Water Supply Update

City of West Palm Beach

January 24, 2019

WPB

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Overview of West Palm Beach Water System

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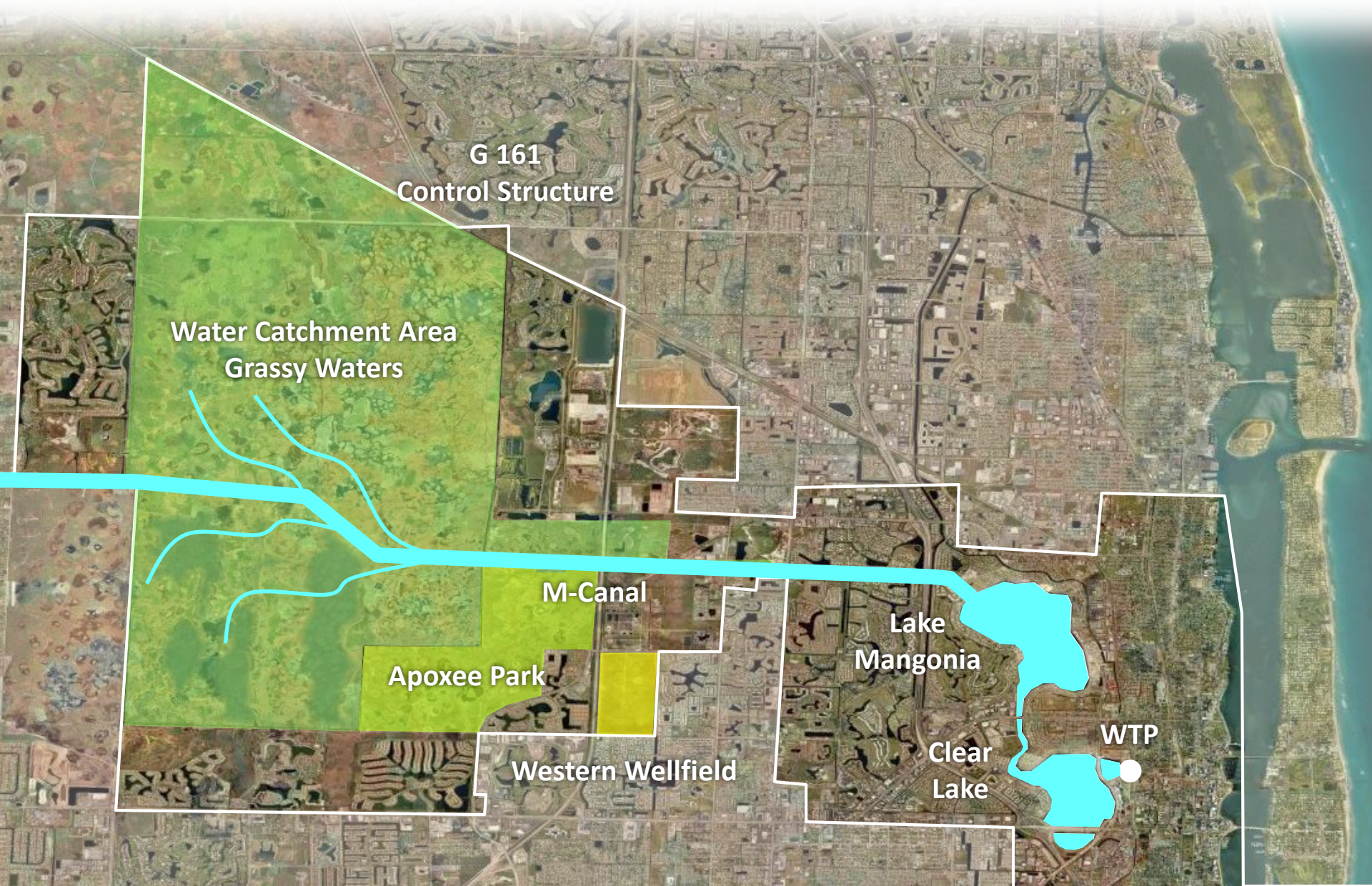
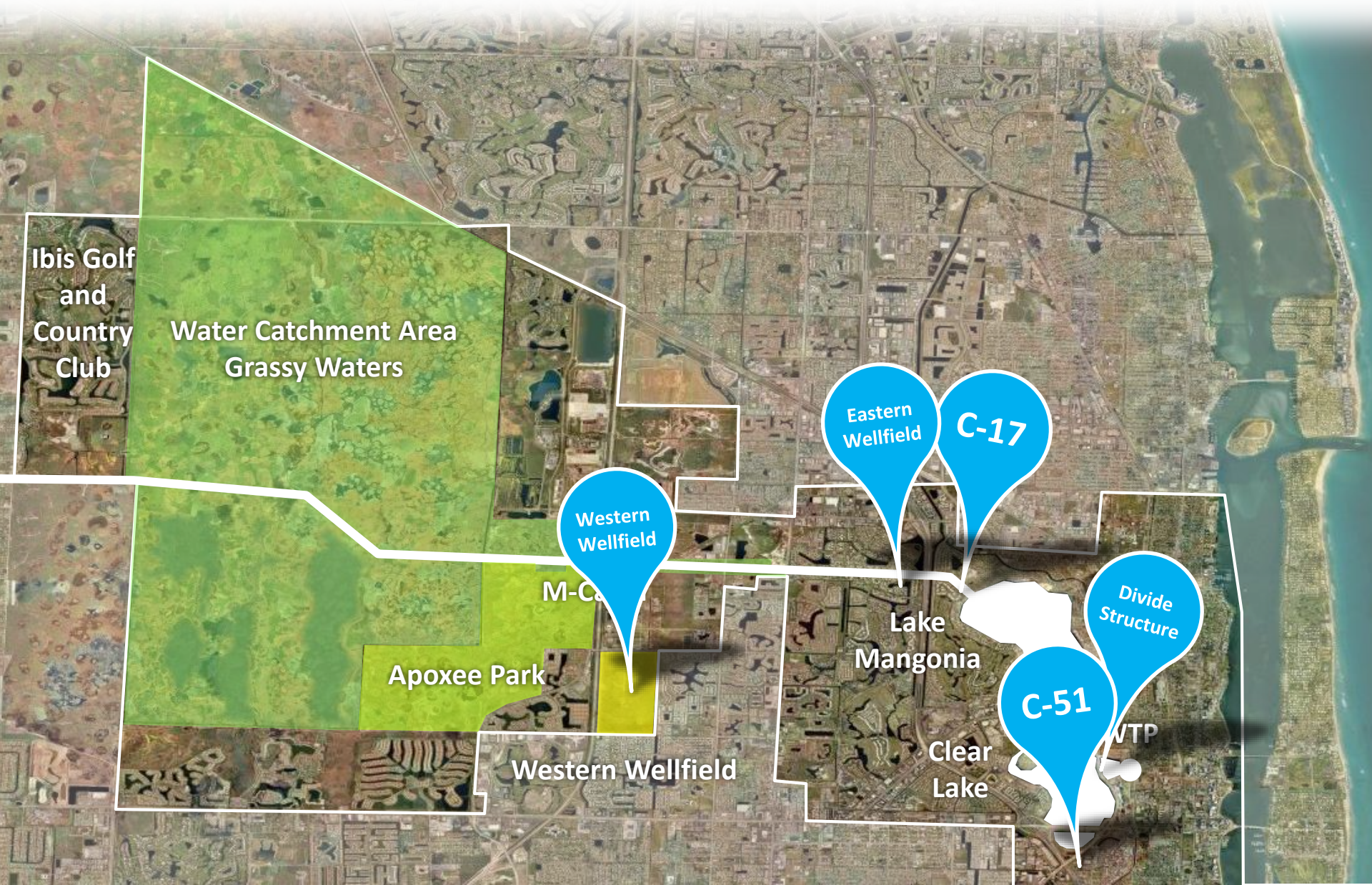


