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Technical Advisory Panel (TAP) for City of Santa Barbara's Subsurface Desalination Intake and Potable Reuse Feasibility Studies

PUBLIC MEETING #3

October 26, 2016

9:30 am–12:00 noon

Santa Barbara City Hall, Santa Barbara, CA

Agenda Item #1

Welcome and Introductions

Jeff Mosher, Executive Director
National Water Research Institute (NWRI)

Public Meeting Purpose

- City of Santa Barbara's Public Works Department
  - Evaluating water supply options
  - Conducting feasibility studies
- Technical Advisory Panel (TAP) review
  - Conceptual Design and Initial Technical Screening Analysis of Subsurface Desalination Intake Options
  - Regulatory and Permitting Requirements for Potable Reuse Alternatives
- TAP administered by NWRI
  - Public meeting component

About NWRI

- Based in Fountain Valley, California
- Founded in 1991
- 501c3 non-profit organization
- Water and wastewater agency members
- Purpose: to collaborate on research projects and activities that produce beneficial change and improved policy decisions

Visit www.nwri-usa.org for more information

NWRI National Water Research Institute

Agenda

1. Welcome and Introductions
2. Overview of the Panel Process
3. Presentation on Design and Initial Screening Analysis of Potable Reuse Alternatives
4. Questions from Technical Advisory Panel
5. Public Comments
6. Wrap Up and Next Steps
7. Adjourn

Resources

All materials distributed and presented at this meeting are available for download from the NWRI-Santa Barbara TAP Web Page. You may also sign up for e-mail updates on the panel's activities at:

www.nwri-usa.org/santa-barbara-panel.htm

Contact:

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sfaubl@nwri-usa.org

(714) 378-3728

Introductions

1. Panel Members
2. City of Santa Barbara staff
3. Project Team staff
4. NWRI staff

#2 Overview of the Panel Process

- Third-party review and evaluation
- Scientific and technical advice by leading experts
- Address challenging scientific questions and regulatory requirements
- Document findings and recommendations
- Assist with interactions of the public, decision makers, and regulators

Agenda Item #3

Basis of Design and Initial Screening Analysis of Potable Reuse Alternatives

Introduction by:
Joshua Haggmark
City of Santa Barbara

Presented by:
Tom Seacord and Eric Cherasia
Carollo Engineers, Inc.

Subsurface Desalination Intake & Potable Reuse Feasibility Studies

TAP Workshop #3

City of Santa Barbara, California

October 26, 2016

Engineers...Working Wonders With Water®

Agenda

- Feasibility Study Background & Objectives
- Update following TAP Workshop #2 for SSI Study
  - Comments addressed
  - Final TM 1, TM 2, TM 3 for SSI Study
- Potable Reuse (PR) Study
  - Regulatory Summary
  - Basis of Design, Alternative Development, Treatment Process Requirements, Conceptual Design
  - Initial Screening
  - Summary

Feasibility Study

Background & Objectives

Study Scope & Work Plan Objective

- **Scope of Study:** "direct staff…[to evaluate the] feasibility, cost & timeline associated with both converting the offshore facility to a subsurface intake & look at the options about potable reuse" (City Council 9/23/14)
- Scope includes:
  - Identifying feasible alternatives
- Scope excludes:
  - Determining best alternative

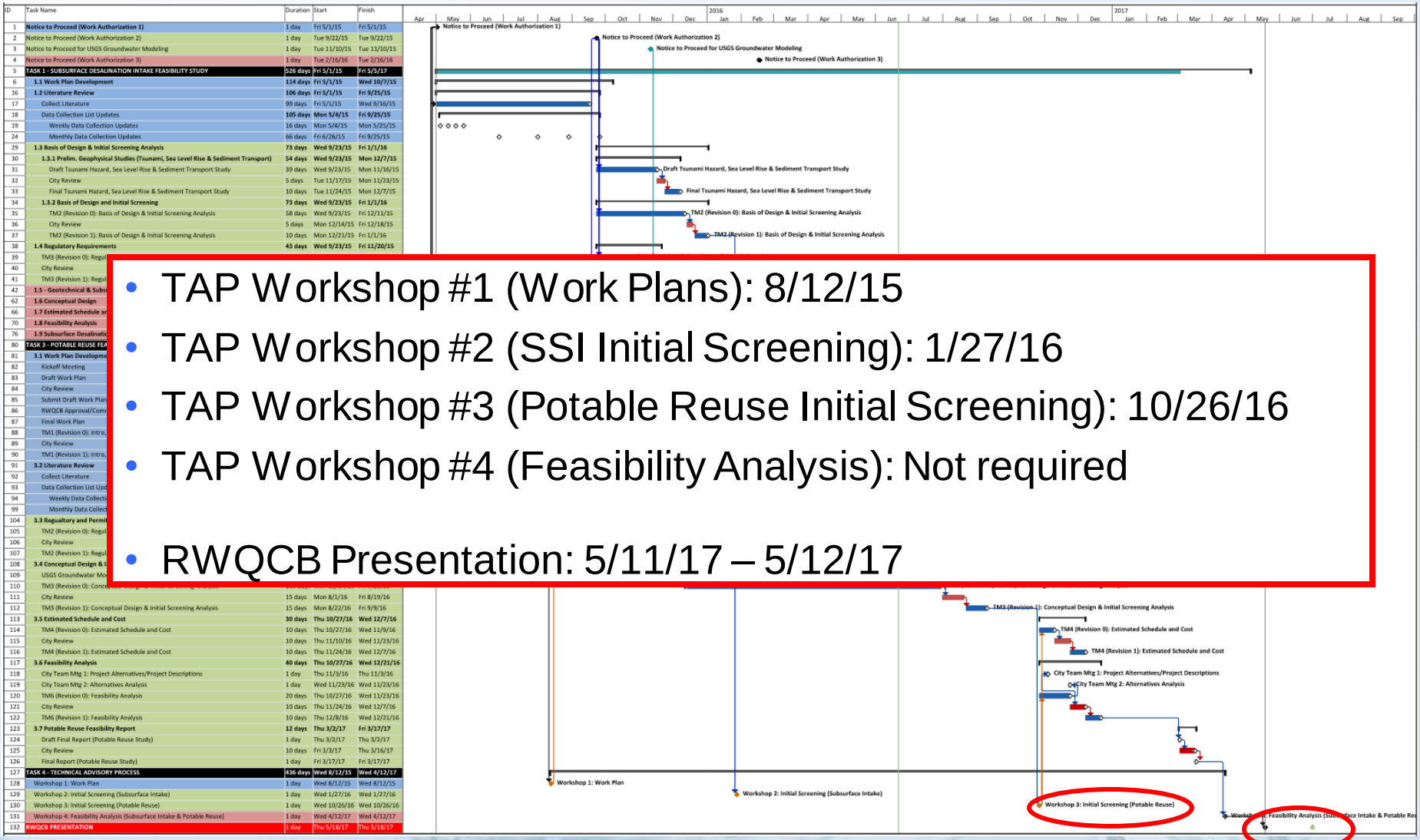
- **Work Plan Objective**: Establish the process & criteria used to evaluate feasibility

Work Plans define how the studies are to be conducted

Work Plans have 7 sections that define study methods

1. Introduction
2. Basis of Design
3. Feasibility Criteria
4. Implementation Schedule Development
5. Cost Estimating Methodology
6. Feasibility Analysis
7. Technical Advisory Process

Permit deadline drives the project schedule



- TAP Workshop #1 (Work Plans): 8/12/15
- TAP Workshop #2 (SSI Initial Screening): 1/27/16
- TAP Workshop #3 (Potable Reuse Initial Screening): 10/26/16
- TAP Workshop #4 (Feasibility Analysis): Not required
- RWQCB Presentation: 5/11/17 – 5/12/17

SSI Study Update Following TAP Workshop #2

Following January 27, 2016 TAP Workshop for SSI Study:

- Through February 11, 2016
  - Public comments accepted via email
- April 1, 2016
  - Updated documents posted to NWRI website http://www.nwri-usa.org/santa-barbara-panel.htm
    - Revised Work Plans, SSI TMs 1-3, Responses to TAP comments, Responses to Public Comments
- May 12, 2016
  - TAP responses to Public Comments posted to NWRI website
- October 11, 2016
  - Final Report: SSI Feasibility Study

Potable Reuse Study
TAP Workshop #3

Potable Reuse Study has been grouped into three TMs

- TM 1 – Introduction and Background
- TM 2 – Regulatory and Permitting Requirements
- TM 3 – Basis of Design and Initial Screening Analysis

TM 1 provides study goals and approach

- RWQCB & City Council Requirements
  - Evaluate alternatives to desalination using screened open ocean intake
- First evaluate technical feasibility
- Then, evaluate social, economic, & environmental feasibility for technically feasible alternatives
- Develop information that can inform future studies
  - Understand maximum yield that is technically feasible

Regulatory Summary

Potable Reuse Study

TM 2 presents regulatory & permitting requirements associated with PR alternatives

- Major permitting agencies include:
  - California Coastal Commission (CCC)
  - United States Environmental Protection Agency (EPA)
  - State Water Resources Control Board (SWRCB)
    - Division of Drinking Water (DDW)
    - Regional Water Quality Control Board (RWQCB)
  - Santa Barbara County Public Health Department
  - City of Santa Barbara
  - Etc.

