IRP Member Agency Technical Workgroup

Local Resources (Part 2 of 2)
July 8, 2015

IRP Member Agency Workgroup Process

- April 2015
  - IRP/RUWMP Kick-off 4/8
  - Water Use Efficiency Meeting 4/16
  - Uncertainty 4/22
- May 2015
  - Imported Supplies 5/18
  - Water Use Efficiency Meeting 5/20
  - Groundwater (1 of 2) 5/27
- June
  - Groundwater (2 of 2) 6/11
  - Water Use Efficiency Meeting 6/18
  - Local Resources (1 of 2) 6/24

Presentation Overview

- Meeting objectives
- Review of modeling forecast and assumptions
- Review of local projects inventory
- IRP Issue Paper Addendum Outline
- Other local resource topics
- Next steps

IRP Local Resources Discussion Objectives

- Review and receive input on IRP technical approach
  - Identify additional technical refinements to be completed
- Provide an overview of local resources topics impacting the IRP
- Facilitate discussion of local resources issues
  - Identify and quantify future potential and risk
  - Collect policy and implementation issues for consideration by the Board

IRP Local Resources

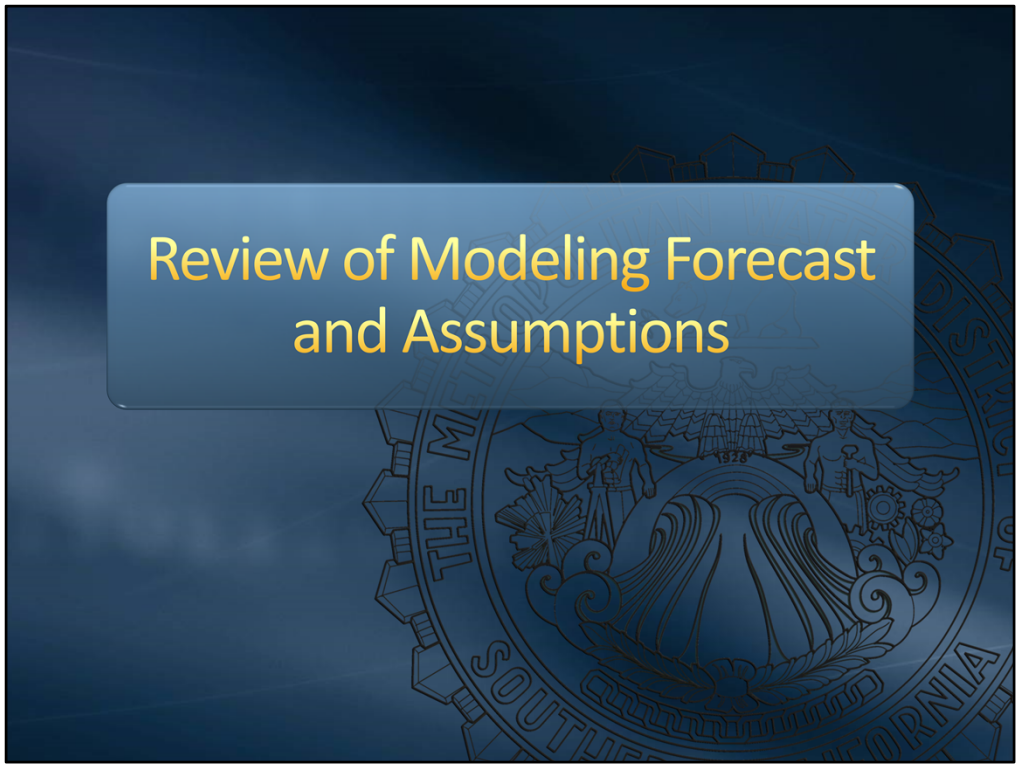
Meeting 1 of 2

- Review of technical modeling and assumptions
  - Recycling
  - Groundwater recovery
  - Seawater desalination
- Issue paper input and discussion
  - Recycled water
  - Seawater desalination
  - Graywater
  - Stormwater
  - Synergy

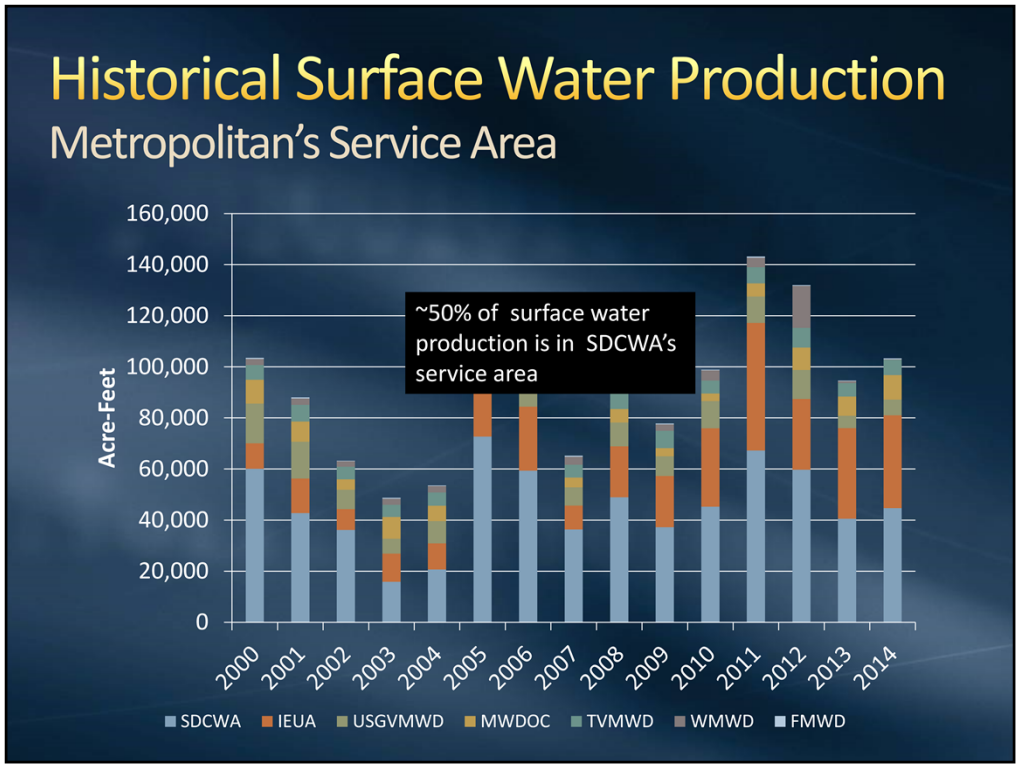
IRP Local Resources

Meeting 2 of 2

- Review of technical modeling and assumptions
  - Surface water
  - Los Angeles Aqueduct
- Review of local projects inventory
  - Quantification of potential development
- Issue paper addendum outline
- Other local resources topics
  - Foundational actions
  - Local resources and the WSAP
  - Water-energy nexus


Review of Modeling Forecast and Assumptions

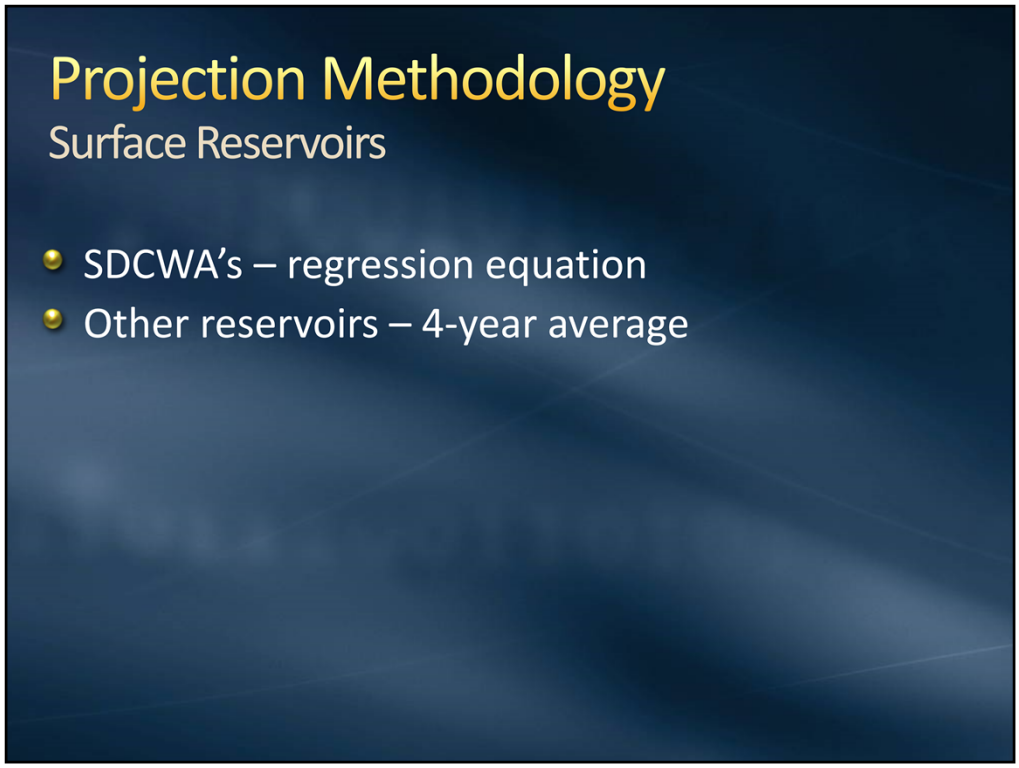
Surface Water Production



I want to start off by showing you the surface water production in Metropolitan's service

There are 7 member agencies that have surface water production.
In the past 15 years, production ranges from 49,000 AF in 2003 to 143,000 AF in 2011.
The long-term average is 94,000 AF.