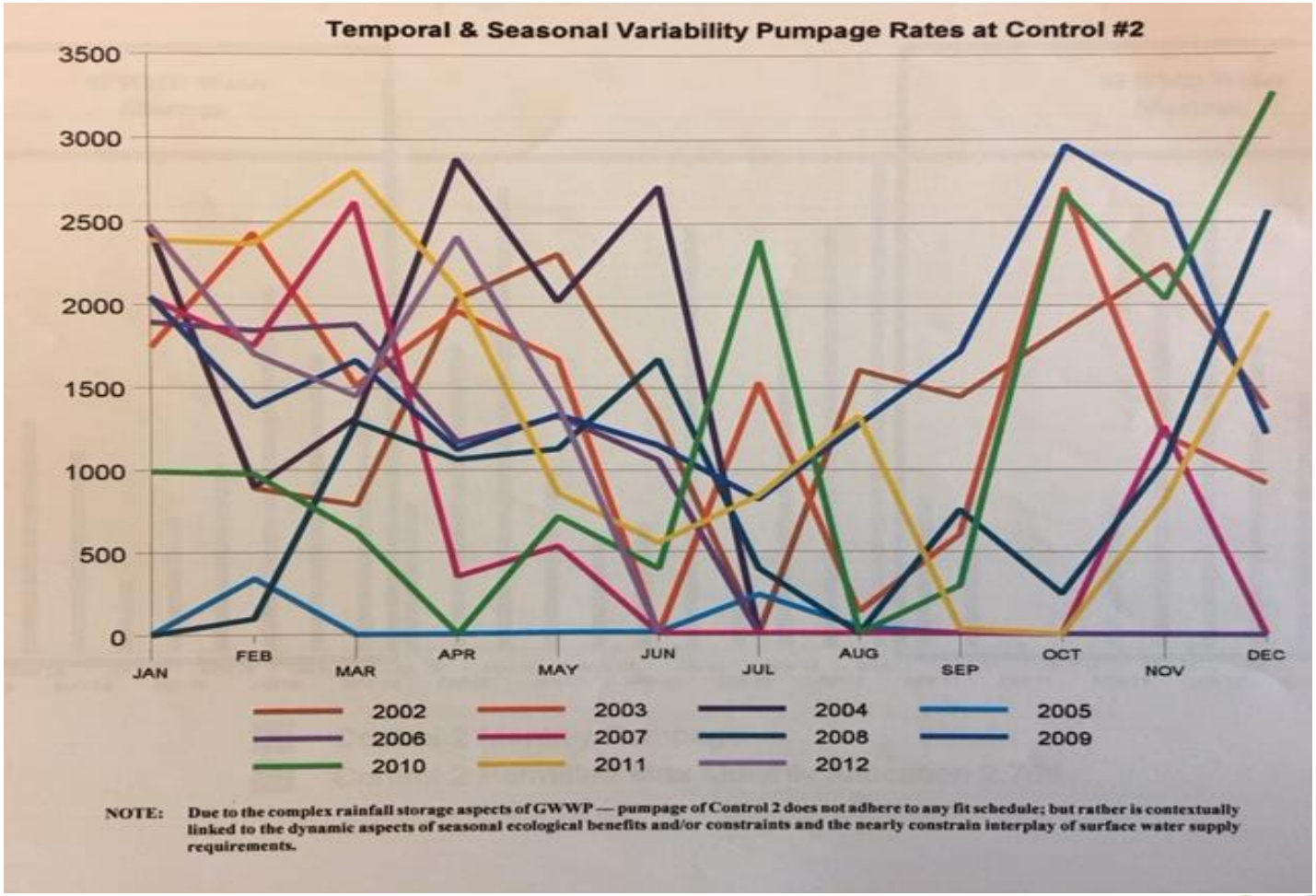
Drought Initiated Projects Implemented in 2013



Water Supply Challenges Near & Long Term

- Natural drought cycles.
- WQ induced restrictions from harmful algal blooms.
- Elevated conductivity and TDS levels from L-8 Reservoir augmentation.
- Limitations on freshwater mixing zones to assimilate high conductivity from wells and L-8 reservoir augmentation.
- Augmentation to meet MFLs for NW fork of Loxahatchee River
- Lake Okeechobee regulation schedules.
- Climate change feedback.

