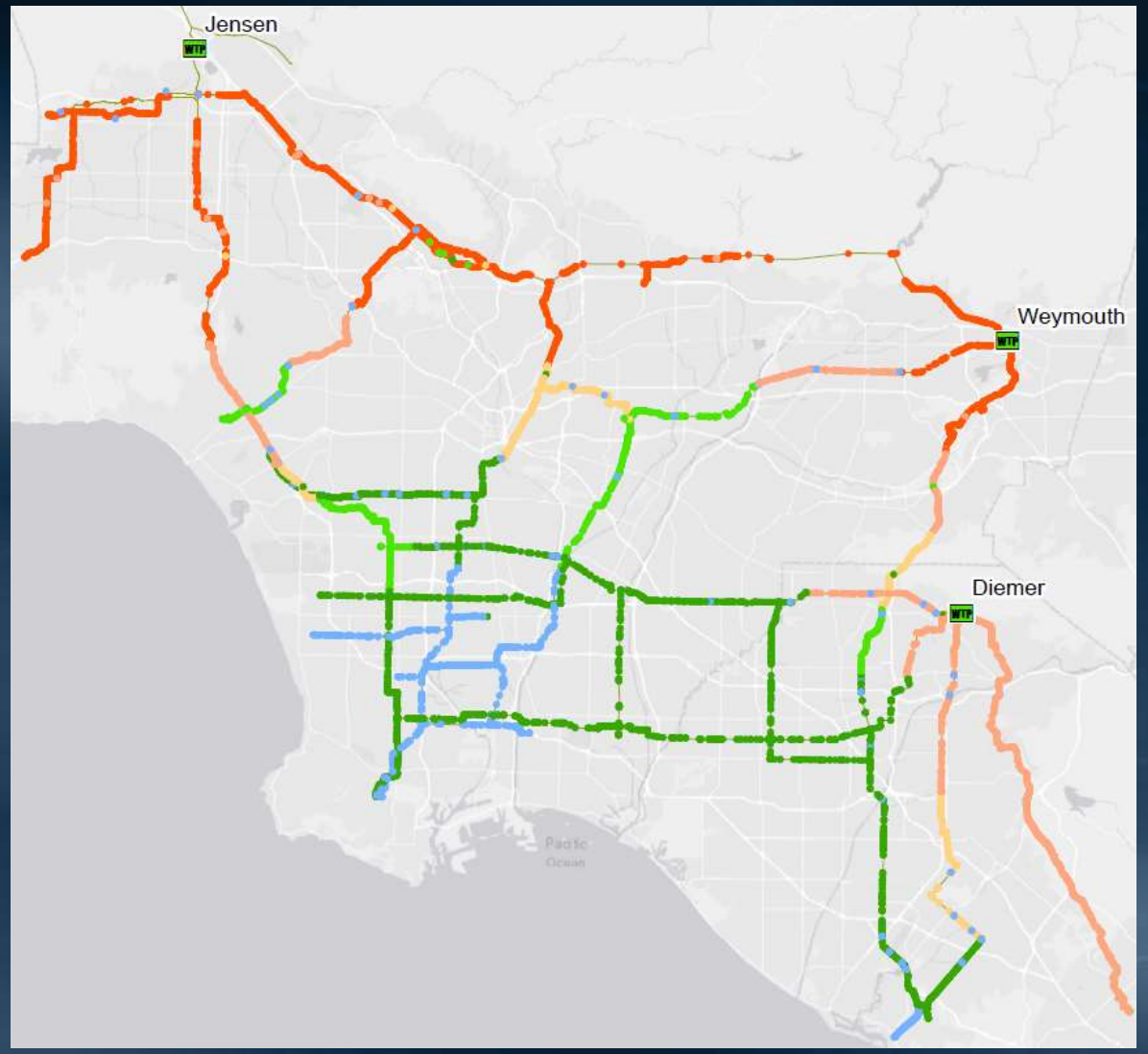
- What is the impact of PCCP relining on our ability to deliver flow to member agencies?