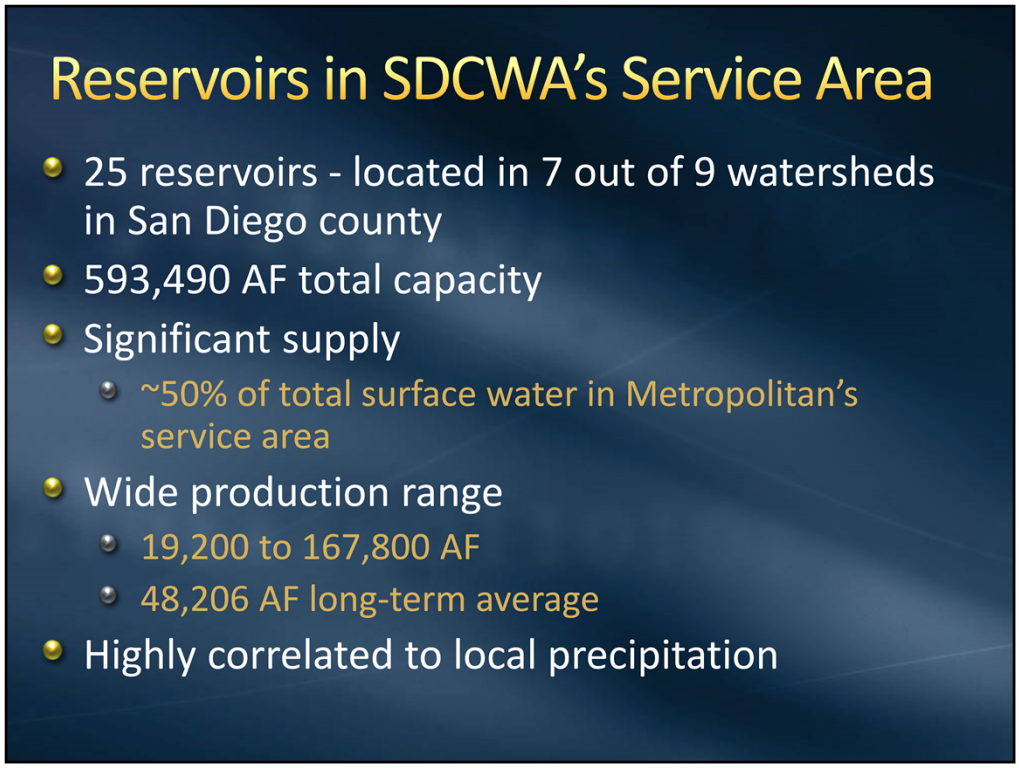
About half of the total surface water production is in San Diego Water Authority's service area.



We have developed a regression to project surface water production in San Diego.

Other reservoirs, we use a 4-year average as projection because we simply do not have sufficient precipitation data to develop regression equations.

In the next few slides, I will show you how the regression model works for San Diego.



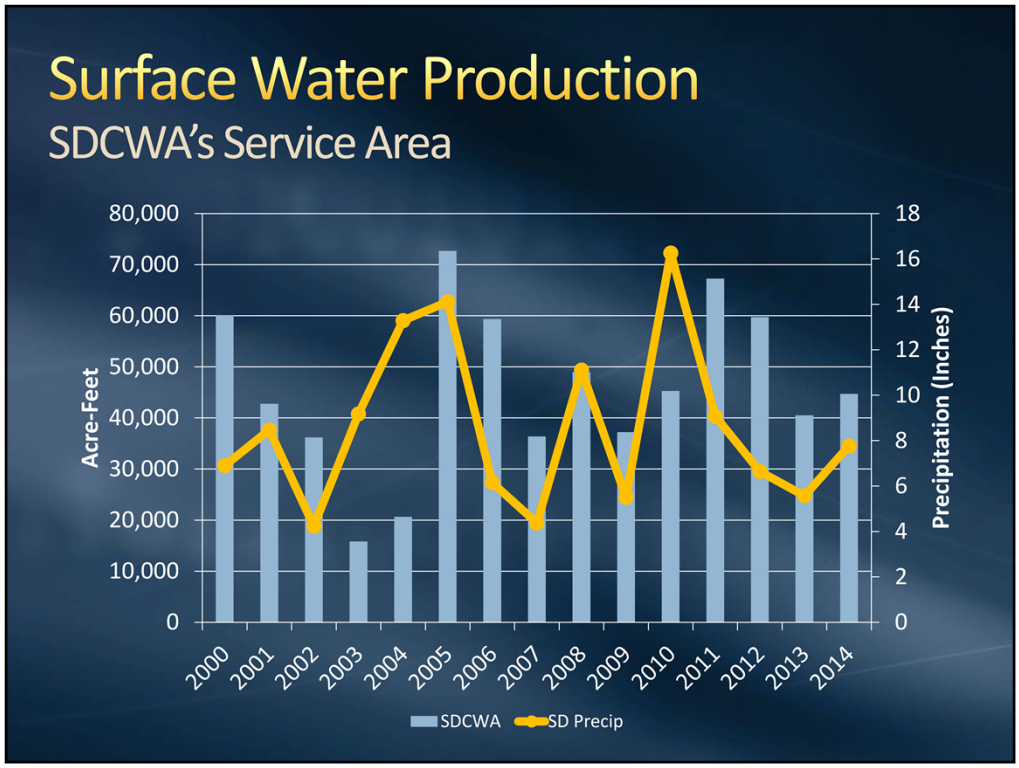
In SDCWA's service area, there are 25 reservoirs, all located in 7 out of 9 watersheds in San Diego county.

They have a combined total of nearly 600 TAF of capacity.

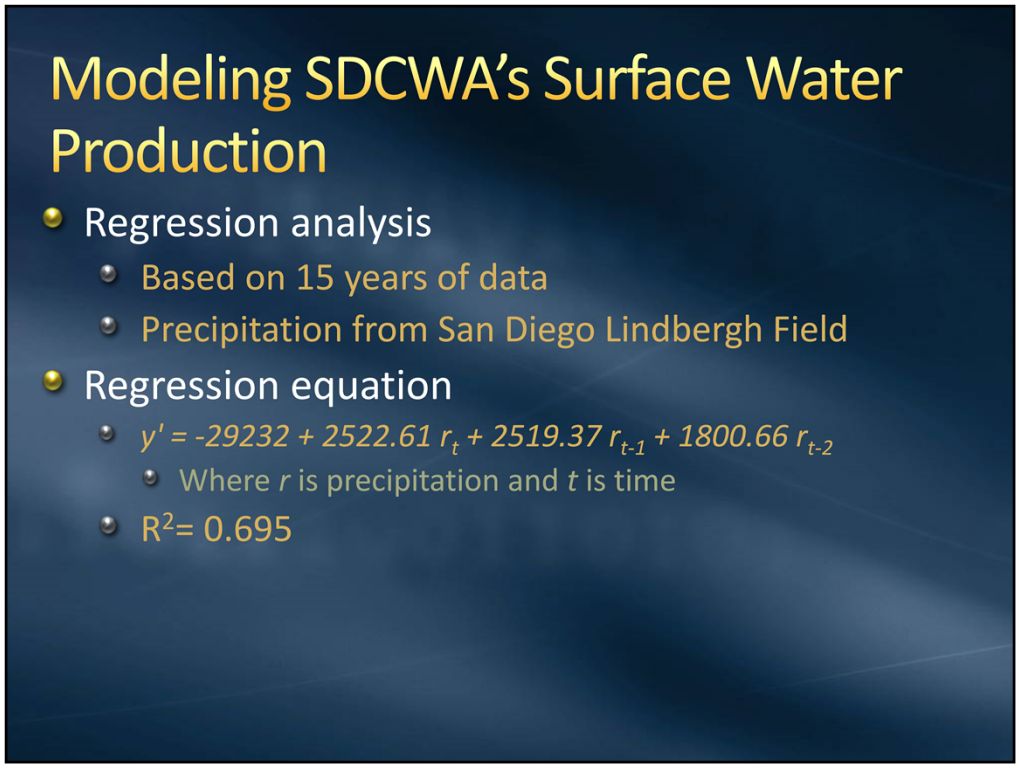
Surface water production in San Diego is supply for the region. It makes up of about 50% of all surface water production in Metropolitan's service area.