Variability of Regional Water Supply



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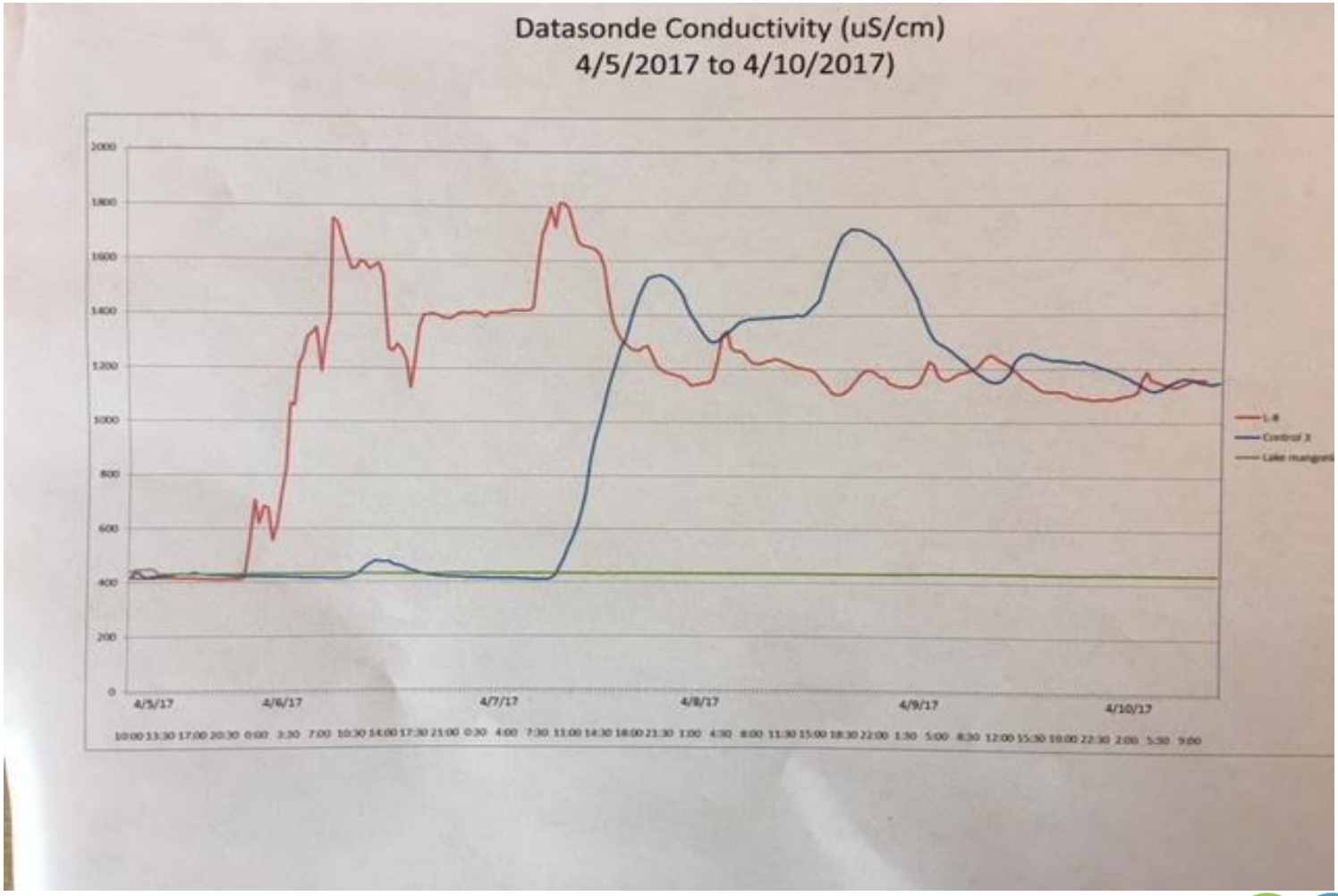
Conductivity has Become Major Issue



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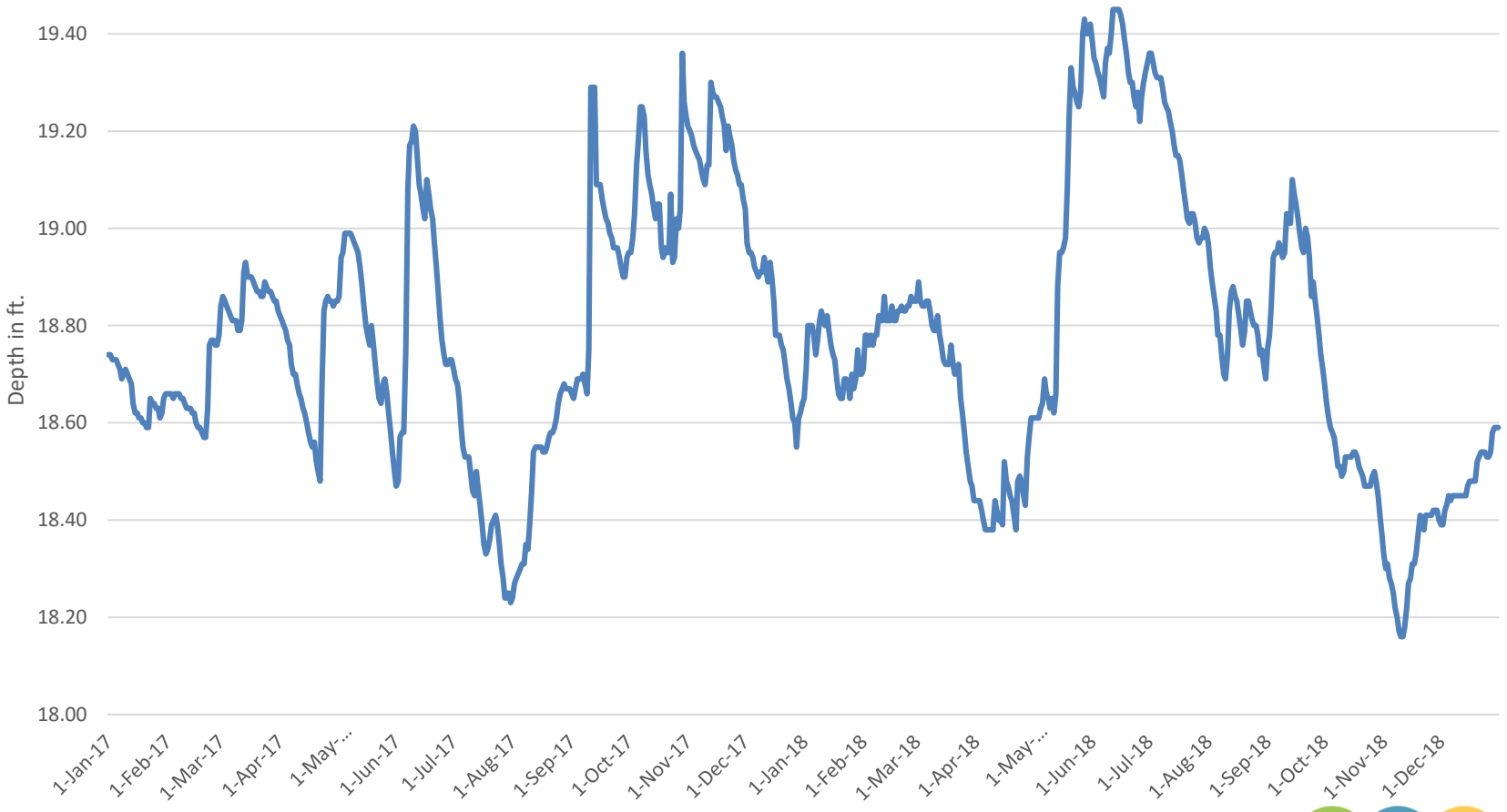
Grassy Waters Levels 2017-2018