Two types of potable reuse, defined in TM 2, are considered

Indirect Potable Reuse (IPR)

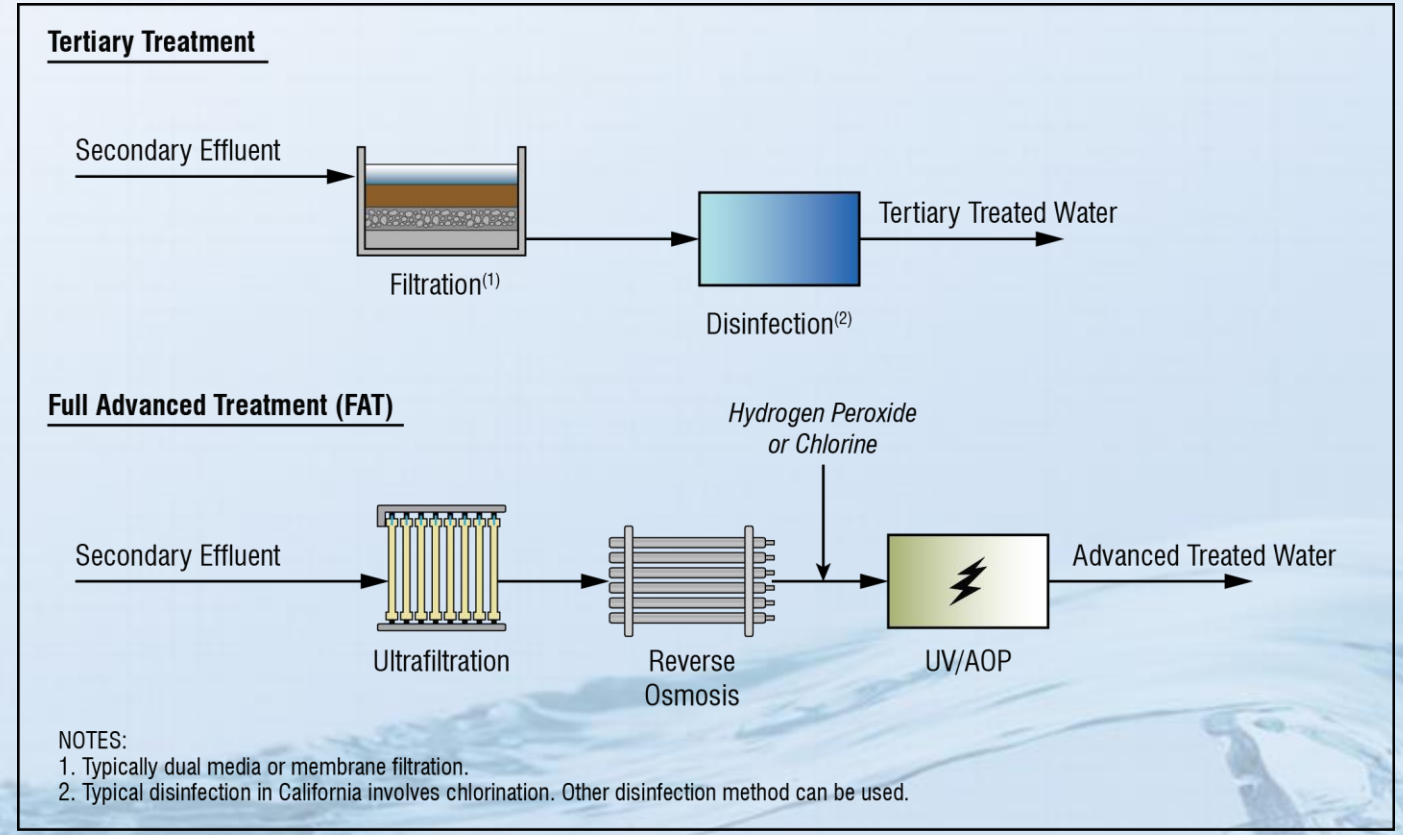
- Introduce ATW into an environmental buffer
  - Surface water body
  - Groundwater aquifer
- CCR Title 22 defines 2 types:
  1. GWR by surface application
     - Spreading basin
  2. GWR by subsurface application
     - Injection wells

Direct Potable Reuse (DPR)

- Two forms:
  1. RW Supply Augmentation
     - ATW introduced upstream of a drinking water tmt facility
  2. Direct introduction into PW system
     - AWTF permitted as drinking water tmt facility
- No regulations exist for DPR

Regulatory Requirements for IPR are stated in CCR Title 22

- GWR by Surface Application (Article 5.1)
  - At minimum, disinfected tertiary treatment
- GWR by Subsurface Application (Article 5.2)
  - Requires full advanced treatment (FAT)



Travel Time Requirements for IPR vary by application and calculation method

- Environmental buffer required:
  - Between recharge & withdrawal location
  - Provide adequate time to evaluate water quality

Minimum Travel Time Requirements for Groundwater Replenishment

Application	Travel Time Demonstrated by Added Tracer	Travel Time Demonstrated by Intrinsic Tracer	Travel Time Calculated by Darcy's Law	Travel Time Calculated by Complex Numerical Model
Surface Application - Disinfected Tertiary Water(1)	6 Months	9 Months	24 Months	12 Months
Surface Application - Advanced Treated Water(1)	2 Months	3 Months	8 Months	4 Months
Subsurface Application - Advanced Treated Water(2)	2 Months	3 Months	8 Months	4 Months

Notes:
(1) Title 22, Article 5.1.
(2) Title 22, Article 5.2.

Regulatory Status for DPR continues to evolve

- CA has not adopted regulations at this time
- DPR guidelines published – serve as starting point
- DPR projects will likely incorporate:
  - Log reduction in excess of Title 22 requirements
    - (i.e., 14/12/12 – log enteric virus, Giardia, Cryptosporidium reduction)
  - Additional barriers for trace pollutants
  - Enhanced monitoring
  - Engineered storage
    - Allow each key process to be monitored and quality verified prior to distribution
    - Provide "Failure and Response Time" (FRT)

Environmental, regulatory, & permitting requirements for developing PR alternatives

- Two central permitting documents (IPR projects)
  - Engineering Report
    - Public health protection
  - Report of Waste Discharge (ROWD)
    - Protection of surface/ground water quality
- Environmental Review
  - CEQA
  - Update LTWSP and programmatic EIR
- Regulatory Requirements & Permitting
  - 8 regulatory bodies
  - 12 requirements/permits were identified

Basis of Design

Potable Reuse Study

Basis of Design for technical feasibility is determined by the following factors:

- Potable reuse application
  - (i.e., IPR vs. DPR)
- Water quality and treatment needs
- Treated water production capacity
- Subsurface properties and hydrogeologic considerations
- Available project sites
- Project life
- Reliability features

PR Application

- **IPR**: GWR by Surface & Subsurface Application
  - Foothill Basin
  - Storage Unit 1
- **DPR**: Raw water supply augmentation
  - Cater WTP (Lauro Reservoir)
  - Charles E Meyer Desalination Plant
  - New WTP