Engineering – Five Priority PCCP Feeders



Engineering – Analyze Impact of PCCP Relining

- Analyzed numerous scenarios by varying
  - Supply conditions
  - Service connection demands
  - Operational strategies
- Results
  - Member Agency demands met after relining



Operations - Dewatering Estimates

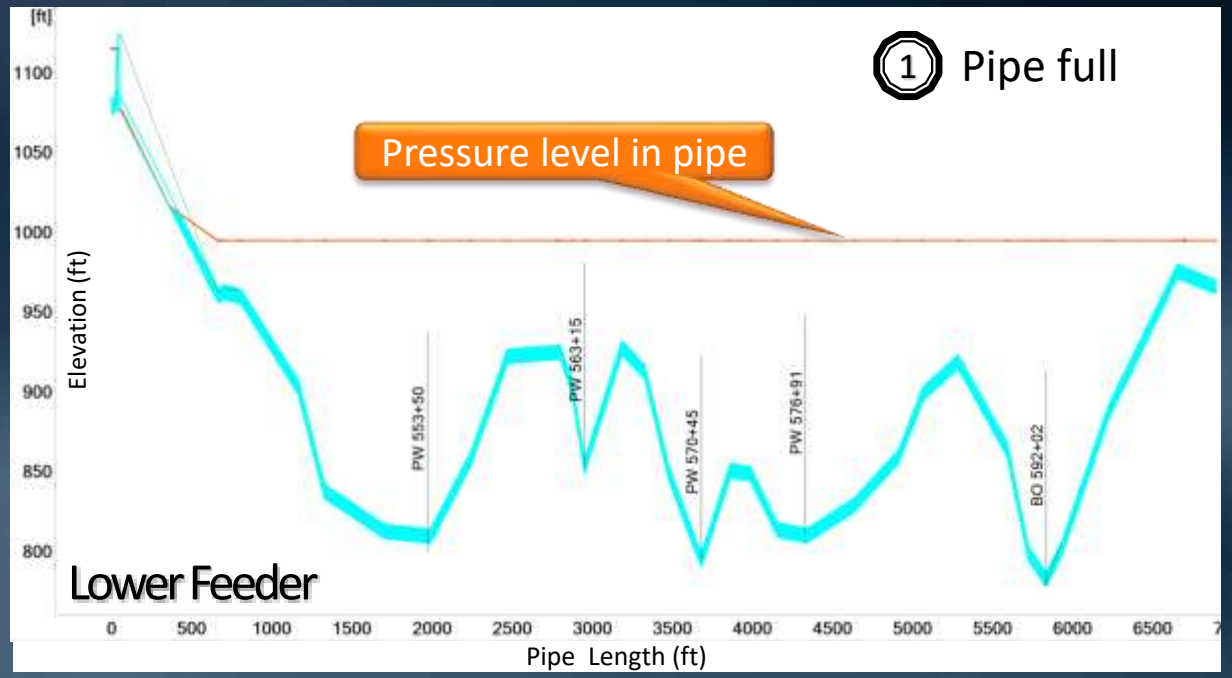
Questions:

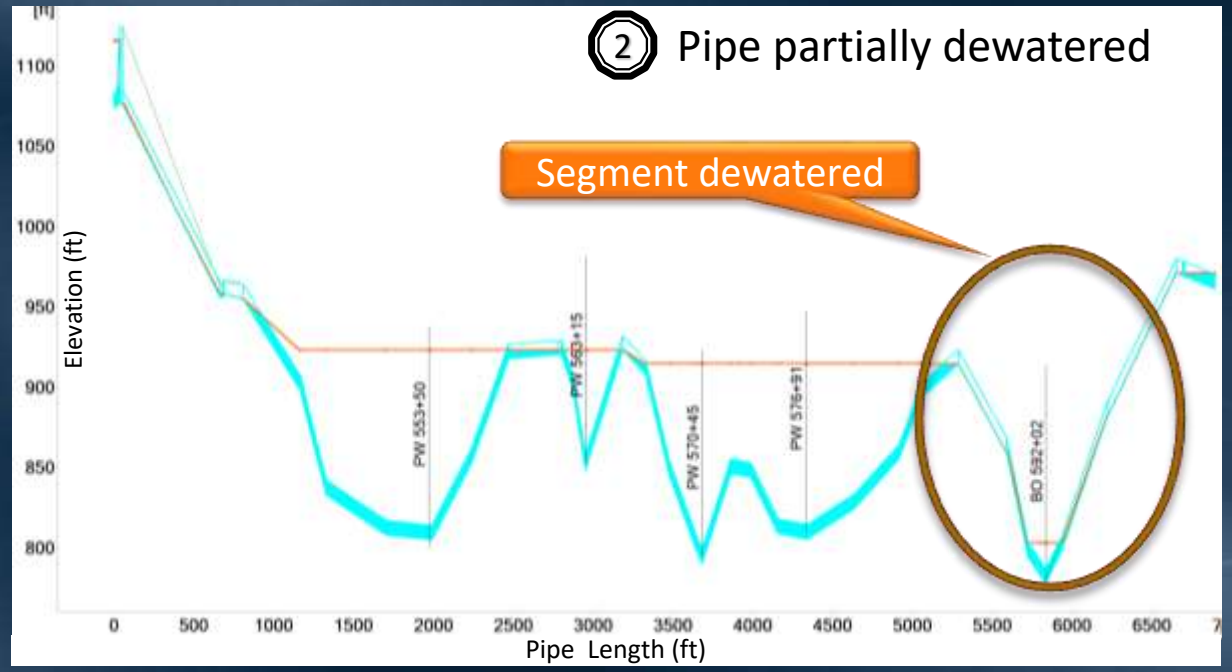
1. How long will dewatering take?
2. What is the volume released at each dewatering location?
3. What is the extent of the overland flows from the discharges?