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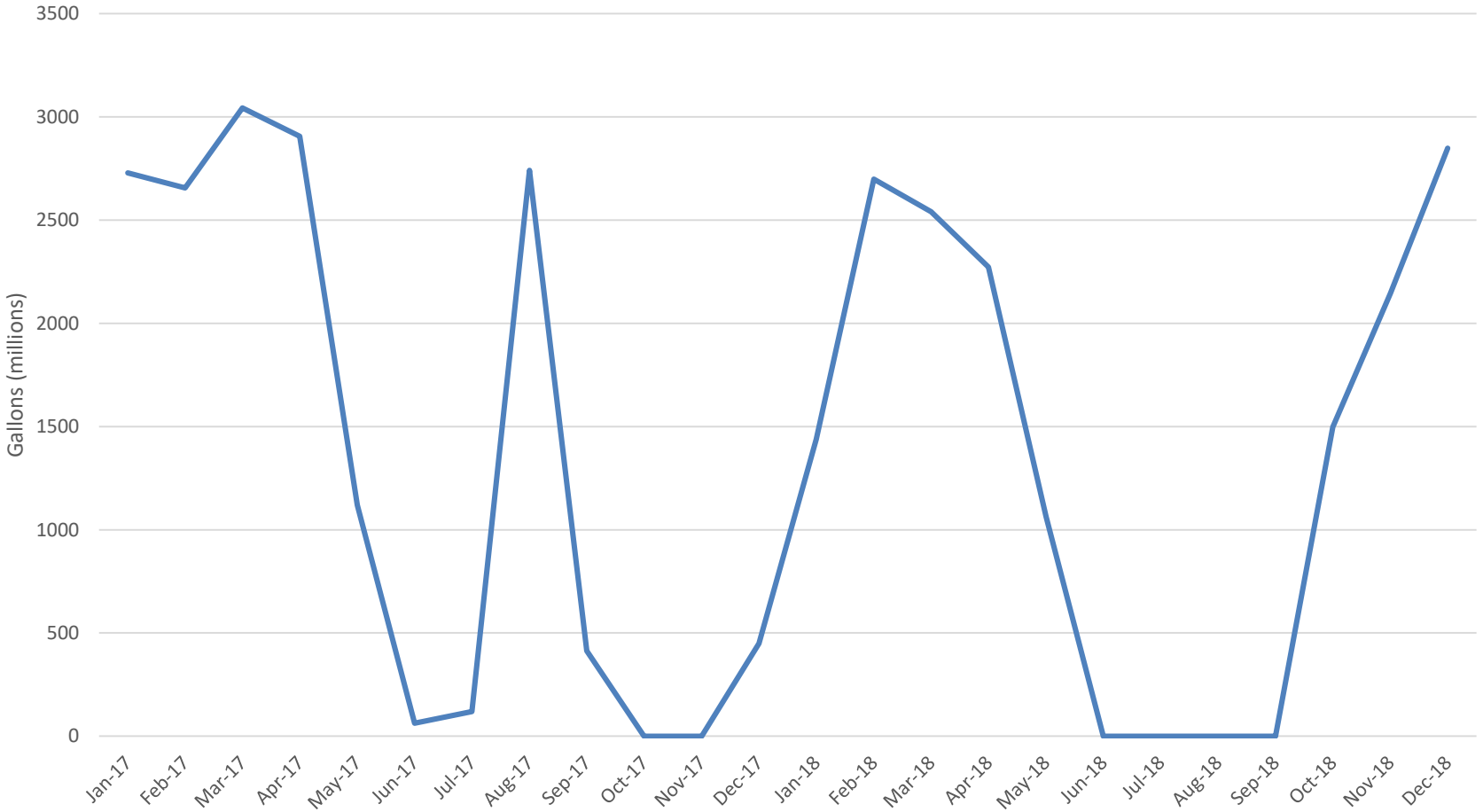
Control 2 Pumpage 2017-2018



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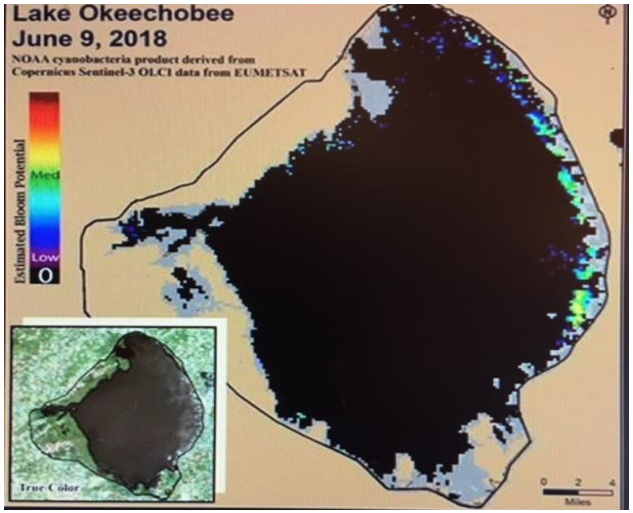
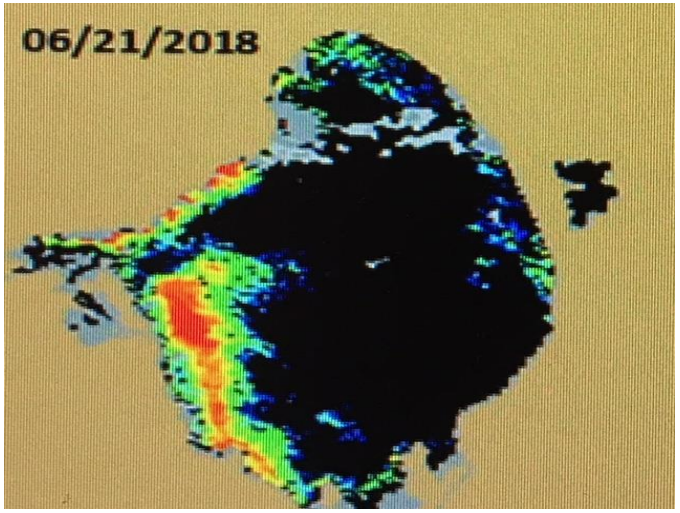
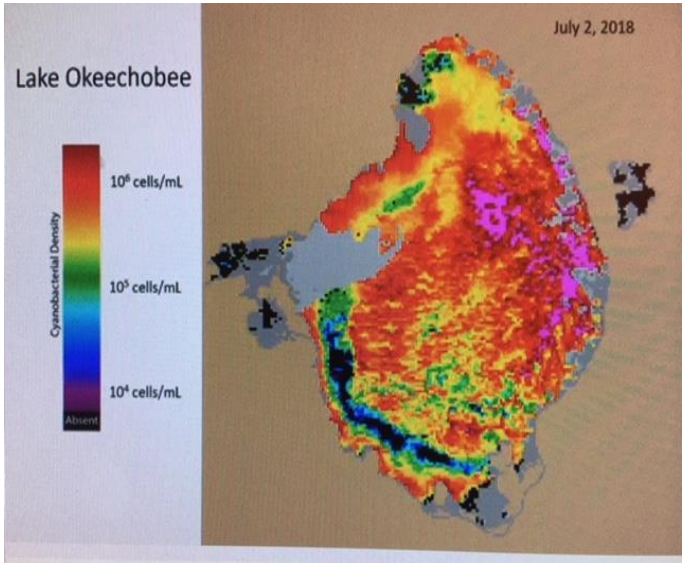
Lake Okeechobee Algal Blooms