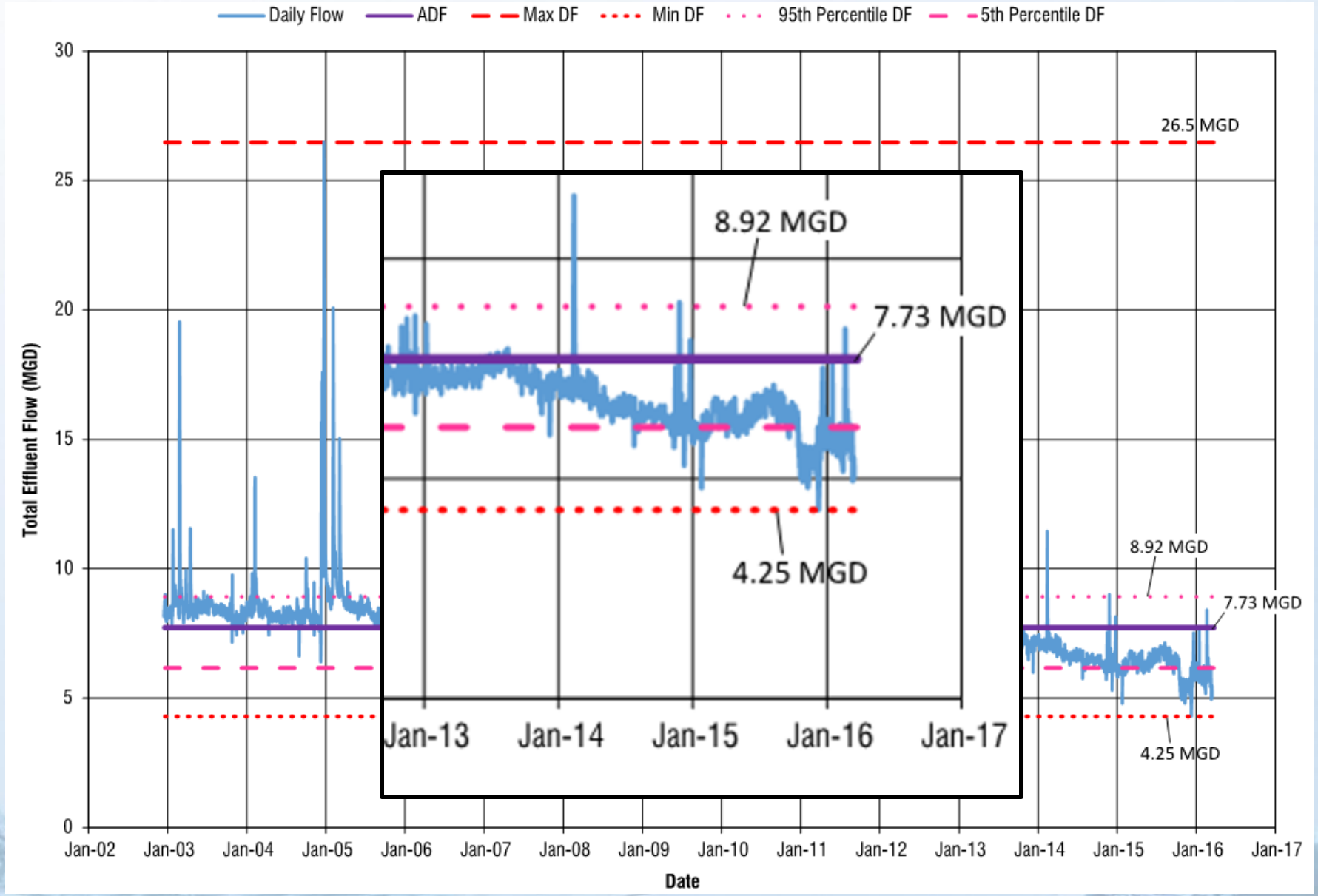
WQ and Treatment Requirements

- **IPR**: GWR by Surface Application
  - Tertiary treatment
- **IPR**: GWR by Subsurface Application
  - FAT
- **DPR**: Raw water supply augmentation
  - 14/12/12 log reduction
  - Engineered storage
  - Enhanced monitoring

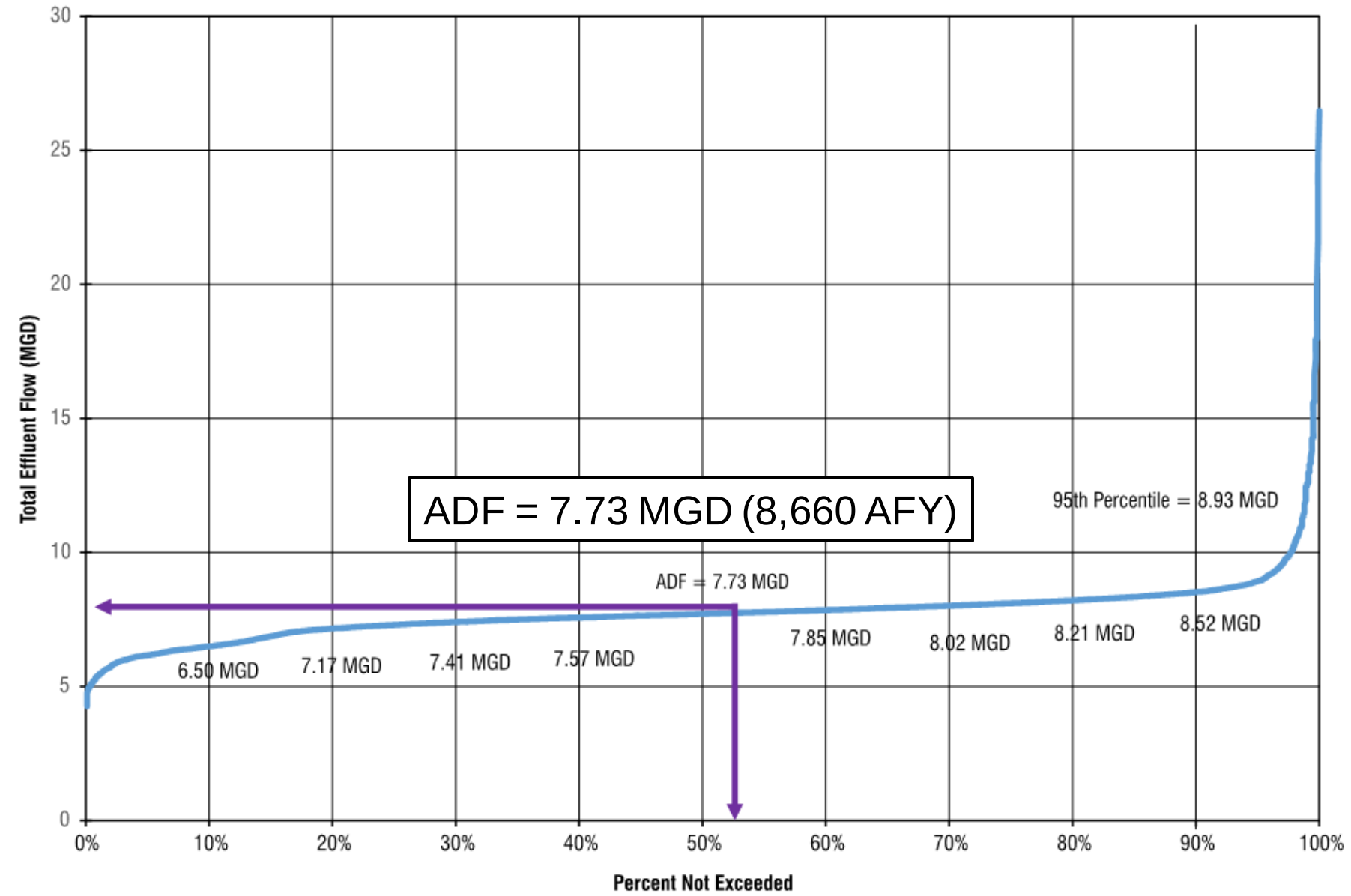
Target production capacity is specified in the Work Plan

- Yield based on City's permitted desalination plant capacity
  - 10,000 AFY
- City produces 1,400 AFY of NPR water
  - PR alts cannot impact NPR production
- Combined PR and NPR production capacity
  - 11,400 AFY
- El Estero WWTP Flow Characterization
  - Annual, daily, and hourly flows