Blow-off Location along Foothill Feeder

Unarmored Threespine Stickleback

Operations - Dewatering Estimates and Flow Paths





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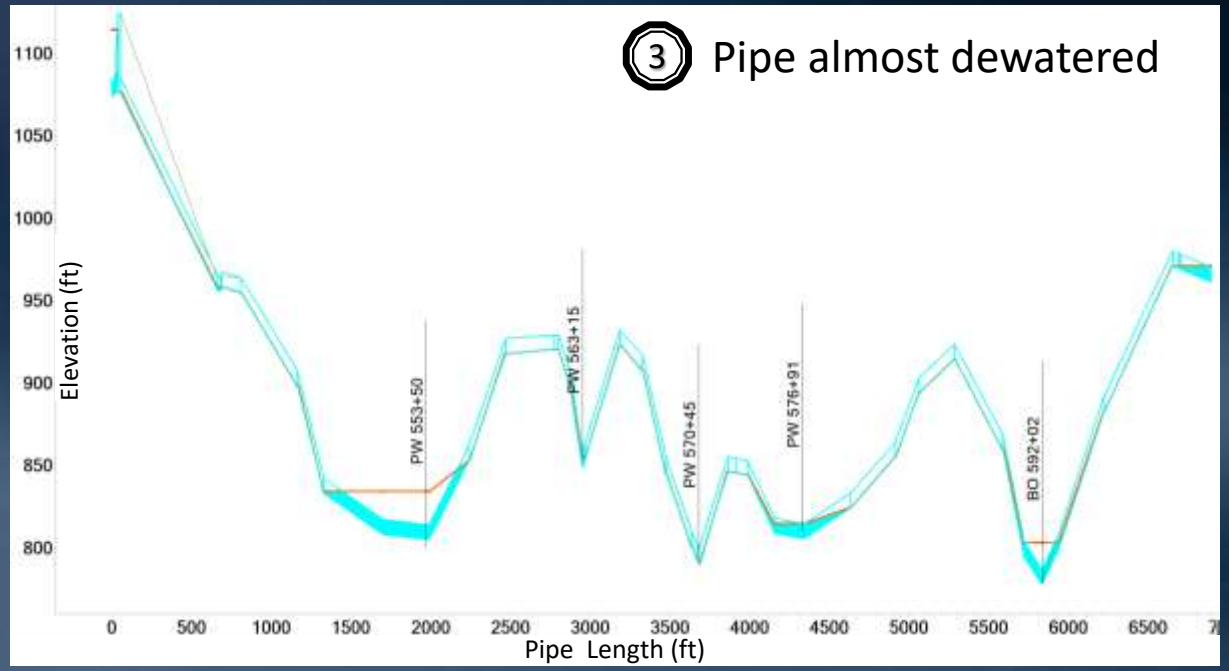

Summary

- Applications of the water distribution model
  - Provides quick results
  - Ability to holistically assess hydraulic impacts of a project
- Benefit to Member Agencies
- Future Capabilities
  - Transient analysis
  - Advanced water quality analysis
  - Real-time analysis
  - Integrate two-dimensional flood routing analysis


THE METROPOLITAN WATER DISTRICT OF
SOUTHERN CALIFORNIA
1928