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Lake Okeechobee Algal Bloom

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Control 2 Algal Bloom

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City of West Palm Beach Conducted Water Supply Plan in 2015

Purpose of Study

- Demonstrate the benefits of water supply investments made since last drought
- Estimate the possible future need for new water supply projects (gap between projected water demands and existing water supply)
- Summarize new supply options that could be implemented if and when needed
- Evaluate supply options and develop adaptive strategy for 2065 planning period, with continuous re-evaluation

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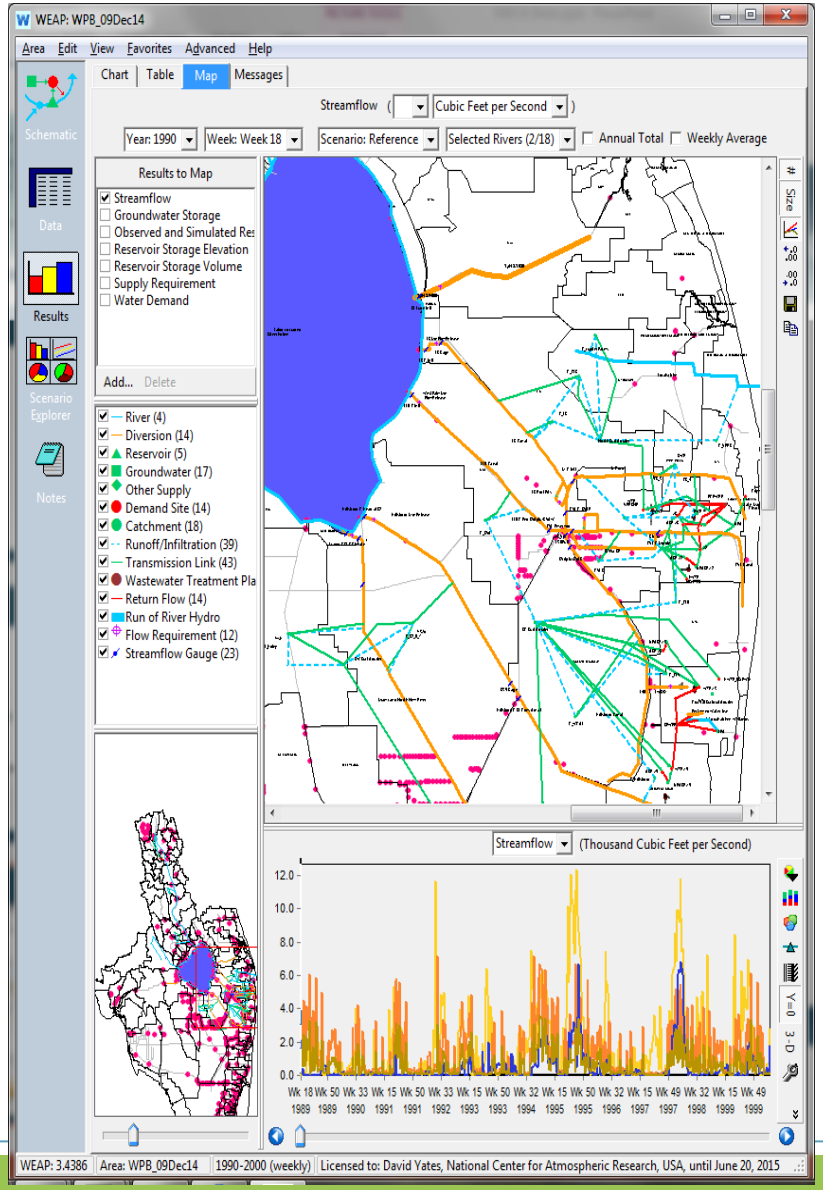
City Utilized WEAP Hydrological Model



Natural Resources

- Rainfall-Driven Water Supply/Demand
- Water Quality
- Ecosystem
- Needs/Constraints

Human Infrastructure

- Water Demand & Demographics
- Transport: Canals, Pipelines
- Supply: Reservoirs, Groundwater, ASR

Capital Investment

- Revenue & Reserves
- Capital Financing – Net Present Value
- Dynamic Cost-Benefit Analysis

WEAP Model Simulated Operations

Table 7.1
Long Term Water Supply Plan Operating Protocol
Based on Water Level Triggers

	Primary		Secondary		
Grassy Waters Preserve Water Level	≥ 18.5’	18.4 - 17.25’	< 17.25’		
Lake System Water Level	≥ 12.5’	< 12.5 - 10.5’	< 10.5’	≤10.0’	≤ 9.0’
Control Structure No. 2	ON	ON	ON	ON	ON
Control Structure No. 4	OFF[1]	ON	ON	ON	ON
C-17 / C-51 Drainage Basin Capture	ON	ON	ON	ON	ON
ASR Well Injection	ON	OFF	OFF	OFF	OFF
ASR Well Recovery	OFF	ON	ON	ON	ON
Eastern Wellfield	OFF	OFF	ON	ON	ON
Clear Lake Divide Structure	OPEN	OPEN	OPEN	CLOSED	CLOSED
Clear Lake Pump Station	OFF	OFF	OFF	ON	ON
Western Wellfield	OFF	OFF	OFF	OFF	ON