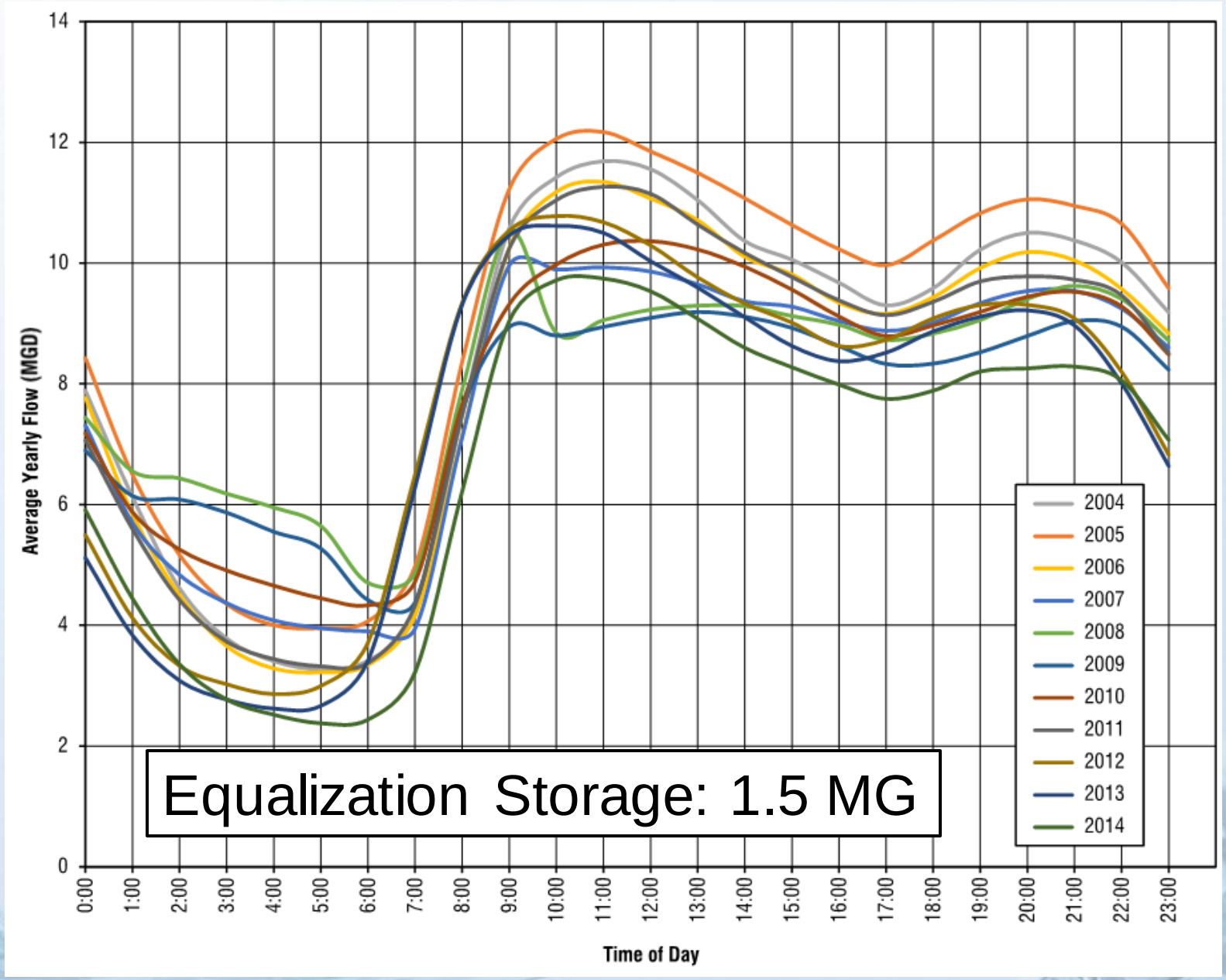
El Estero WWTP Daily 2nd Effluent Flows



WWTP Flows – Percent Not Exceeded



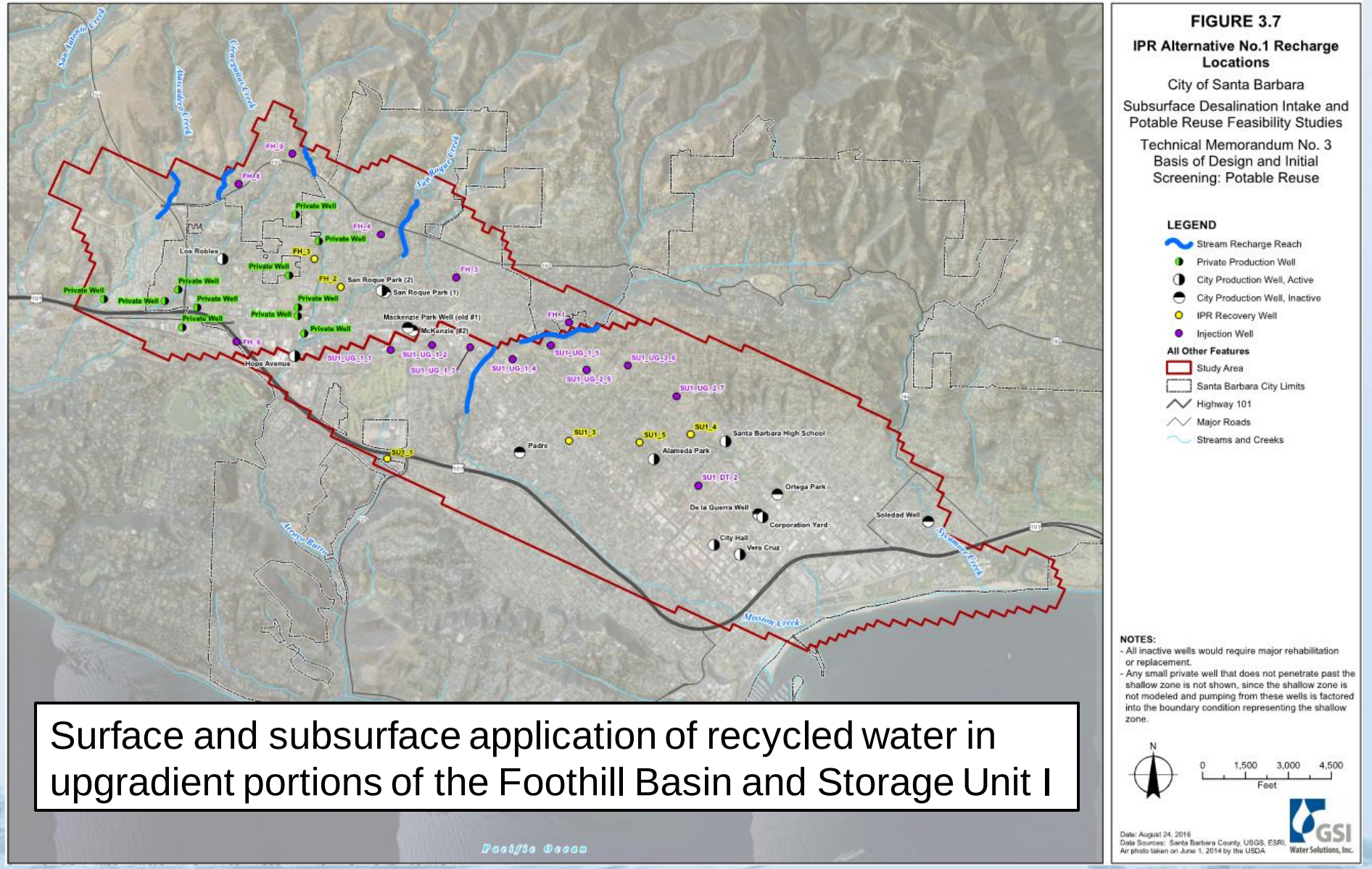
WWTP Flows – Diurnal Variation



Subsurface/hydrogeologic properties determined by:

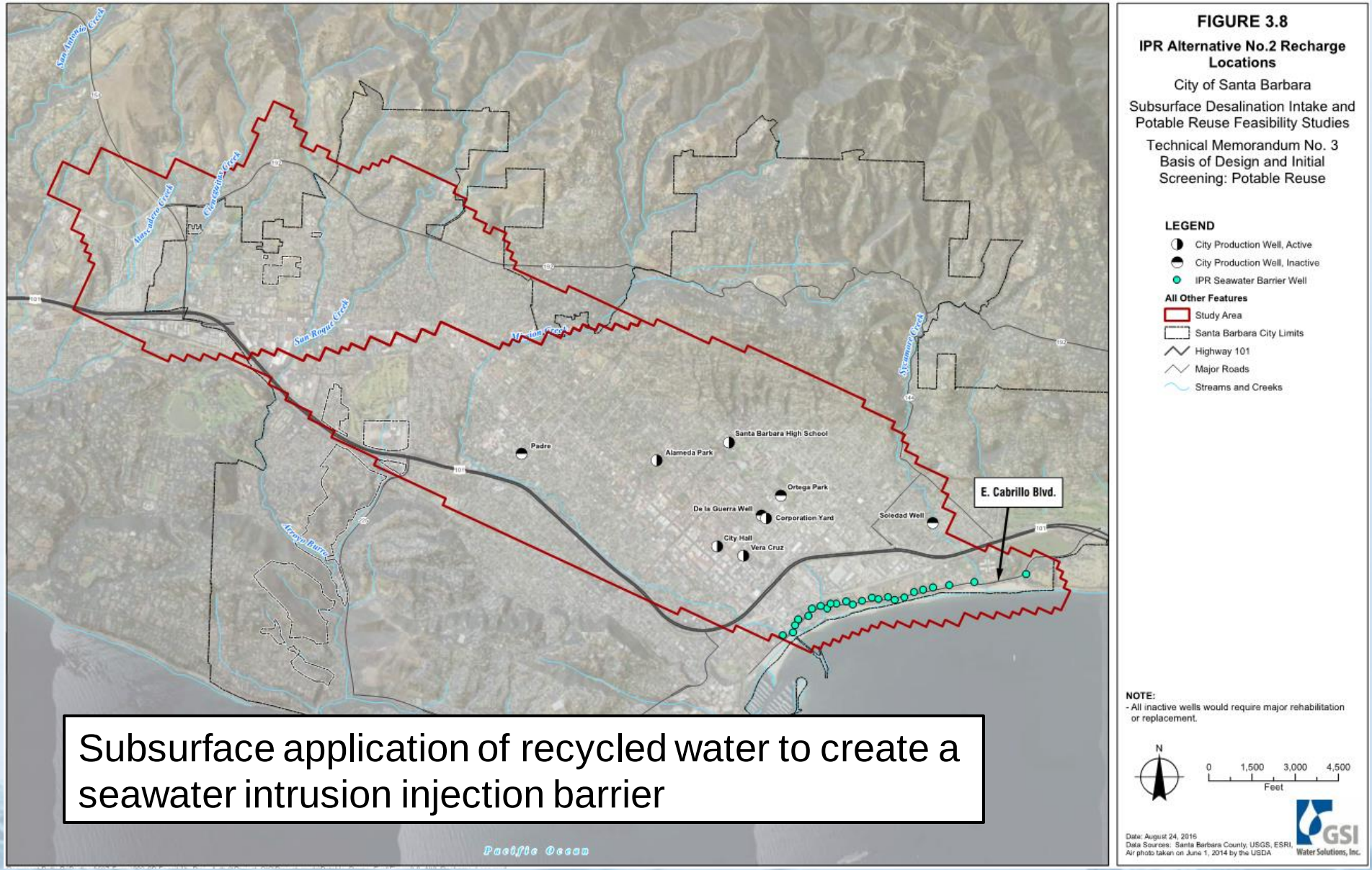
- Literature review
  - Assess subsurface properties
  - Potential recharge rates and basin wide responses
- Evaluation of analysis inputs
  - Aquifer and aquitard properties
  - Groundwater recharge and discharge
  - Well production rates
  - Injection rates
  - Percolation volumes