Since 1976, surface water production ranged from 19,000 to nearly 168,000 AF per year. This range does not include 2015 production, which is probably lower than the lower range.

Production is highly correlated to precipitation. I'll show you in the next slide.



Production variability is strongly correlated to precipitation.



In developing the regression model, we used 15 years of production data and ran regression analysis against different dependent variables including temperature and precipitation from San Diego Airport.

We observed that the best fit regression line is the current year's rain and rain from the past 2 years. In other words, there are lagged effects in precipitation. What that means is that reservoir production is affected by the current year's rain, as well as last year's and the year before that.

So, the right-hand side variables are current year's rain (rt), last year's rain (rt-1) and rain from 2 years ago (rt-2).

The R-squared for this regression line is nearly 0.70.

Data from Escondido, Helix W.D. National City, Poway, Ramona M.W.D., San Dieguito W.D., Santa Fe I.D., South Bay I.D., and Vista I.D.

Applying the Regression Equation

2015 Forecast

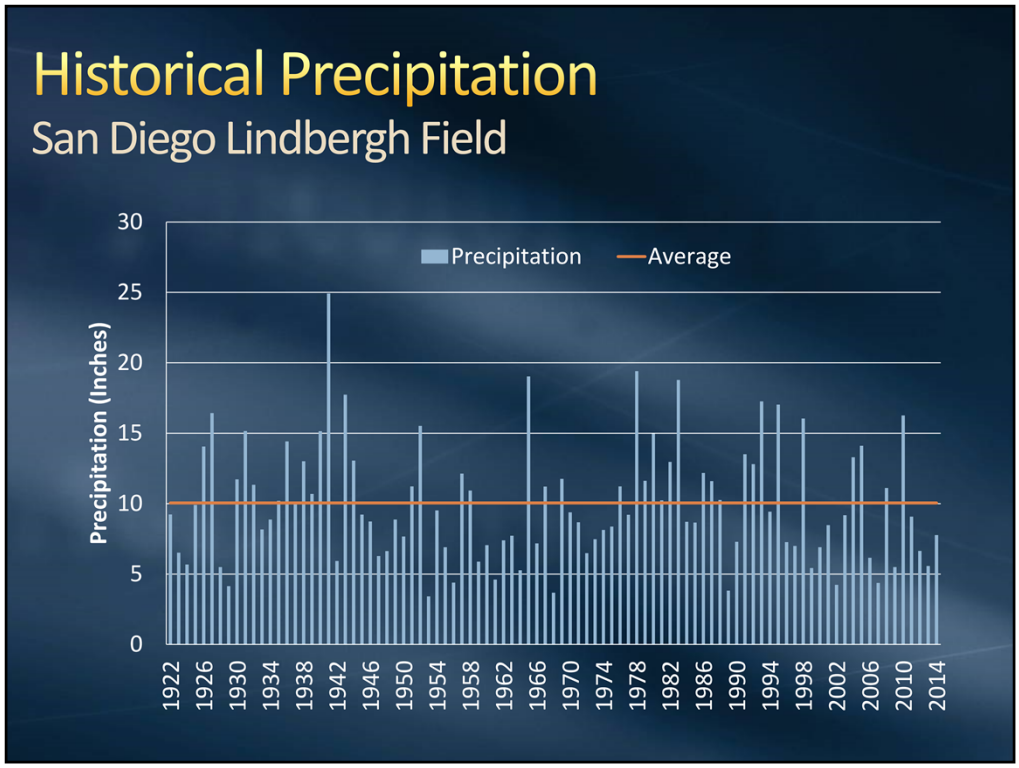
2015 (1st year forecast)		
r_t	r_{t-1}	r_{t-2}
sd_rain	2014 Precip	2013 Precip
1922 - 9.24	2014 - 7.77	2013 - 5.57
1923 - 6.52	2014 - 7.77	2013 - 5.57
:	:	:
2014 - 7.77	2014 - 7.77	2013 - 5.57
2015 being the first forecast year, we do not have complete precip for 2015, so we use a historical range as a substitute.	Lag 1 year from 2015 is 2014, so we use 2014 actual precip.	Lag 2 years from 2015 is 2013, so we use 2013 actual precip.

Here's how we apply the regression equation for 2015 forecast:

The first covariate, Rt, uses the current year's rain. In this case, 2015 being the first forecast year, we do not have complete precip for 2015, so we use a historical range as a substitute. In all of our models, we use historical hydrology to model the variation of possible outcomes. So we use precip data from 1922 to 2014 as stand-in precip for 2015.

The second covariate, Rt-1 represents rain from the previous year. 1 year lag from 2015 is 2014, so we use 2014 actual precip.

Similarly for the third covariate, Rt-2 represents rain from 2 years ago. 2 years lag from 2015 is 2013, so we use 2013 actual precip.



Before I continue, I want to show you a graph of the range of precipitation in San Diego. This data is used to substitute for precipitation that we do not have.

The red line is the long-term average, a little more than 10 inches.

Applying the Regression Equation

2016 Forecast

2016 (2nd year forecast)		
r_t	r_{t-1}	r_{t-2}
sd_rain	sd_rain_lag1	2014 Precip
1922 - 9.24	1921 - 17.55	2014 - 7.77
1923 - 6.52	1922 - 9.24	2014 - 7.77
:	:	:
2014 - 7.77	2013 - 5.57	2014 - 7.77
2016 being the 2nd forecast year, we do not have precip for 2016, so we use a historical range as a substitute.	Lag 1 year from 2016 is 2015 and we do have precip for 2015, so we use a historical range as a substitute, but lag 1 year.	Lag 2 years from 2016 is 2014, so we use 2014 actual precip.

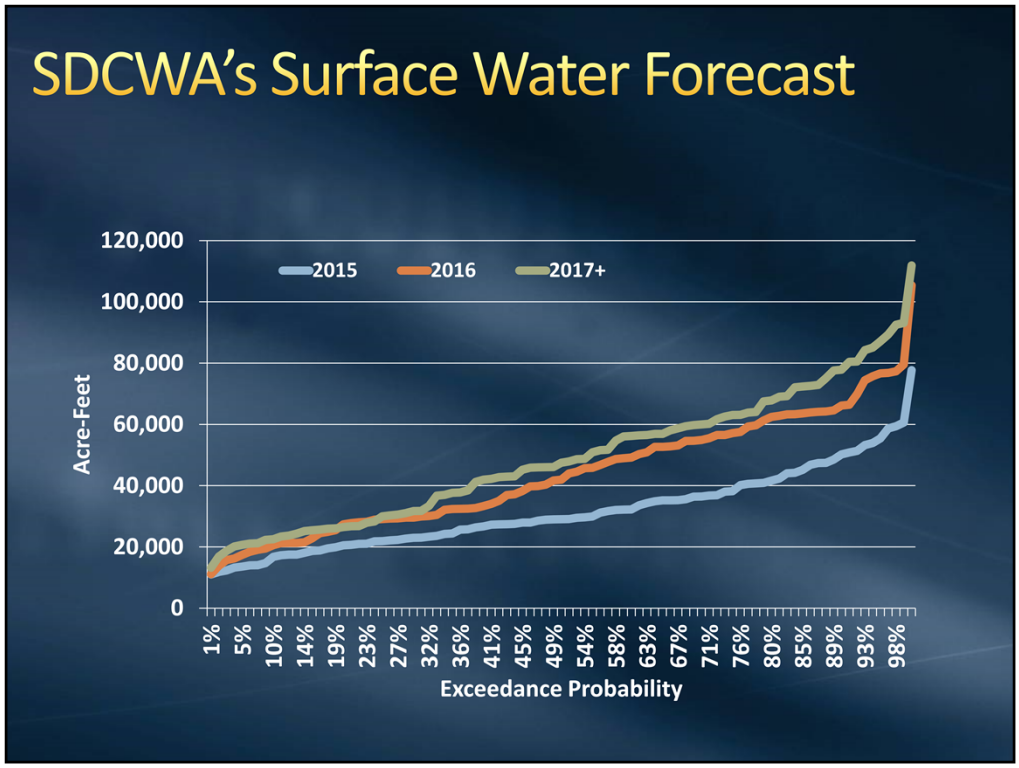
Similar concept for 2016. We use historical precip to substitute for data that we don't have.