“ON” indicates the City may use these facilities if water is available
Elevations are referenced to the National Geodetic Datum of 1929 (NGVD 1929)
[1] Control Structure No. 4 will not be used unless necessary for flood control or other purposes

Gap Analysis & Scenarios

Common Assumptions:

- Repeat of historical hydrology (2006 to 2013) that includes three drought periods: 2007, 2008 and 2011
- Simulated with Baseline, 2035, and 2065 water demands
- Simulated with all 2013 Drought Management Facilities online (more than 3 billion gallons of additional water)

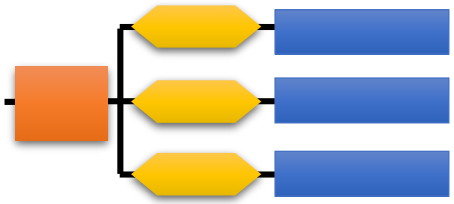
Scenarios:

1. Mid-Level Water Demands (43.3 MGD by 2065)
2. High-Level Water Demands (43.3 + 12.9 = 56.2 MGD by 2065)
3. “Black Swan” (Mid-Level Demands and no water from Lake Okeechobee during drought years)

Planning Terms

Objectives	Major goals of plan (e.g., provide reliable water)
Performance Measures	Metrics used to assess how well an objective is being achieved (e.g., unmet demand in MGD)
Options	Individual water supply options (e.g., new wellfield)
Alternatives	Combinations of water supply options
Scenarios	Plausible future conditions that alternatives will be tested against

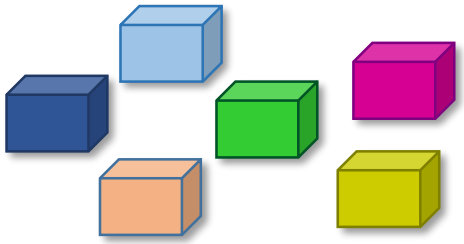
Planning Terms



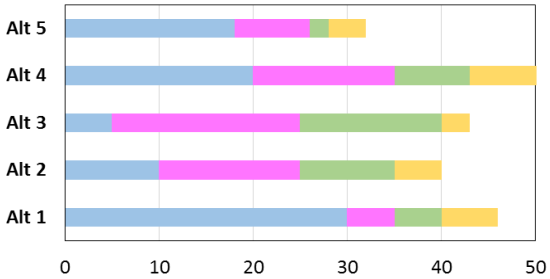
Define Planning Objectives, Metrics & Scenarios

WEAP Model

Determine Need (Gap Analysis)

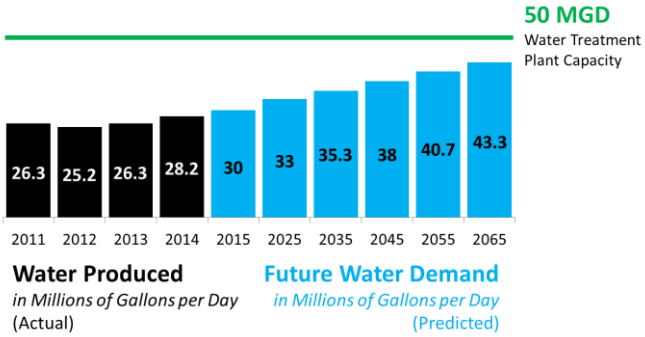


Analyze Supply Options and Combine into Alternatives



Rank Alternatives

Test Under Scenarios



Water Demands and Existing Water Supply System

Recommended Strategy

Planning Objectives

Objectives	Performance Measures
SUPPLY RELIABILITY. Provide supply reliability during average weather and drought conditions	Number of weeks of unmet water demand
	Maximum weekly unmet water demand (MGD)
COST-EFFECTIVENESS. Develop cost effective solutions with rate payers in mind.	Cumulative capital and operating costs through 2065 planning period
IMPLEMENTATION EASE. Provide solutions that are acceptable by public, easy to operate, and scalable.	Degree of public support
	Degree of operational complexity
	Degree of project scalability
WATER QUALITY IMPACTS. Improve taste, odor and other secondary water quality attributes.	Degree of taste, odor, and other secondary water quality attributes
ENVIRONMENTAL IMPACTS. Minimize impacts on ecosystems and natural environment.	Grassy Waters elevation level
	Degree of greenhouse gas emissions
STEWARDSHIP. Provide leadership in sustainable water management.	Degree of maximization of existing water resources
	Degree of providing regional water solutions

Performance measures shown in **blue** represent quantitate metrics from WEAP model.
Performance measures shown in **black** represent qualitative scores using professional judgement.

Summary of Gap Analysis

Scenario	Number of Weeks of Unmet Demand*	Maximum Unmet Demand (MGD)
Scenario 1 – Mid Demands, Repeat of Local & Regional Hydrology		
Baseline	0	0
2035	0	0
2065	0	0
Scenario 2 – High Demands, Repeat of Local & Regional Hydrology		
2035	0	0
2065	4	39 MGD
Scenario 3 – “Black Swan” No Lake O Water During Drought Years		
2035	14	38 MGD
2065	27	47 MGD

* Number of weeks in a year, averaged over 2007, 2008 and 2011 hydrologic conditions.