Project Sites – IPR Alternative No. 1



Surface and subsurface application of recycled water in upgradient portions of the Foothill Basin and Storage Unit I

Project Sites – IPR Alternative No. 2



Subsurface application of recycled water to create a seawater intrusion injection barrier

Hydrogeologic Analysis of IPR Alternatives

Potable Reuse Study

Hydrogeologic Evaluation Approach

- Draft Santa Barbara Groundwater Flow and Transport Model (SBFTM)
  - Prepared by USGS
  - Developed for City's LTWSP
- Iterative process for both implementation approaches
  - GWR increased with/without IPR recovery pumping
  - Until constraints could not be met

Without increased pumping, recharge volumes are limited

Calendar Year	Storage Unit I			Foothill Basin			Total RW Recharge Both Basins
	Surface Percolation	Injection	Total RW Recharge	Surface Percolation	Injection	Total RW Recharge	
1987	37	0	37	244	0	244	281
1988	38	0	38	250	0	250	288
1989	41	0	41	269	0	269	310
1990	41	0	41	267	0	267	308
1991	35	0	35	227	0	227	262
1992	32	0	32	211	0	211	243
1993	20	0	20	133	0	133	153
1994	34	0	34	224	0	224	259
1995	21	0	21	140	0	140	162
1996	31	0	31	205	0	205	236
1997	32	0	32	213	0	213	245
1998	22	0	22	142	0	142	164
1999	40	0	40	261	0	261	301
2000	34	0	34	222	0	222	256
2001	28	0	28	184	0	184	212
2002	40	0	40	263	0	263	303
2003	38	0	38	253	0	253	291
						Min	**153**
						Ave	**251**
						Max	**310**

Notes:
All values reported in acre-feet per year (AFY)
RW = recycled water

Recharge volumes increase with pumping

Calendar Year	Storage Unit I			Foothill Basin			Total RW Recharge Both Basins
	Surface Percolation	Injection	Total RW Recharge	Surface Percolation	Injection	Total RW Recharge	
1987	322	4,490	4,812	505	2,628	3,133	7,945
1988	331	4,490	4,821	519	2,628	3,147	7,968
1989	356	4,490	4,845	557	2,628	3,185	8,030
1990	354	4,490	4,843	554	2,628	3,182	8,025
1991	301	4,490	4,790	472	2,628	3,100	7,890
1992	279	4,650	4,928	437	2,628	3,065	7,993
1993	176	4,490	4,665	275	2,628	2,903	7,569
1994	297	4,785	5,082	465	2,628	3,093	8,176
1995	186	5,437	5,623	291	2,628	2,919	8,542
1996	271	5,585	5,855	424	2,628	3,052	8,907
1997	282	5,585	5,866	442	2,628	3,070	8,936
1998	188	5,585	5,772	294	2,628	2,922	8,695
1999	345	5,585	5,930	541	2,628	3,169	9,099
2000	294	5,585	5,878	461	2,628	3,089	8,967
2001	243	5,585	5,828	381	2,628	3,009	8,837
2002	347	5,585	5,932	544	2,628	3,172	9,104
2003	334	5,585	5,919	524	2,628	3,152	9,071
						Min	**7,569**
						Ave	**8,456**
						Max	**9,104**

Available WWTP ADF = 8,660 AFY
Available ATW (80% RO Recovery) = 6,928 AFY

Impact to Sensitive Habitats and shallow GW contamination

- **IPR: GWR by Surface Application**
  - Increased GW levels impact sensitive vegetation
  - Increased surface water flow creates riparian/wetland areas
  - Changes in water quality (existing areas)
  - Recharge reaches are coincident w/ sensitive habitats
  - May mobilize shallow aquifer contamination

Surface application increases risk of geologic hazards

- ***Liquefaction***
  - Affected by rising water levels/head
- ***Slope failure***
  - Some recharge reaches within hazard areas
  - Changes in shallow zone groundwater may increase slope failure
- ***High groundwater in shallow zone***
  - Moisture intrusion
  - Buoyancy forces

Negative effects make surface application not feasible

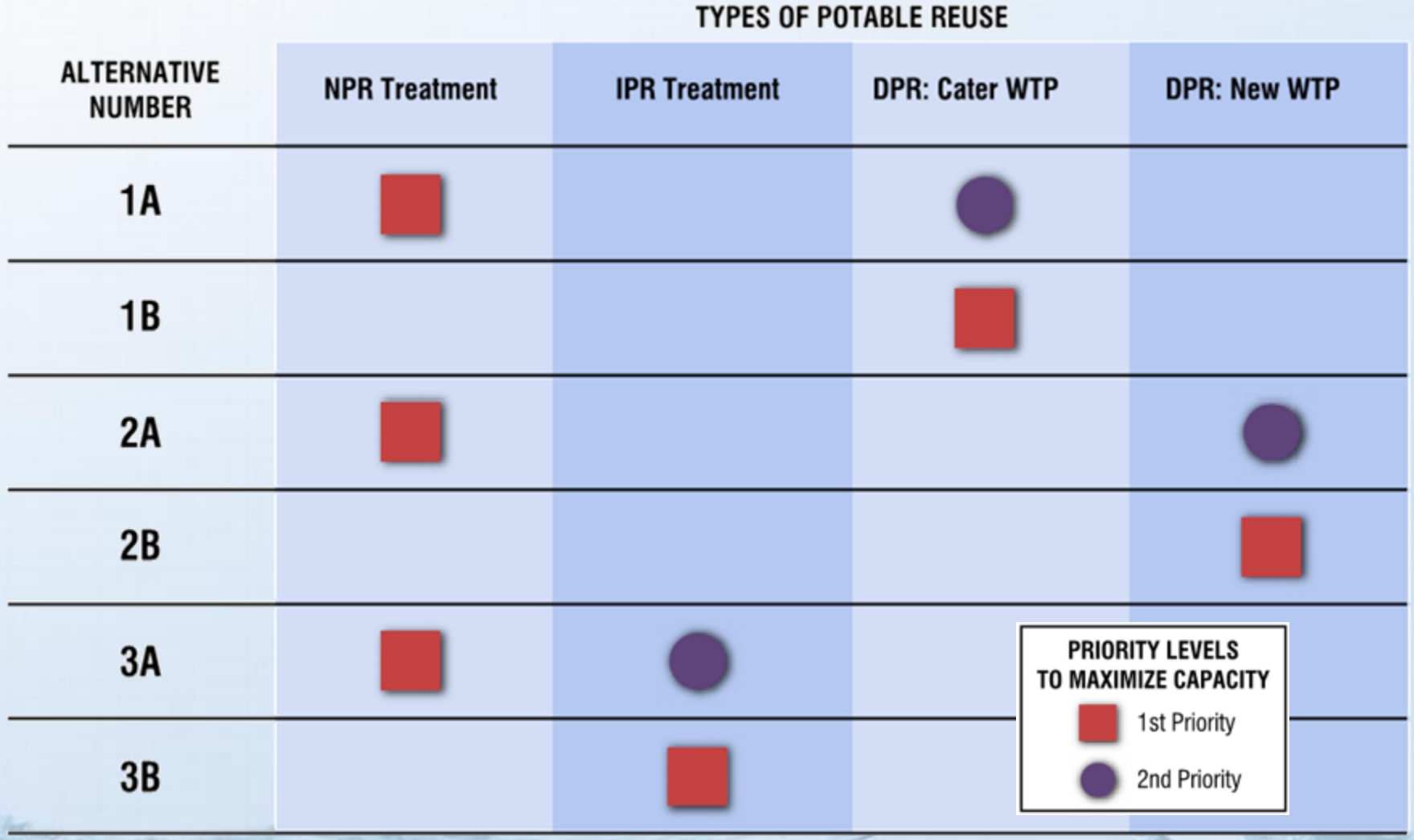
Calendar Year	Storage Unit I			Foothill Basin			Total RW Recharge Both Basins
	Surface Percolation	Injection	Total RW Recharge	Surface Percolation	Injection	Total RW Recharge	
1987	0	4,490	4,490	0	2,628	2,628	7,118
1988	0	4,490	4,490	0	2,628	2,628	7,118
1989	0	4,490	4,490	0	2,628	2,628	7,118
1990	0	4,490	4,490	0	2,628	2,628	7,118
1991	0	4,490	4,490	0	2,628	2,628	7,118
1992	0	4,650	4,650	0	2,628	2,628	7,278
1993	0	4,490	4,490	0	2,628	2,628	7,118
1994	0	4,785	4,785	0	2,628	2,628	7,413
1995	0	5,437	5,437	0	2,628	2,628	8,065
1996	0	5,585	5,585	0	2,628	2,628	8,213
1997	0	5,585	5,585	0	2,628	2,628	8,213
1998	0	5,585	5,585	0	2,628	2,628	8,213
1999	0	5,585	5,585	0	2,628	2,628	8,213
2000	0	5,585	5,585	0	2,628	2,628	8,213
2001	0	5,585	5,585	0	2,628	2,628	8,213
2002	0	5,585	5,585	0	2,628	2,628	8,213
2003	0	5,585	5,585	0	2,628	2,628	8,213
						Min	**7,118**
						Ave	**7,715**
						Max	**8,213**