Applying the Regression Equation

2017+ Forecast

2017 (and beyond)		
r_t	r_{t-1}	r_{t-2}
sd_rain	sd_rain_lag1	sd_rain_lag2
1922 - 9.24	1921 - 17.55	1920 - 7.69
1923 - 6.52	1922 - 9.24	1921 - 17.55
:	:	:
2014 - 7.77	2013 - 5.57	2012 - 6.64
2017 and beyond - we do not have precip, so we use a historical range.	Lag 1 year from 2017 is 2016 and we do have precip for 2016, so we use a historical range as a substitute, but lag 1 year.	Lag 2 years from 2017 is 2015 and we do have precip for 2015, so we use a historical range as a substitute, but lag 2 year.

For 2017, we use all historical precip for each of the right-hand side variable, but lag by 1 year for the second variable and 2 years for the third variable.



This graphic shows the forecast for SDCWA's surface water production. The vertical axis is the acre-feet production and the horizontal axis is the exceedance probability.

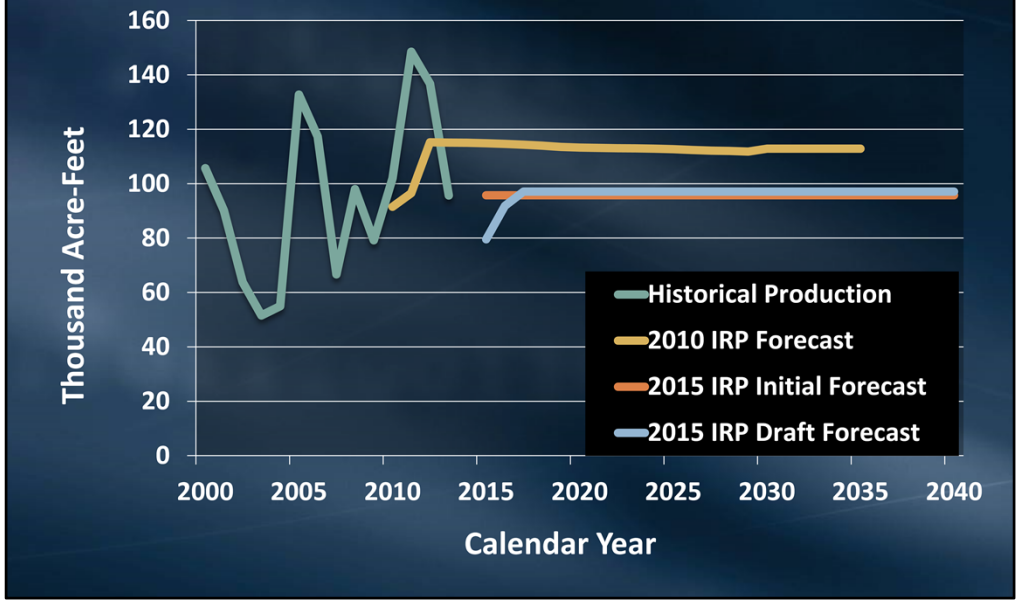
The blue line shows the range of production for 2015: 11,000 – 78,000 acre-feet. Average is 32,000 acre-feet (which is roughly 57% probability). Another way of reading this graph is there is a 80% probability that the production will be exceed 20,000 acre-feet.

The orange line is the range of production for 2016. It is slightly higher as we move away from 2013 and 2014 (which were below average precipitation years).

The green line is the for 2017 and beyond. The forecasts for these years are based on long-term historical precipitation.

Surface Water Average-Year Supplies

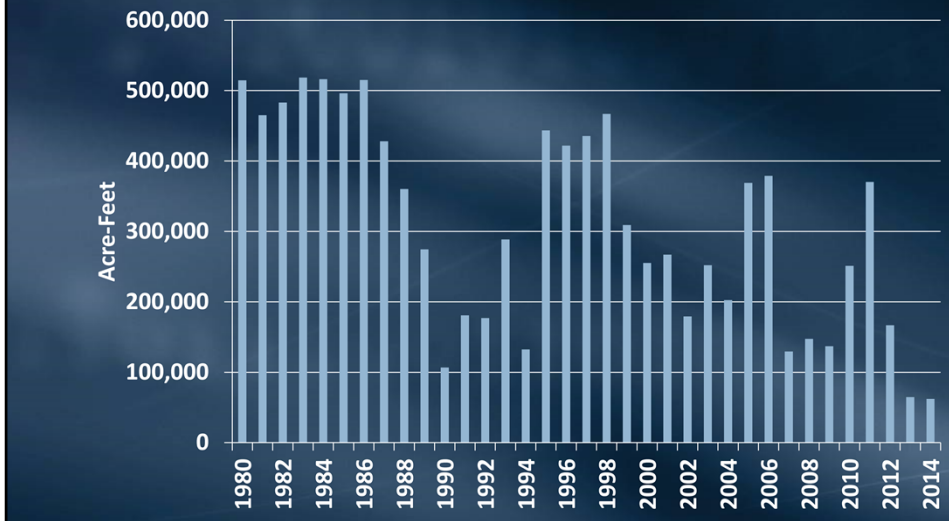
Historical and Projected (Average)