New Supply Options Evaluated

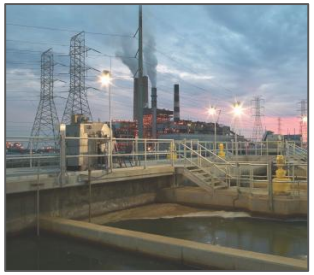
Demand-Side Management (up to 9.5 MGD by 2065)

Brackish Groundwater Desalination (10 MGD)

Expanded Aquifer Storage & Recovery (2 MGD)

C-51 Surface Reservoir (10 MGD)

Expanded Eastern Wellfield (7.2 MGD)



Seawater Desalination (10 MGD)

Expanded Tidal Capture (up to 45 MGD)

Others (but not evaluated today)

Changes in permits (essentially free or very low cost options)

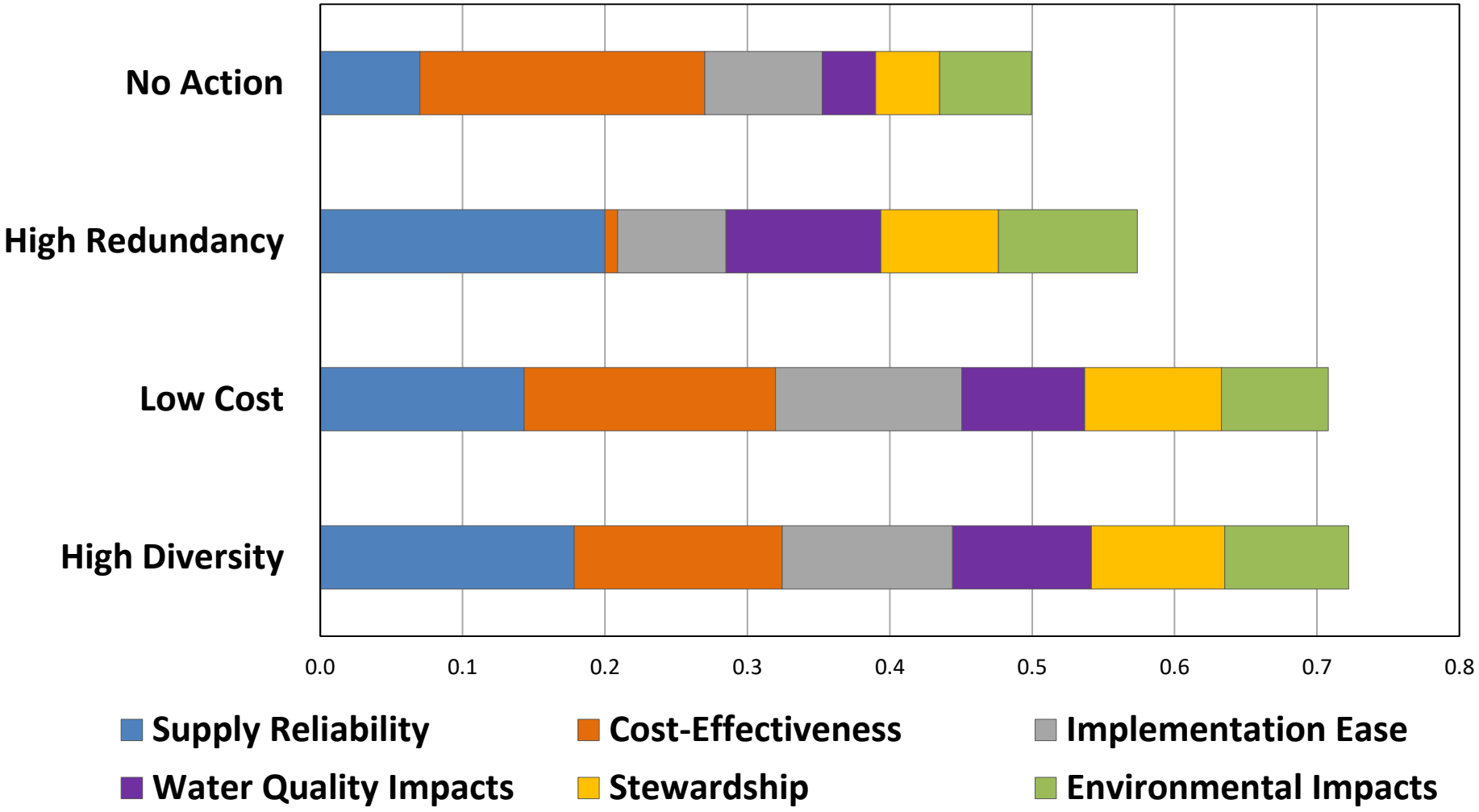
Alternatives

1) Low Cost
2) High Redundancy
3) High Diversity
4) No Action

	Year 2035			
	Max Yield (mgd)	Low Cost	High Redundancy	High Diversity
Demand-Side Manag.	4.7	4.7	1.8	4.7
Eastern WF Expansion	7.2	7.2	7.2	7.2
ASR Expansion	2	2		2
Tidal Capture Expansion	30	10		10
Brackish GW Desal	10		10	5
C-51 Reservoir	10		10	
Seawater Desal	10		10	
Total	73.9	23.9	39	28.9

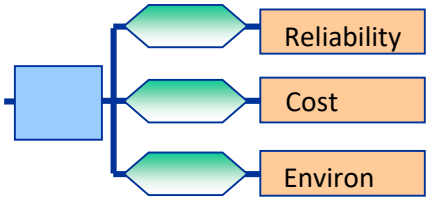
	Year 2065			
	Max Yield (mgd)	Low Cost	High Redundancy	High Diversity
Demand-Side Manag.	9.5	9.5	7.8	9.5
Eastern WF Expansion	7.2	7.2	7.2	7.2
ASR Expansion	2	2	2	2
Tidal Capture Expansion	45	15		15
Brackish GW Desal	10		10	5
C-51 Reservoir	10		10	
Seawater Desal	10		10	
Total	93.7	33.7	47	38.7

Ranking of Alternatives
(all objectives weighted fairly equally)