Available WWTP ADF = 8,660 AFY
Available RW (80% RO Recovery) = 6,928 AFY

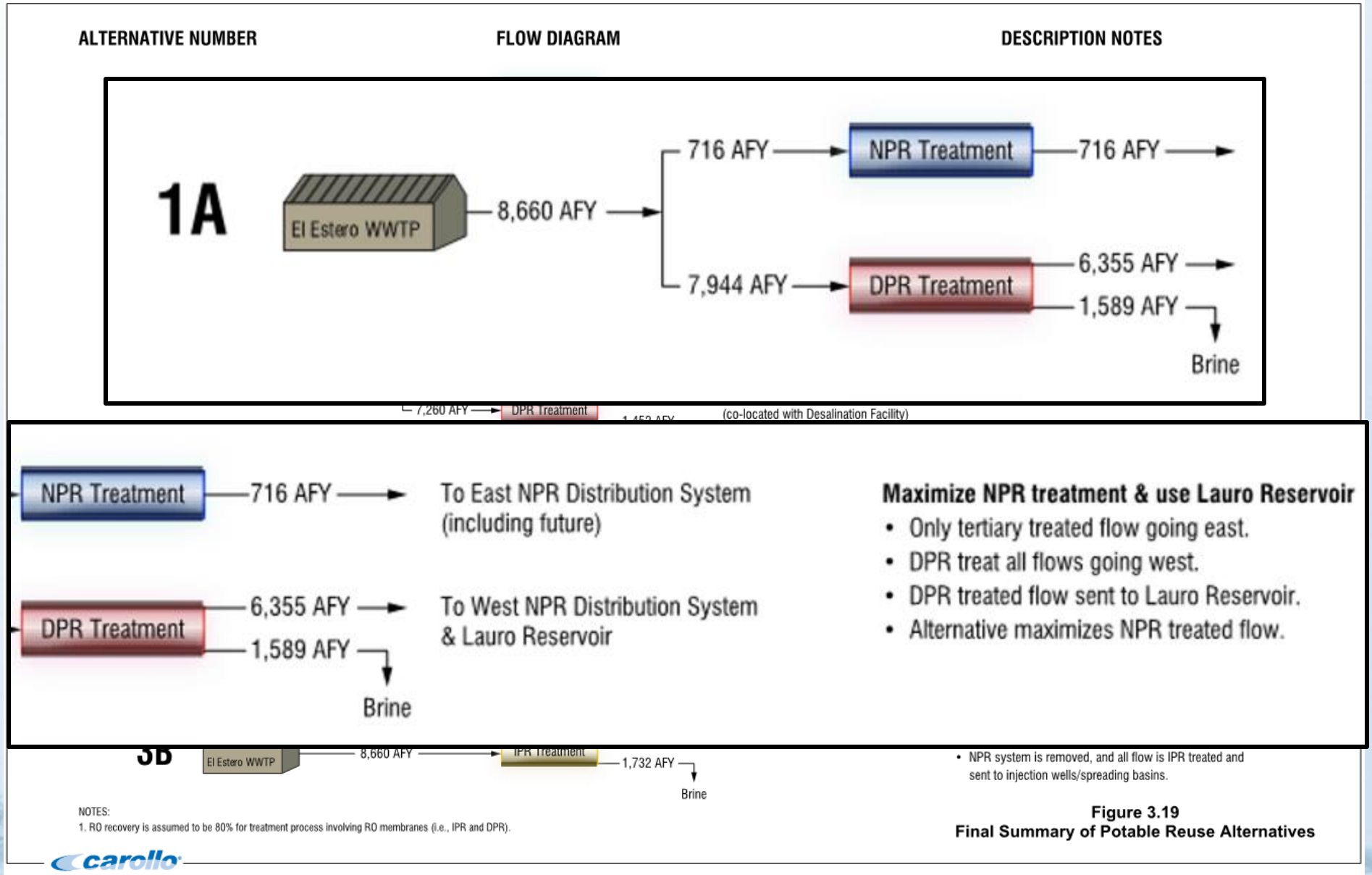
Summary of Potable Reuse Alternatives

Potable Reuse Study

Alternatives optimize contributions to NPR, IPR, & DPR



Final summary of PR alternatives



Dilution of intake water at Desalination Plant discounted after initial analysis

- Advanced treatment @ AWTF still required
- Recovery of desalination plant remains unchanged (i.e., 45%)
  - Intake water salinity from 34,451 to 25,754 mg/L.
  - 55% loss of AWTF product water
- Better utilization of El Estero WWTP effluent with construction of new WTP or using Cater WTP

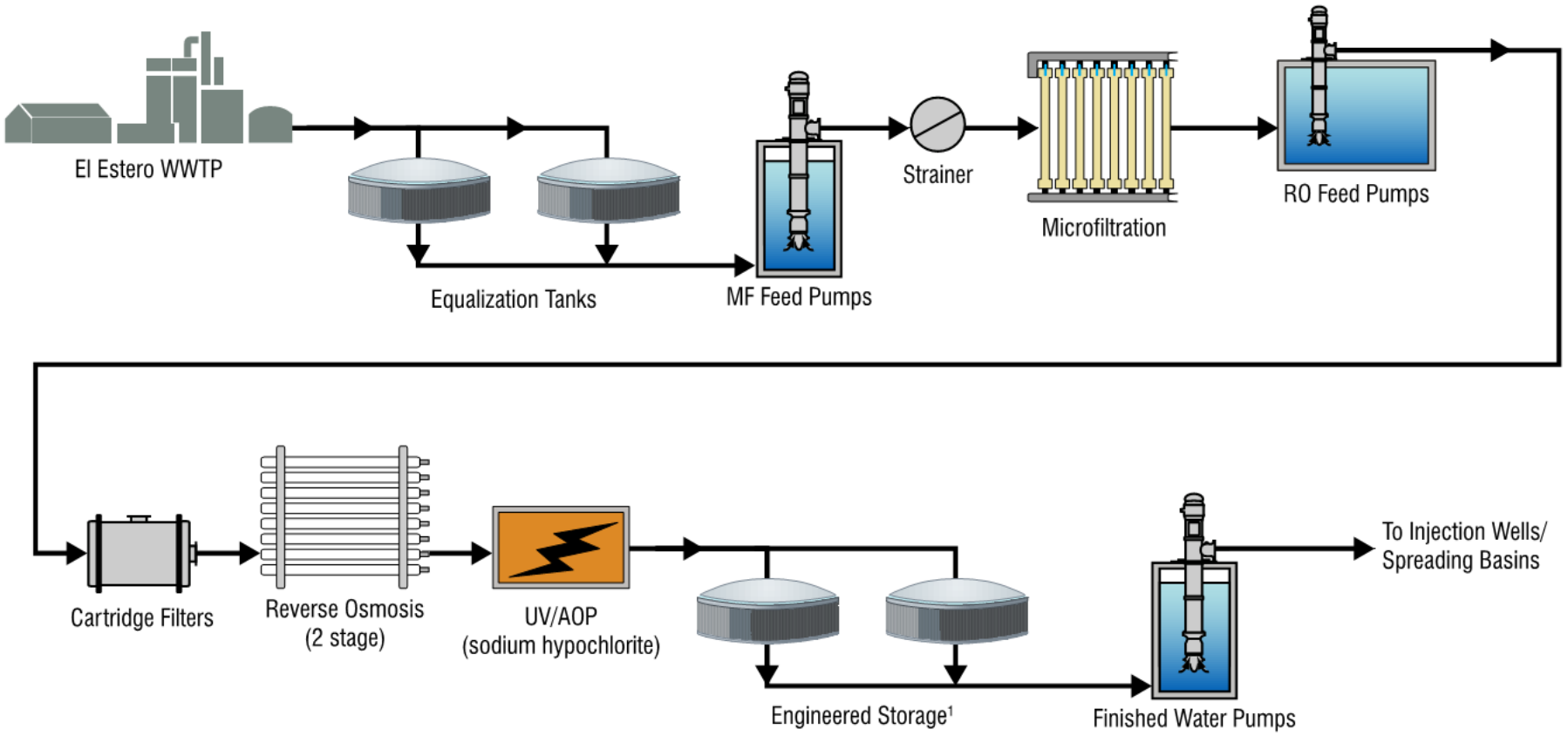
Treatment Process Selection

Potable Reuse Study

Non-Potable Reuse (NPR)