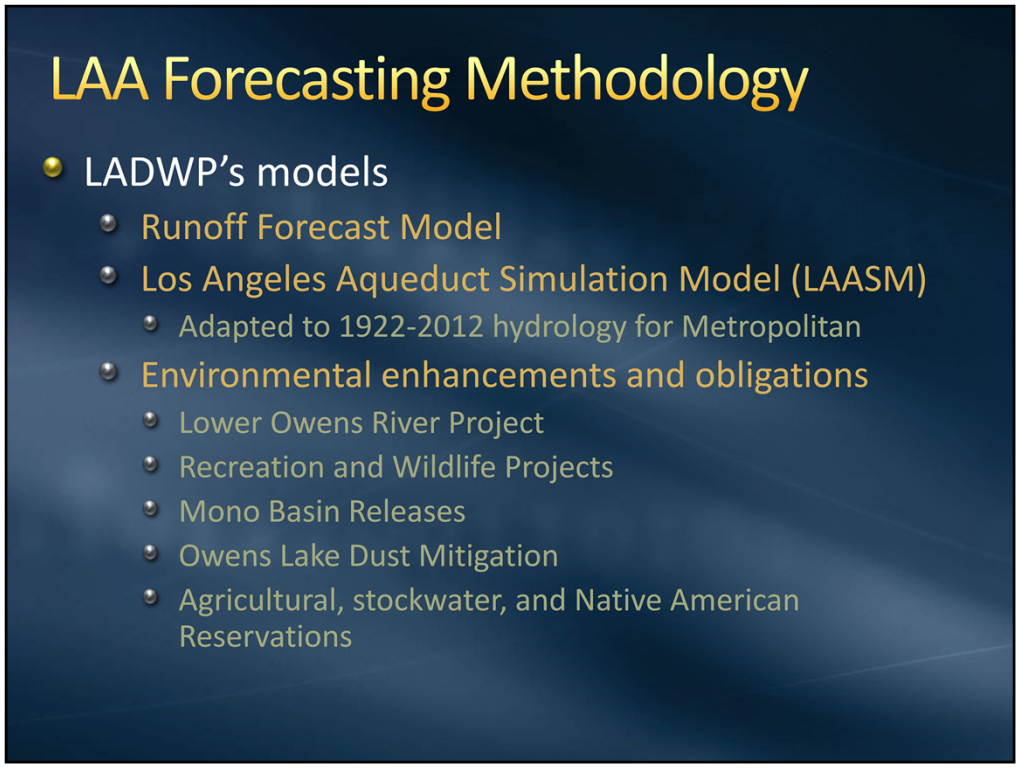


Los Angeles Aqueduct

Los Angeles Aqueduct

Historical Production: CY 1980-2014



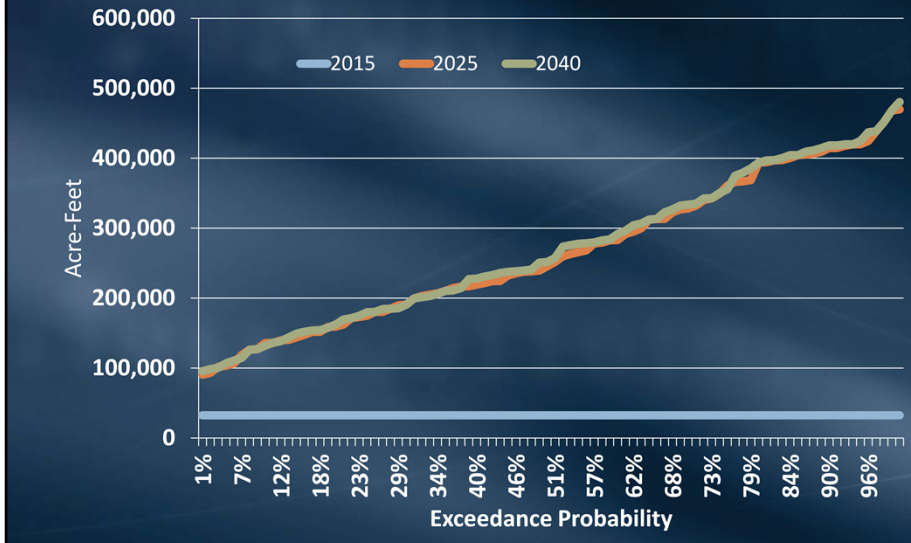


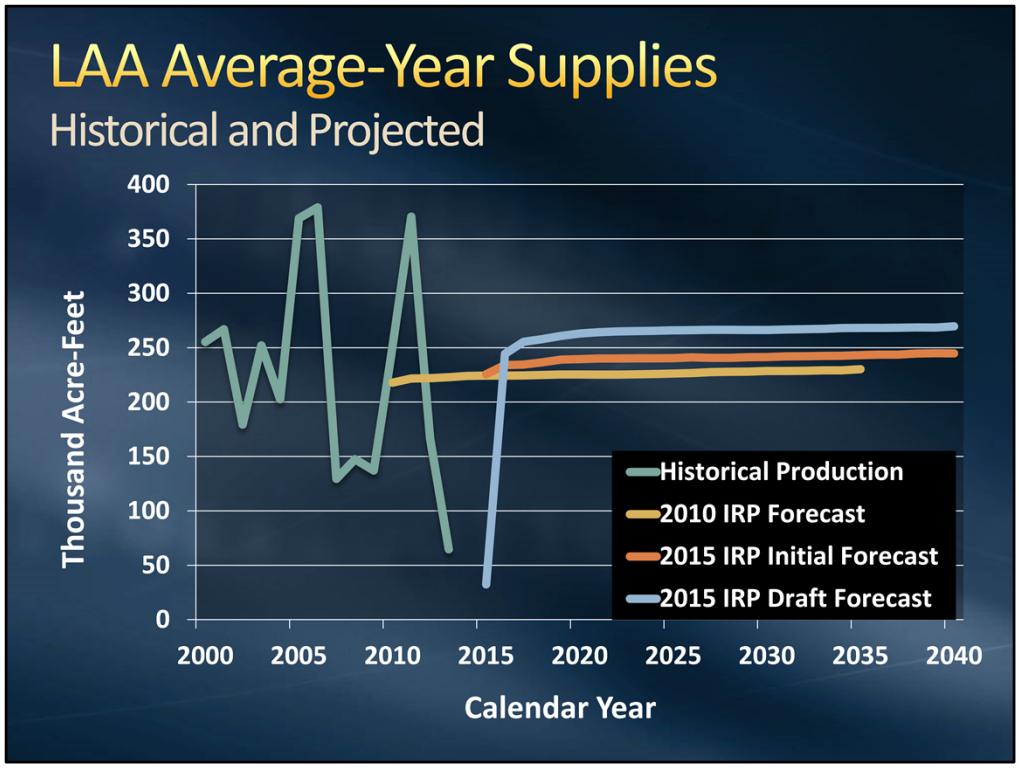
Over time, environmental considerations have required that the City reallocate approximately one-half of the Los Angeles Aqueduct (LAA) water supply to environmental enhancement projects. As a result, the City has used approximately 205,800 AF of water supplies for environmental enhancement in the Owens Valley and Mono Basin regions in 2010, which is in addition to the almost 107,300 acre-ft per year (AFY) supplied for agricultural, stockwater, and Native American Reservations.

Water-gathering activities for the LAA have a junior priority to meeting the Owens Valley and Mono Basin water obligations for environmental, domestic, agricultural, and recreational water needs.

LAA Forecast

April-March



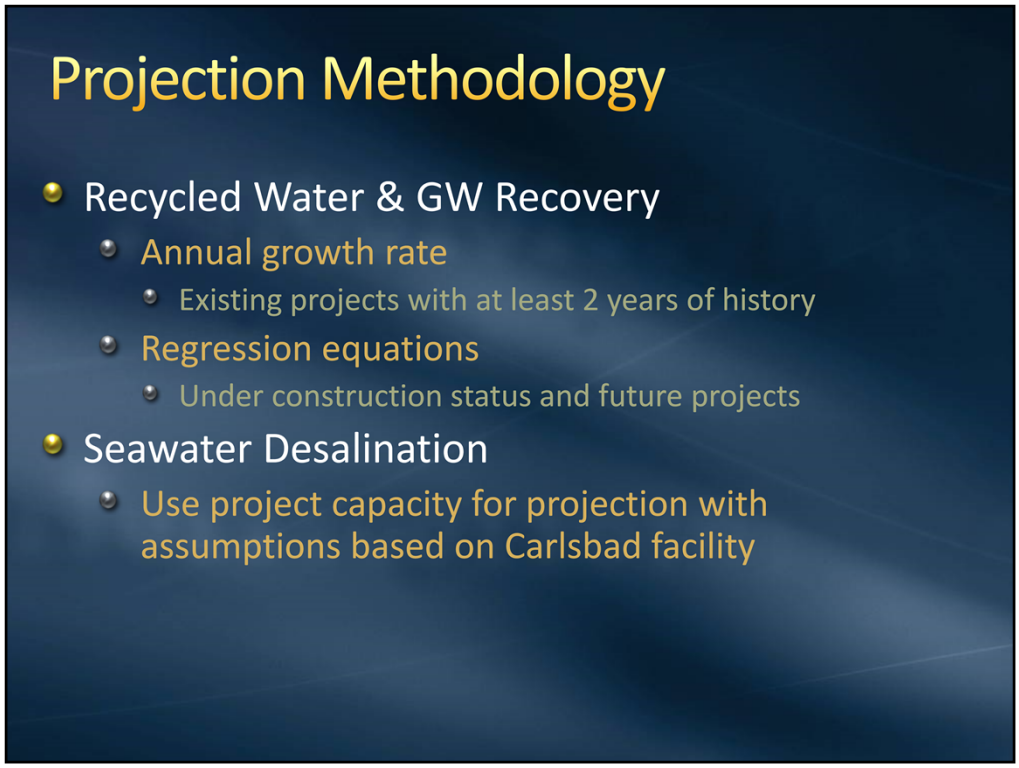


Increase due to forecast methodology


Local Projects Inventory

Project Status

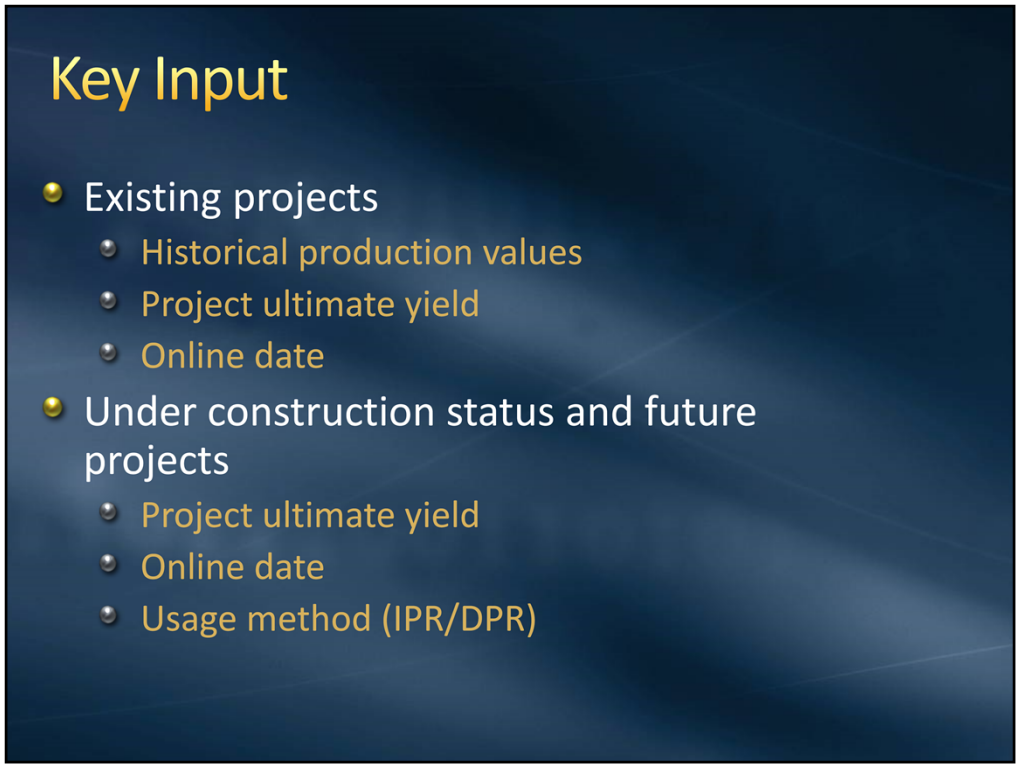
Existing	Projects that are producing water
Under Construction	Projects that are under construction
Full Design and Appropriated Funds	Projects that are designed and have secure funding for construction
Advanced Planning (EIR/EIS Certified)	Projects that have completed environmental impact report and other approvals
Feasibility	Projects that have undergone a feasibility study but have not obtained permits
Conceptual	Projects in early planning phases



For existing projects, we use historical production to formulate the annual rate of growth.