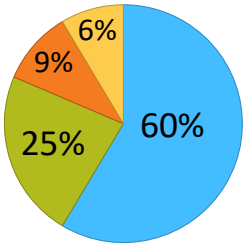


Ranking Method:
Multi-Criteria Decision Analysis

Define Objectives & Metrics

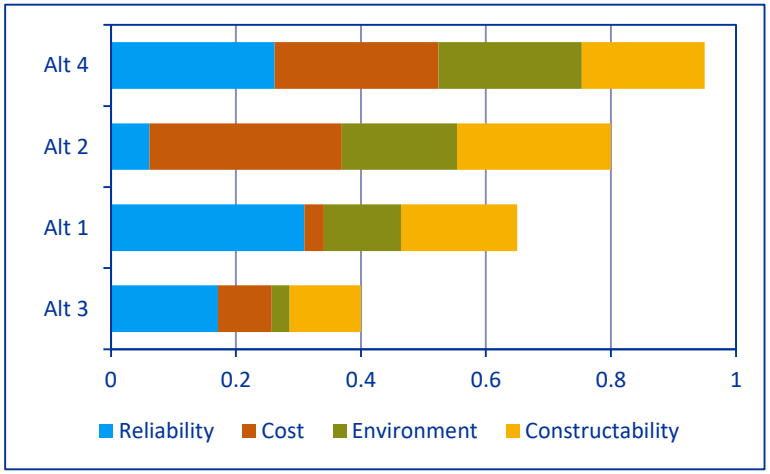


Apply Weights to Objectives



Create Performance Score Card for All Alternatives

Alternative	Capital Cost (millions)	Total Lifecycle Unit Cost ($/AF)	Salinity (mg/liter)	Reliability	Proven Technology	Integration	Constructability	Permitting	Storm/Erosion Impact
Shamel Park Seawater Desal	$ 14.47	$ 4,861	100	5.0	3.0	3.0	3.5	2.0	4.0
Morro Bay Shared Seawater Desal	$ 26.61	$ 7,934	100	5.0	4.0	2.3	3.0	2.6	3.0
Estero Bay Seawater Desal	$ 31.44	$ 9,118	100	5.0	3.0	2.3	3.0	2.3	3.0
San Simeon Creek Rd Brackish Desal	$ 12.87	$ 4,337	100	4.0	4.0	4.3	5.0	3.8	4.0
Whale Rock Reservoir w/o L. Nacimento	$ 21.74	$ 6,048	350	4.0	5.0	2.7	4.0	3.9	4.0
Whale Rock Reservoir w/ L. Nacimento	$ 28.94	$ 8,352	350	4.5	5.0	2.7	4.0	4.8	4.0
San Simeon Creek Offstream Storage	$ 65.27	$ 16,560	350	3.0	5.0	3.0	2.0	3.8	2.0
Hardrock Aquifer Storage Recovery	$ 57.67	$ 15,624	350	3.0	2.0	2.7	2.0	4.3	4.0
San Simeon CSD Recycled Water	$ 11.21	$ 9,795	700	1.0	5.0	2.7	5.0	4.1	4.0



Use Decision Software to Rank Alternatives

Ranking Sensitivity (1 = first ranked)

Most Robust

Weighting Sensitivity	Low Cost	High Redundancy	High Diversity	No Action
Objectives weighted fairly equally	2	3	1	4
Reliability weighted highest	3	2	1	4
Cost weighted highest	1	4	2	3
Environment/Sustain-ability weighted highest	2	3	1	4

High Diversity Alt includes:

- Demand-side management
- Expanded Tidal Capture
- Expanded Eastern Wellfield
- Expanded ASR Well
- Brackish Groundwater Desalination

New Supply Options Selected

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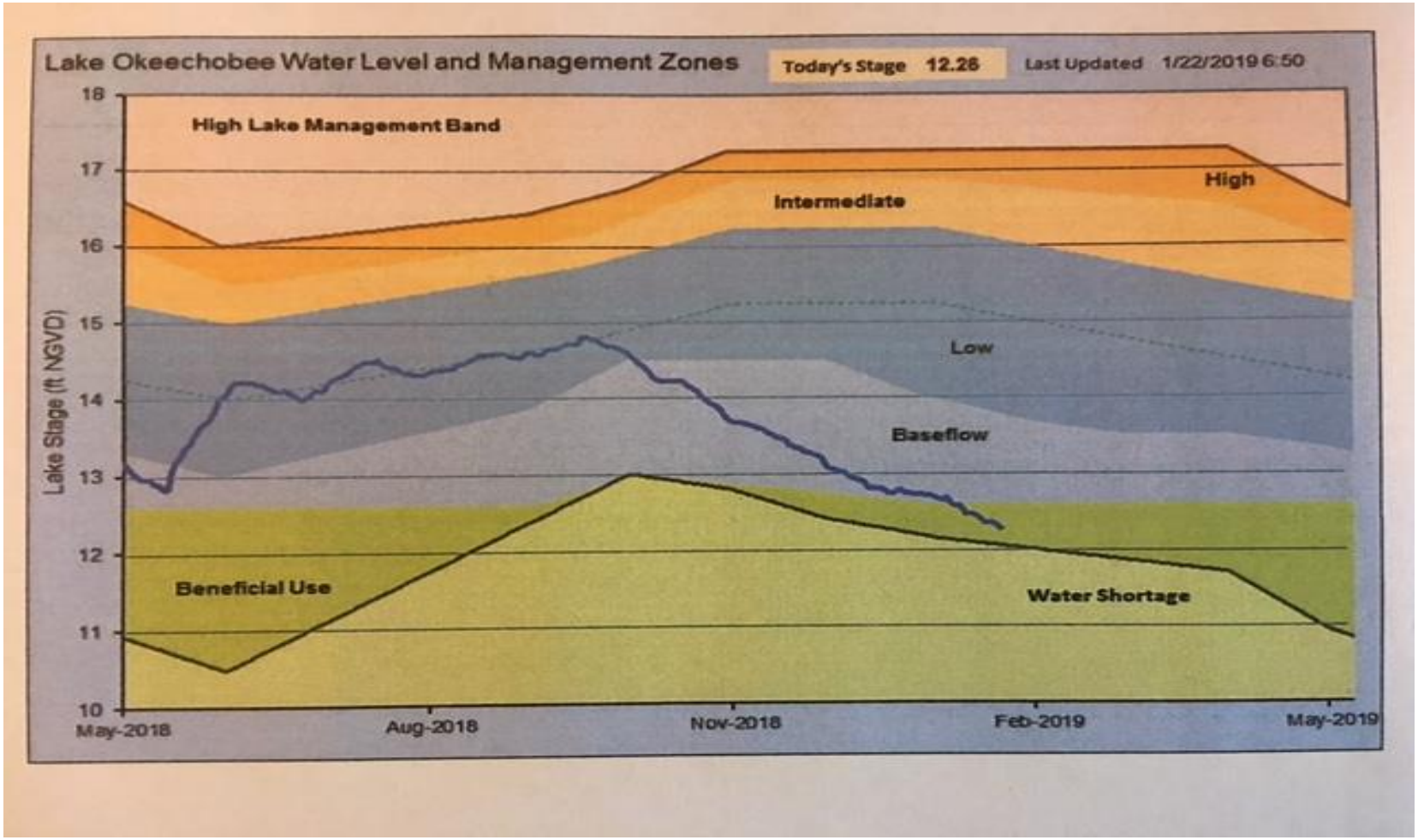
Others (currently evaluating)

Modifications in permit conditions (essentially free or very low cost options)

Current Challenge
Lake Okeechobee Water Level



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Managing Challenges Now and Into the Future

- Water Quality
  - Real Time Monitoring
  - Predictive data analytics
- Water Quantity
  - Alternative Water Supply options
  - Holistic approach to Local and Regional planning

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