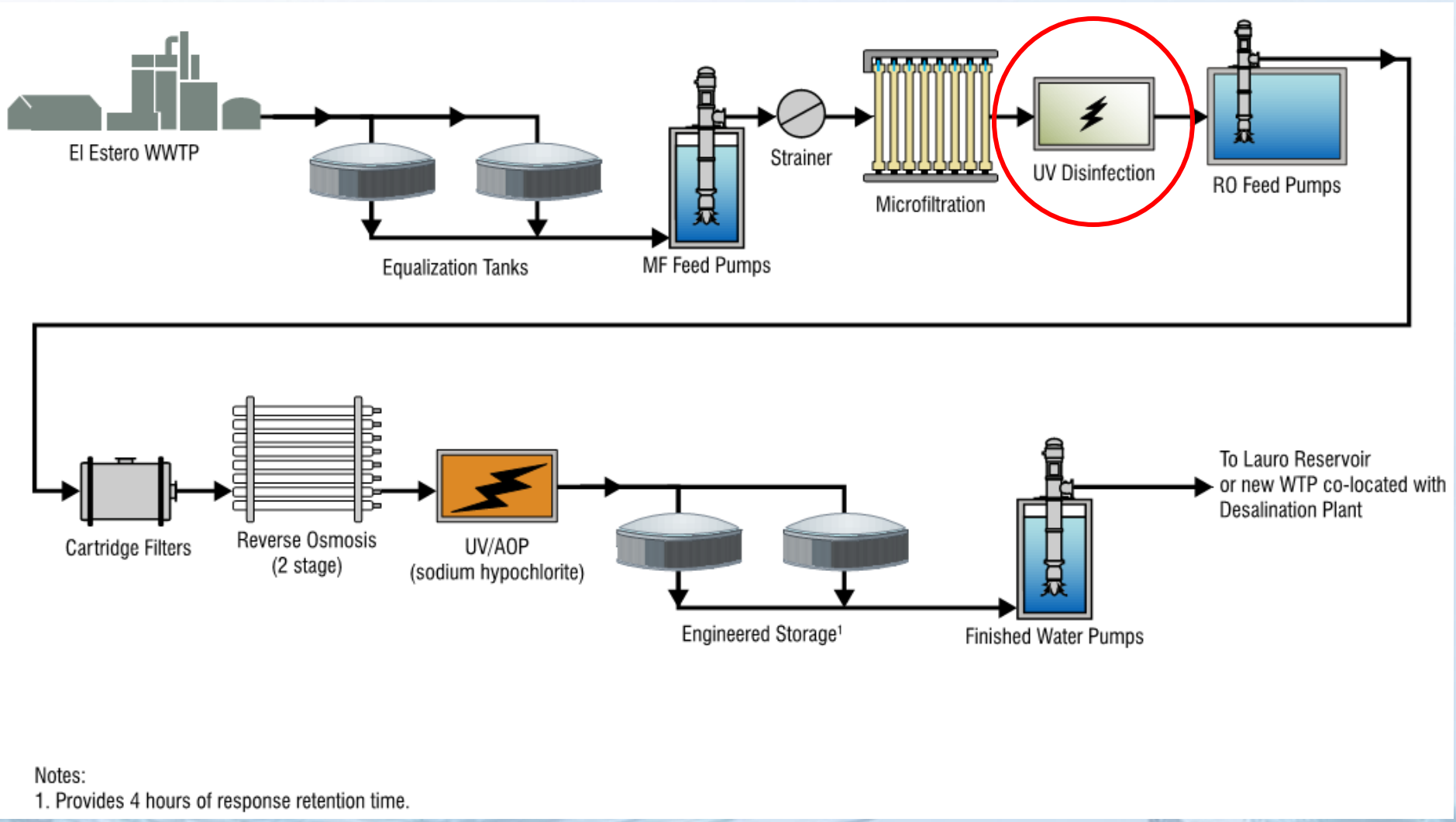
- Currently practiced by City
- Secondary effluent treated with MF & chlorination
- For study, it is assumed that NPR facilities will be relocated to Annex Yard
  - Incorporated into new IPR or DPR AWTF
  - Free up space at El Estero WWTP site
  - Consolidation of treatment equipment & operations expertise

IPR process is dictated by Title 22 requirements



Notes:
1. Provides 4 hours of response retention time.

DPR process based on most recent regulatory activity and precedents in CA

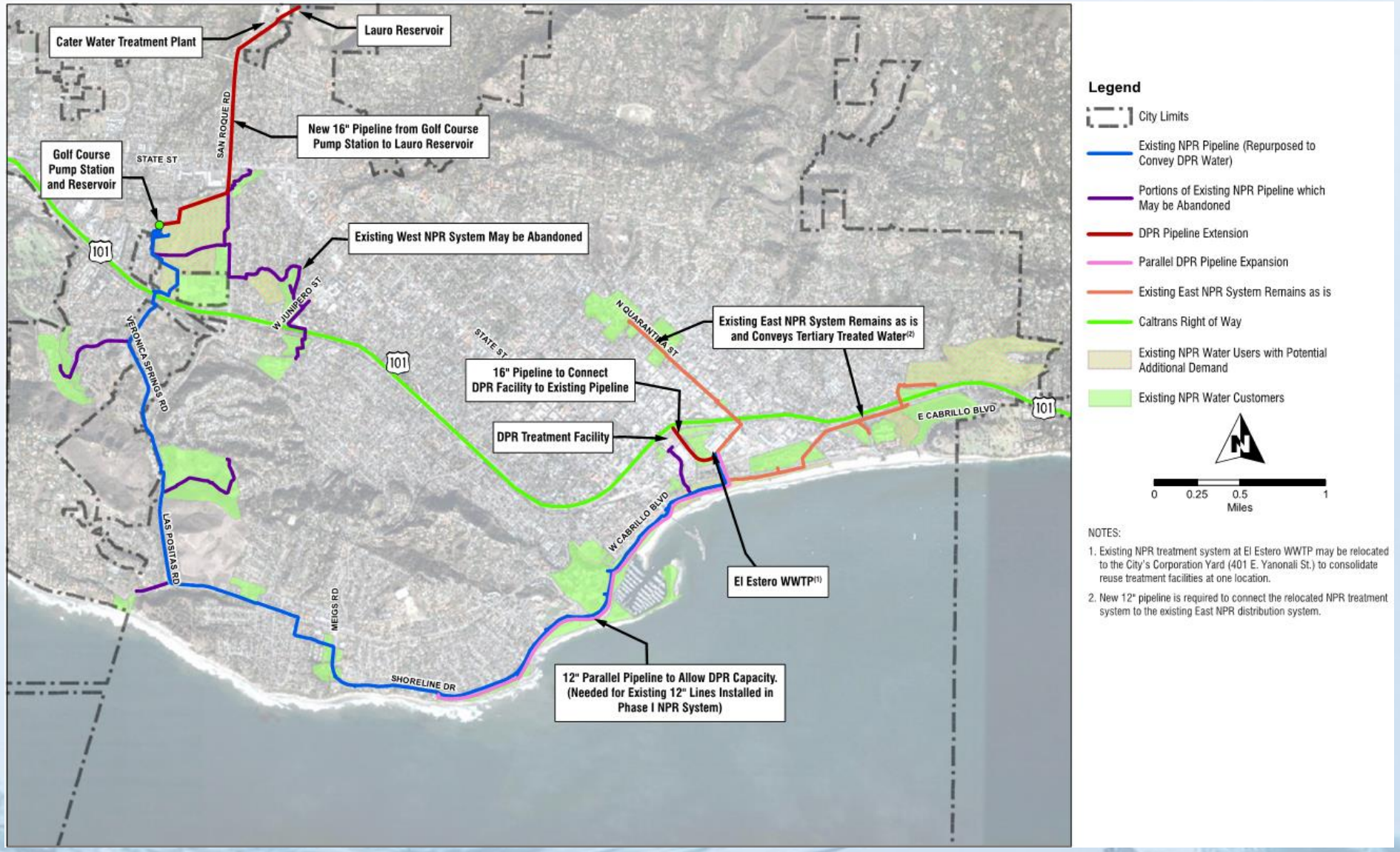


Notes:
1. Provides 4 hours of response retention time.