Future projects, we use historical production data to develop regression models.

Projects with 1 year of production uses the maximum of the first year production value or regression-based estimate.



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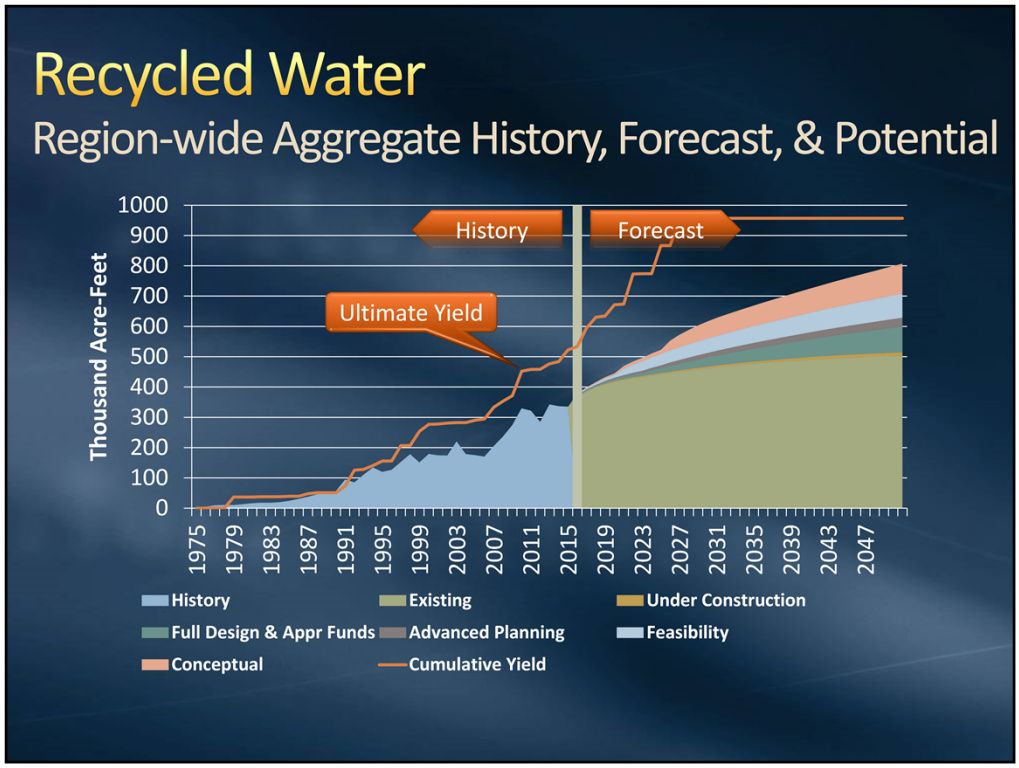


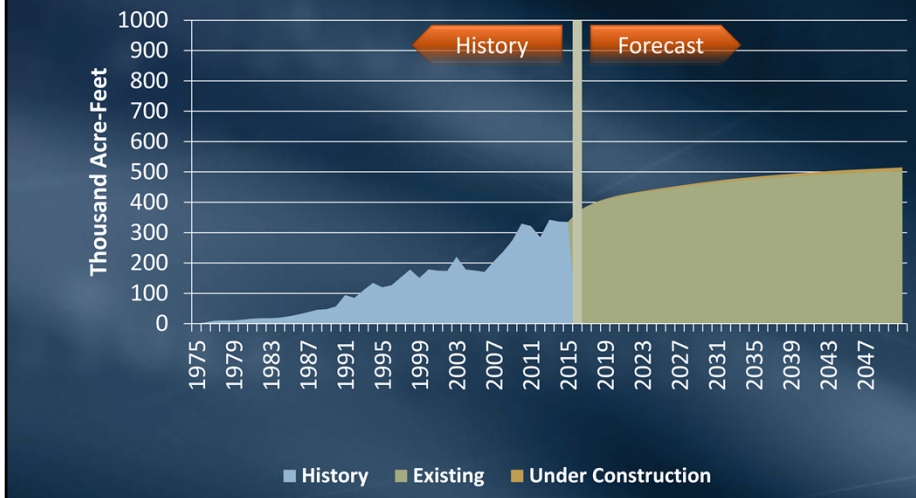
This graphic shows historical production, forecasts by status, and the cumulative yield.

Notice how the production is lower than the ultimate yield for most the 40 years history.

The results from our forecasting models follows the same trend. Numerically, it's about 15% below the ultimate yield in 2050.

Recycled Water Forecast

Existing & Under Construction

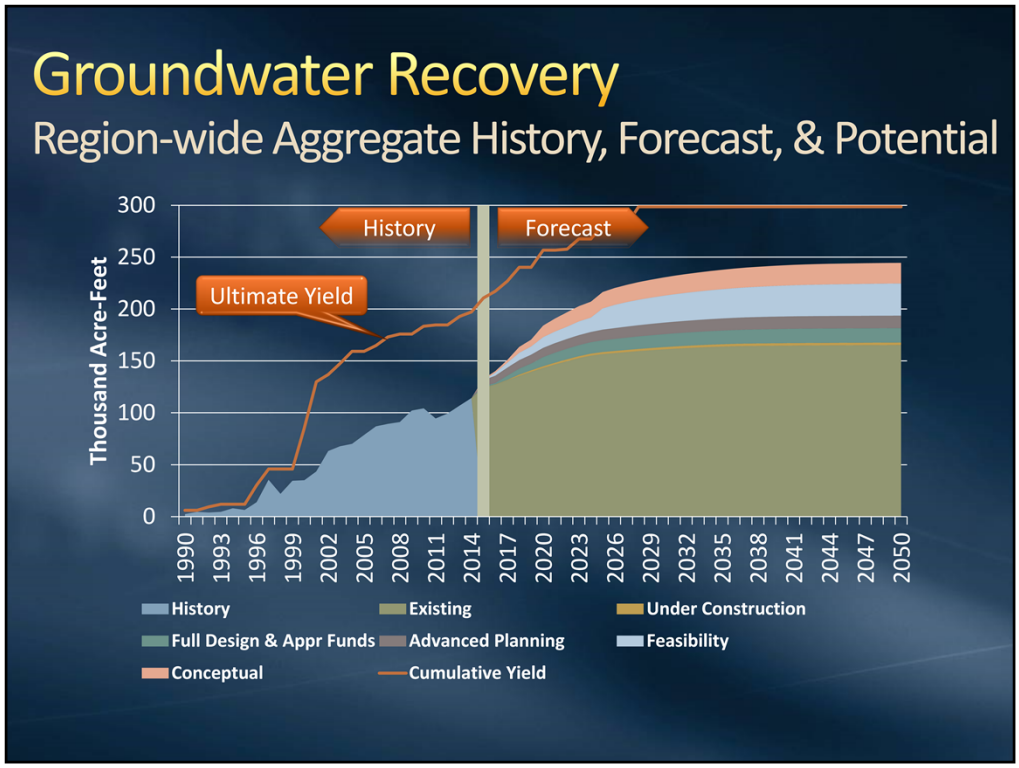


Recycled Water Potential

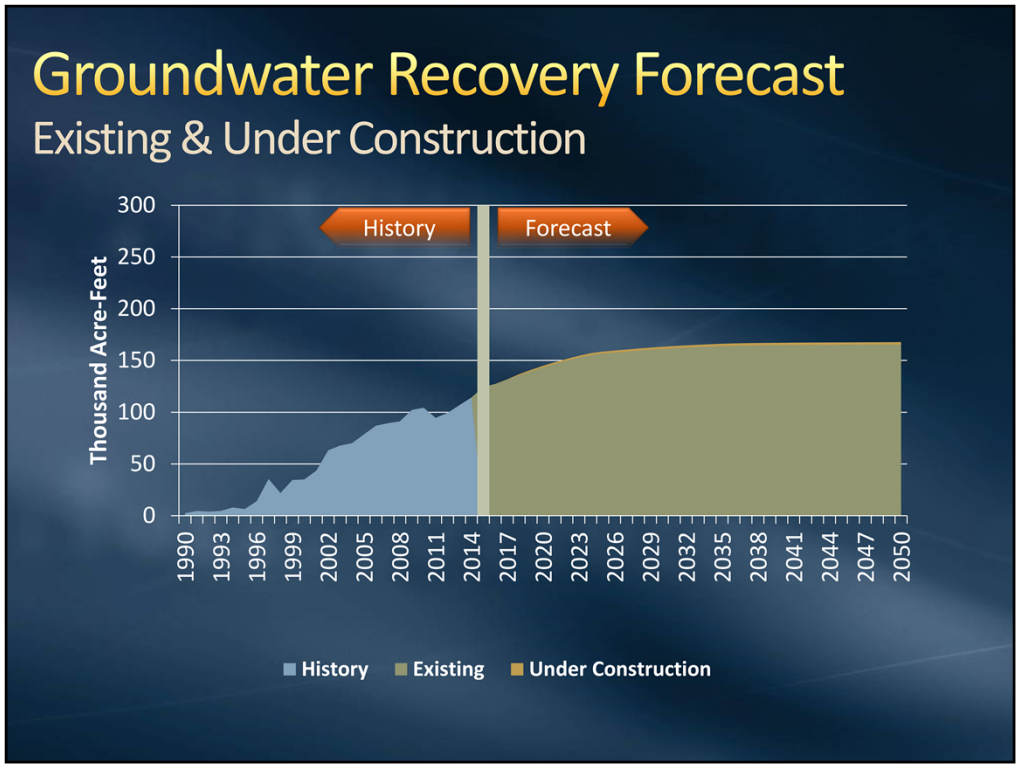
Future Projects

Recycled Water Potential

2040 Projection



This graphic shows the model results for groundwater recovery.



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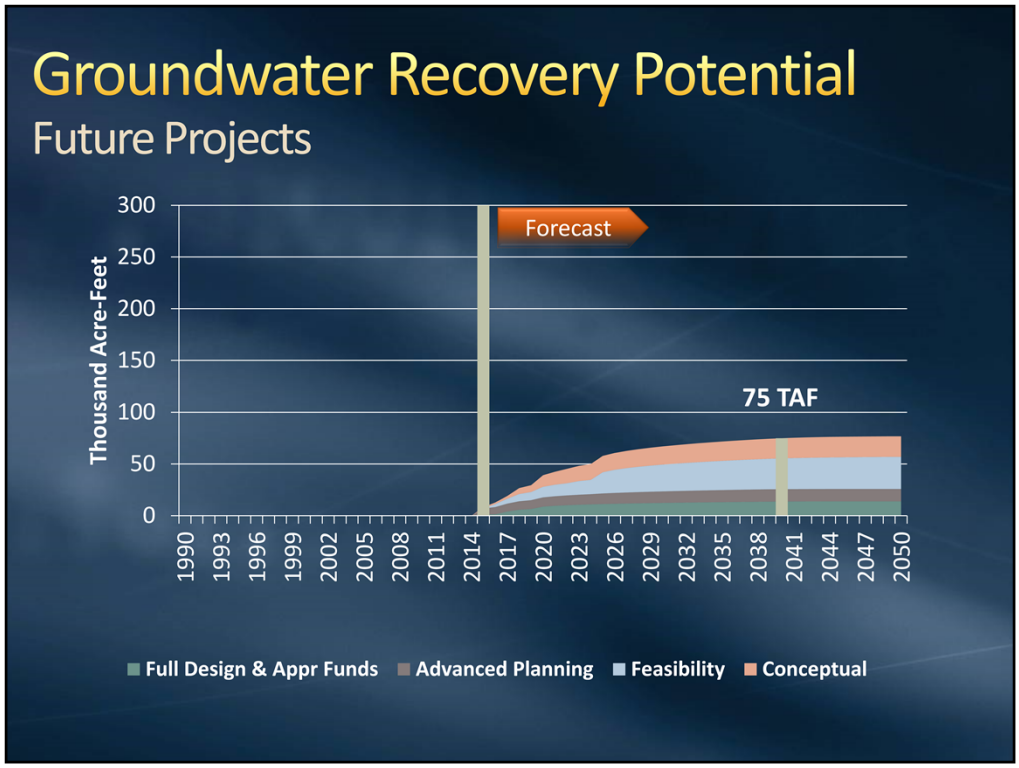

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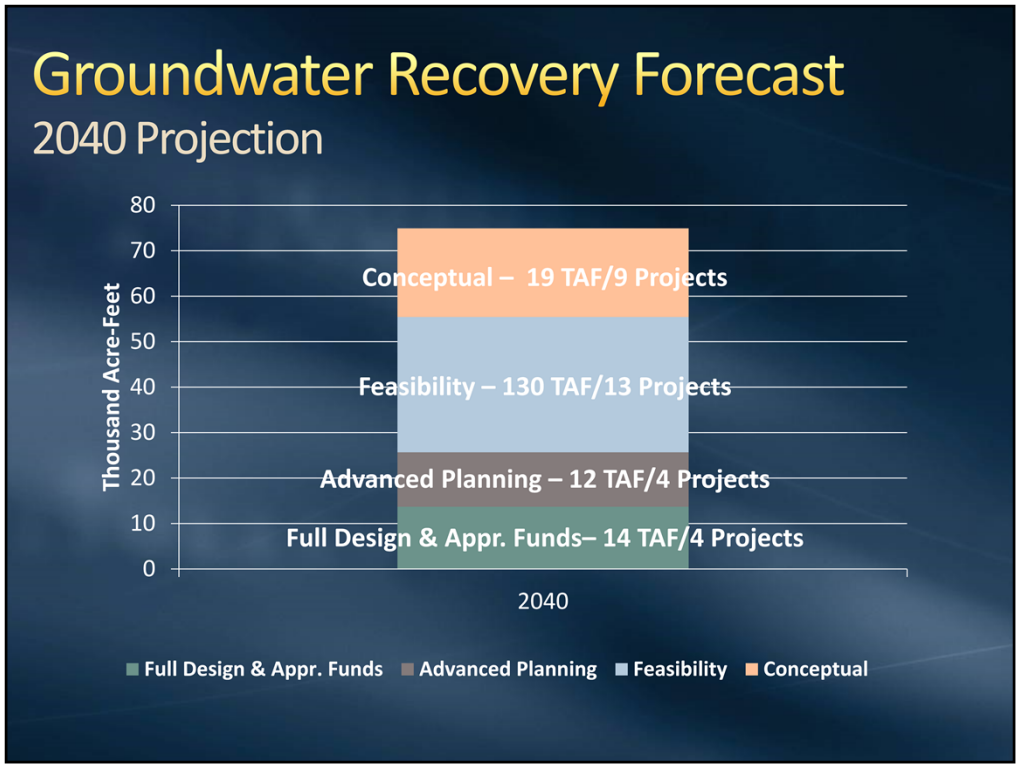
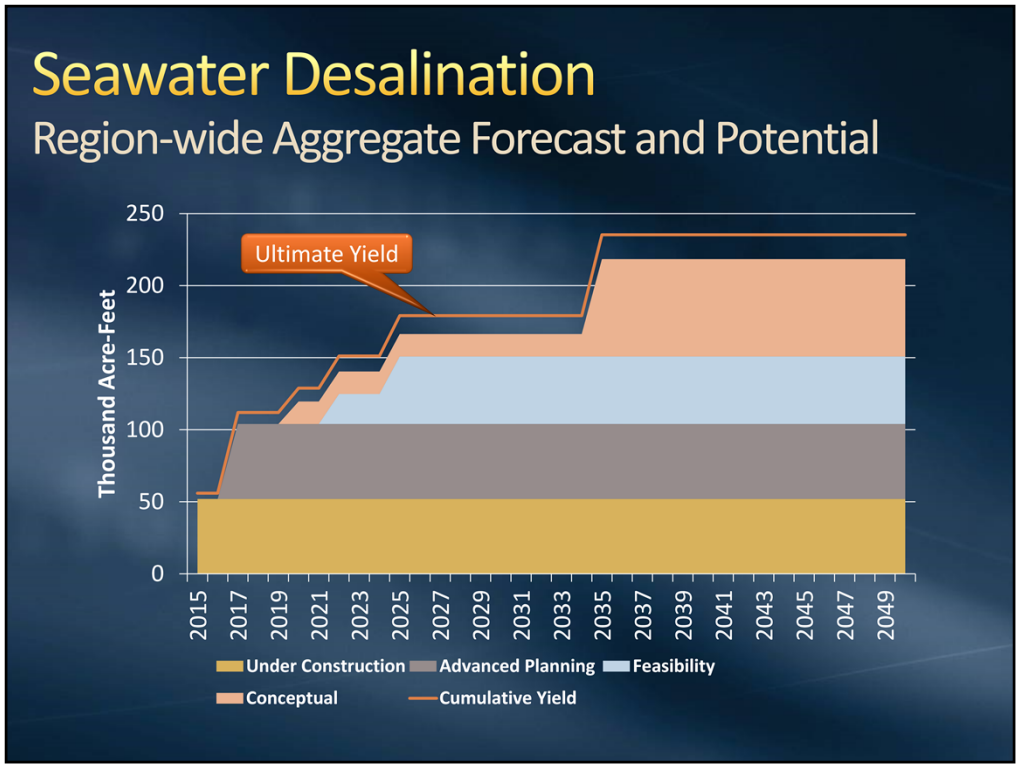
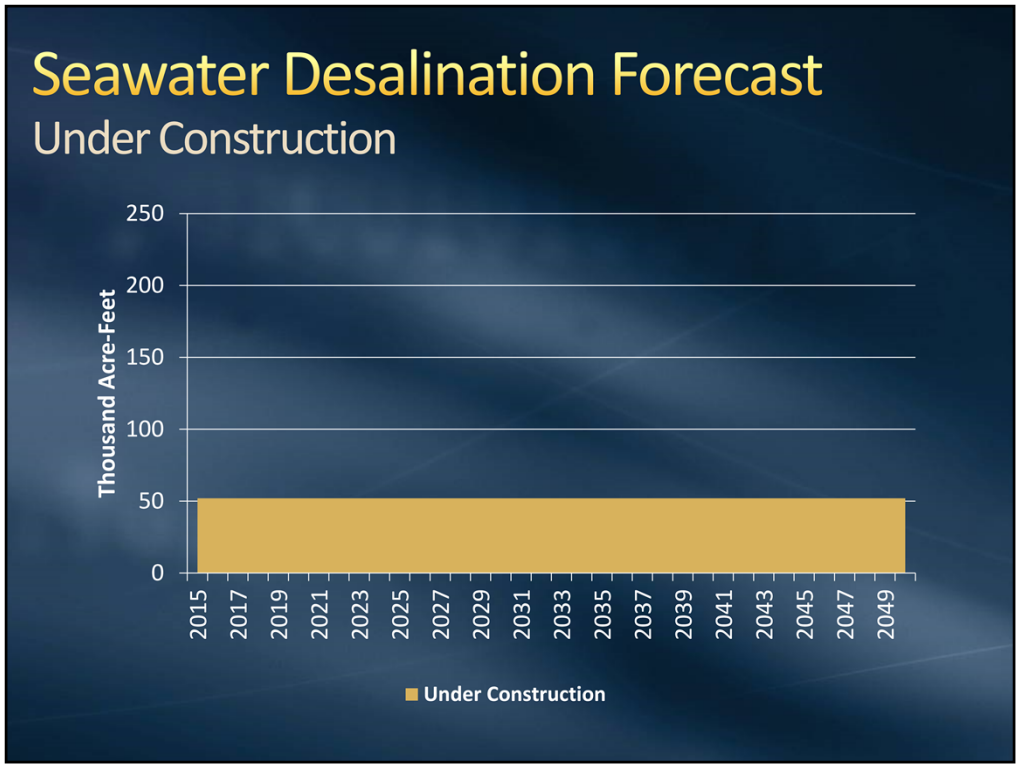