Conceptual Design Summary

Alternatives & Project Descriptions

Alternative 1A – Pipeline Alignment



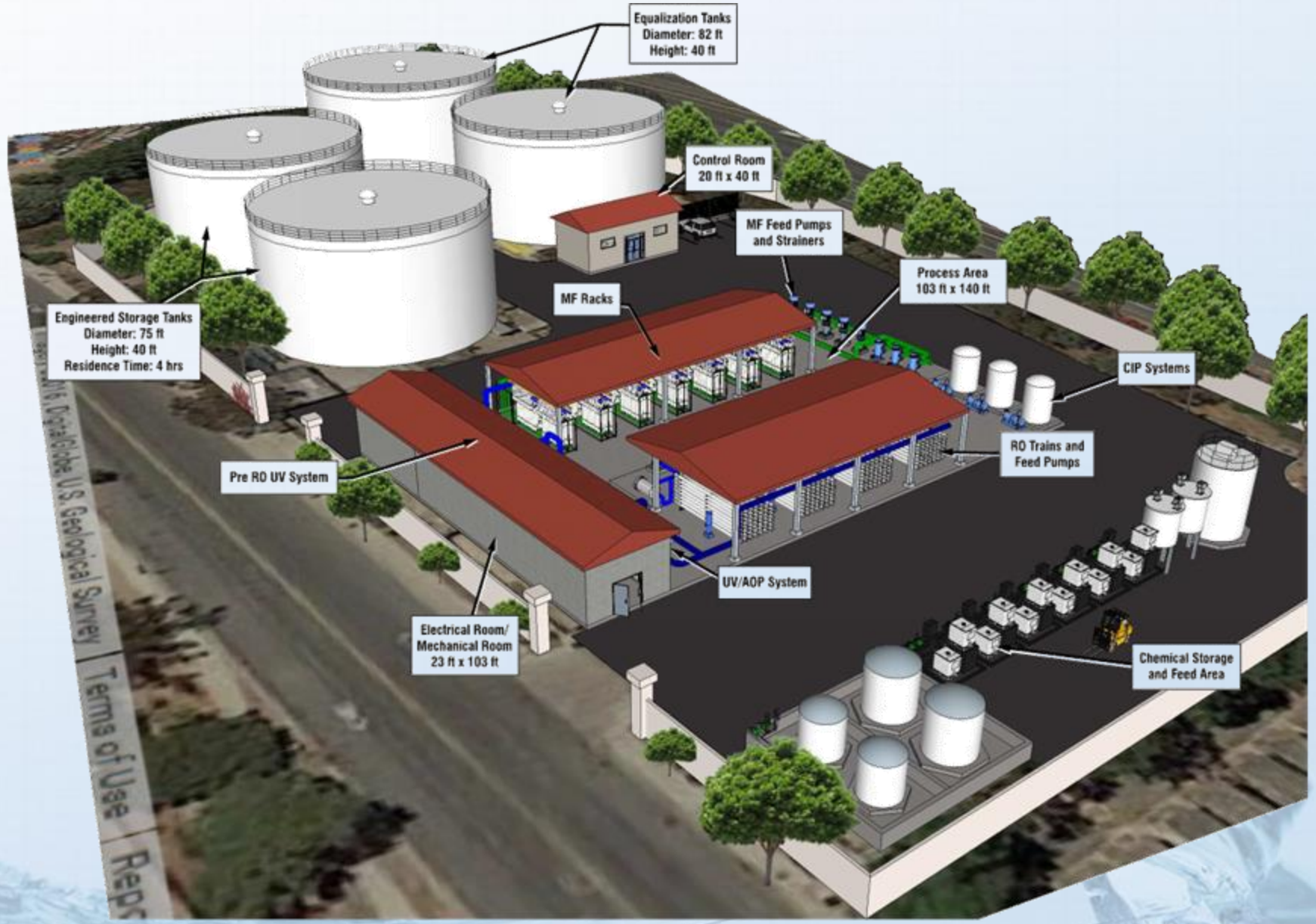
Summary of Potential Maximum Yields

Alternative Number	Potential Maximum Yields (AFY) NPR Yield	IPR Yield	DPR Yield	Total Yield
Alt. 1A	716	0	6,355	7,071
Alt. 1B	0	0	6,928	6,928
Alt. 2A	1,400	0	5,808	7,208
Alt. 2B	0	0	6,928	6,928
Alt. 3A	1,400	5,808	0	7,208
Alt. 3B	0	6,928	0	6,928

Conceptual Design Summary

Advanced Water Treatment Facility

AWTF sited on Annex Yard property



Initial Screening & Summary

Potable Reuse Study

PR Study Initial Screening Criteria

- Criteria were presented in Work Plan
  - Geotechnical Hazards
  - Hydrogeologic Factors (IPR Alts only)
  - Oceanographic Factors
  - Presence of Sensitive Habitats
  - Design and Construction Constraints

- Approved by RWQCB October 20, 2015

Initial screening results

	Initial Screening Criteria	Potable Reuse Alternative					
		Alternative 1A	Alternative 1B	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B
Geotechnical Hazards							
1	**Seismic Hazard**						
a.	Project facilities would cross a known fault line, or be exposed to a seismic hazard that could otherwise not be protected from loss by design	PF	PF	PF	PF	PF	PF
Hydrogeologic Factors							
2	**Operation of groundwater replenishment facilities (i.e., injection wells or spreading basin) adversely impacts existing fresh water aquifers, local water supplies or existing water users.**						
a.	Insufficient travel time (e.g., < 2 months) between groundwater replenishment point and other groundwater users.	PF(4)	PF(4)	PF(4)	PF(4)	PF	PF
3	**Operation of groundwater replenishment facilities (i.e., injection wells or spreading basin) adversely impacts sensitive habitats such as marshlands, drainage areas, etc.**						
a.	Operation of facility adversely changes water quality of habitat (e.g., salt water habitat becomes fresh water).	PF(4)	PF(4)	PF(4)	PF(4)	PF(5)	PF(5)
4	**Insufficient storage space**						
a.	Groundwater basin lacks adequate storage capacity to receive 10,000 AFY (or 11,400 AFY) at build-out	PF(4)	PF(4)	PF(4)	PF(4)	PF*	PF*
b.	Groundwater replenishment of IPR water causes loss of ability to adequately manage the groundwater basin (e.g., artesian or flooding conditions, loss of stored water, etc.)	PF(4)	PF(4)	PF(4)	PF(4)	PF	PF
c.	Groundwater replenishment of IPR water does not result in an increase in total basin yield and overall yield of 10,000 AFY (or 11,400 AFY).	PF(4)	PF(4)	PF(4)	PF(4)	PF*	PF*
Oceanographic Factors							
5	**Sea level rise or tsunami hazard**						
a.	Oceanographic hazards make aspects of the project infrastructure vulnerable in a way that cannot be protected and/or would prevent the City from being able to receive funding or insurance for this concept	PF	PF	PF	PF	PF	PF

Notes:
1) NF = Not Feasible
2) PF = Potentially Feasible
3) PF* = Potentially Feasible, but does not meet current study goals
4) Potentially feasible because alternative does not include an IPR component. Thus, this initial screening criteria is not applicable.
5) Additional study will be required to locate groundwater replenishment wells at locations that will not adversely affect sensitive areas or other users.

Initial screening results (continued)

Initial Screening Criteria		Potable Reuse Alternative					
		Alternative 1A	Alternative 1B	Alternative 2A	Alternative 2B	Alternative 3A	Alternative 3B
Presence of Sensitive Habitats							
6	**Habitat creation**						
a.	Facility creates habitat that is unsustainable (i.e., requires continued discharge by IPR or DPR facility) or adversely affects local ecosystem	PF	PF	PF	PF	PF	PF
Design and Construction Issues							
7	**Adequate capacity**						
a.	Availability of effluent needed to produce 10,000 AFY (or 11,400 AFY) of recycled water at build-out	PF*	PF*	PF*	PF*	PF*	PF*
b.	IPR or DPR production capacity and/or aquifer losses result in less than 10,000 AFY (or 11,400 AFY) of production at build-out	PF*	PF*	PF*	PF*	PF*	PF*
8	Lack of adequate land required for IPR or DPR treatment facilities or groundwater replenishment facilities						
a.	Surface area needed for footprint of IPR or DPR treatment facilities or groundwater replenishment facilities is greater than what is available.	PF	PF	PF	PF	PF	PF
b.	Requires condemnation of property for new injection well facilities.	PF(4)	PF(4)	PF(4)	PF(4)	PF	PF
Passes Initial Screening? Yes (Y) or No (N)		N	N	N	N	N	N
Regulations Exist in CA? Yes (Y) of No (N)		N	N	N	N	Y	Y

Notes:
1) NF = Not Feasible
2) PF = Potentially Feasible
3) PF* = Potentially Feasible, but does not meet current study goals
4) Potentially feasible because alternative does not include an IPR component. Thus, this initial screening criteria is not applicable.
5) Additional study will be required to locate groundwater replenishment wells at locations that will not adversely affect sensitive areas or other users.

None of the PR alternatives met study goals & survived initial screening

- Four alternatives passed all initial screening criteria, except for one – adequate capacity
  - Limited availability of effluent from El Estero WWTP
  - Unable to produce 10,000 AFY (or 11,400 AFY)
- IPR alternatives failed additional criteria
  - Insufficient storage capacity in Storage Unit 1 and Foothills Basin
  - Regardless of available effluent

Several alternatives discounted from further study prior to initial screening

- *Use of AWTF product water for diluting intake water at desalination plant*
  - Low recovery rate and high product water loss
- *IPR Alternative No. 2*
  - Seawater intrusion barrier was not effective
- *IPR by surface application (i.e., spreading)*
  - Liquefaction, slope failure, high groundwater, mobilization/capture of contamination, impacts to sensitive habitats
  - Small potential recharge

Potable Reuse Study provides valuable information for future City planning efforts

- City anticipates updating its LTWSP
  - Incorporate current drought
  - Pending Cachuma environmental decisions
  - Pending re-assessment of Cachuma operational yield
  - PR alternatives can be further evaluated in the LTWSP, along with other potential options

Agenda Item #4

Questions from Technical Advisory Panel on the Work Plans presented

Moderated by Amy Childress, Ph.D.
TAP Chair

Agenda Item #5

Public Comments

Moderated by Jeff Mosher, NWRI

Written comments may also be submitted electronically until midnight on November 2, 2016, to: sfaubl@nwri-usa.org

Agenda Item #6

Wrap-Up and Next Steps

Moderated by Jeff Mosher, NWRI

Resources

All materials distributed and presented at this meeting are available for download from the NWRI-Santa Barbara TAP Web Page. You may also sign up for e-mail updates on the panel's activities at:

www.nwri-usa.org/santa-barbara-panel.htm

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Adjourn Meeting #3

To download reports and to subscribe to e-mail updates on this project, go to www.nwri-usa.org/santa-barbara-panel.htm