This graphic shows the model results for groundwater recovery.



Based on our assumptions, the seawater desalination projections are about 8% below ultimate yield. We feel this forecast is reasonable because of down time for maintenance.



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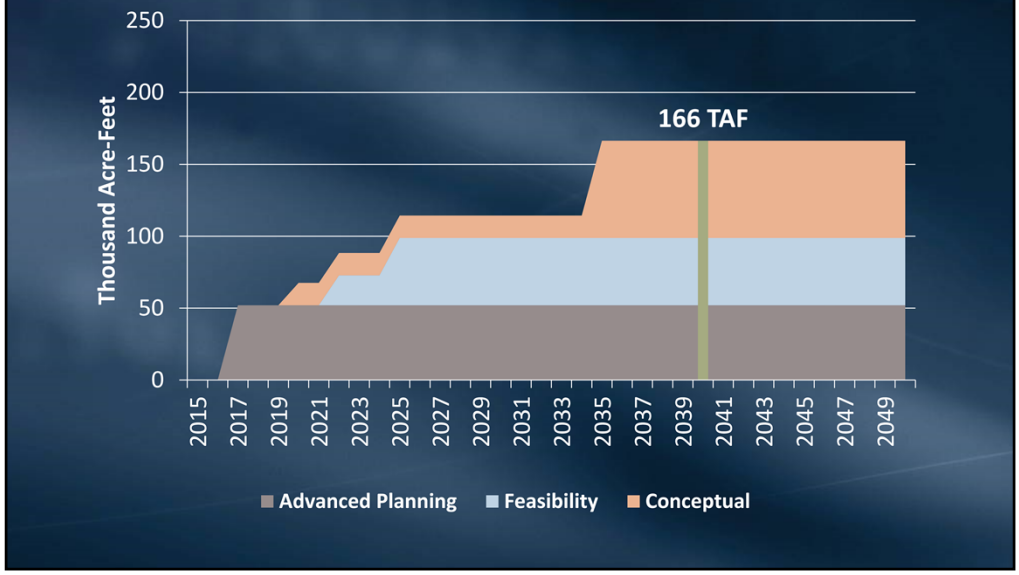
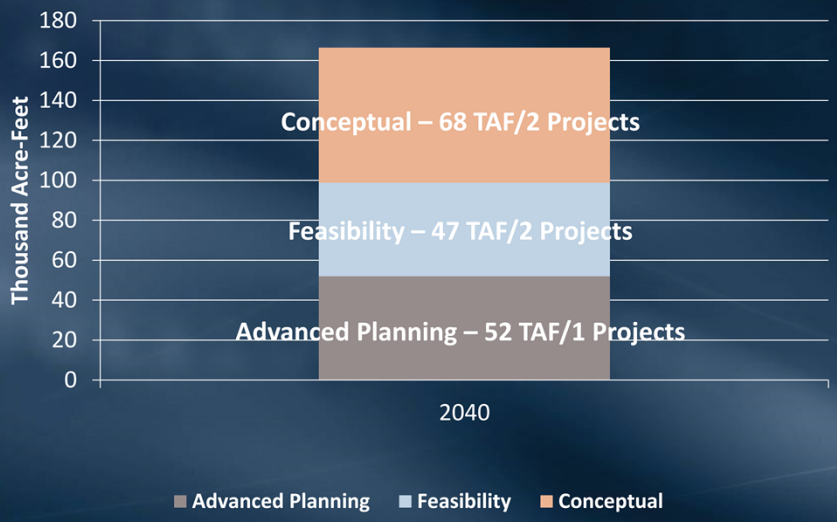
Seawater Desalination Potential

Future Projects



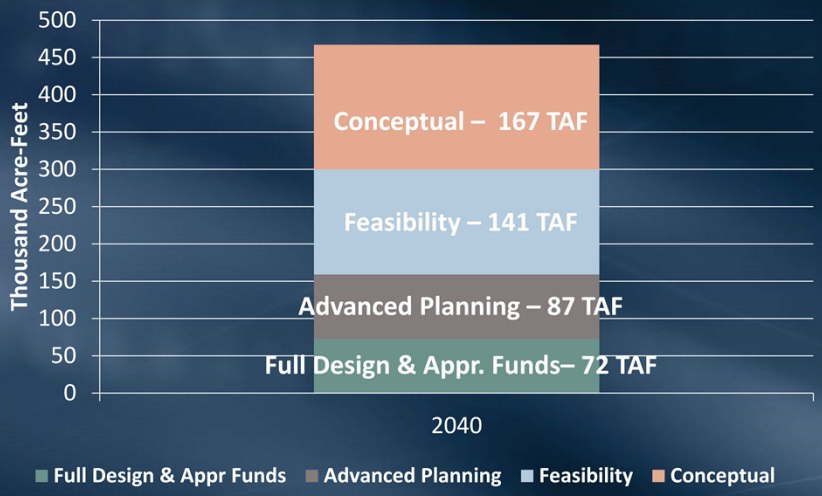
Seawater Desalination Potential

2040 Projection



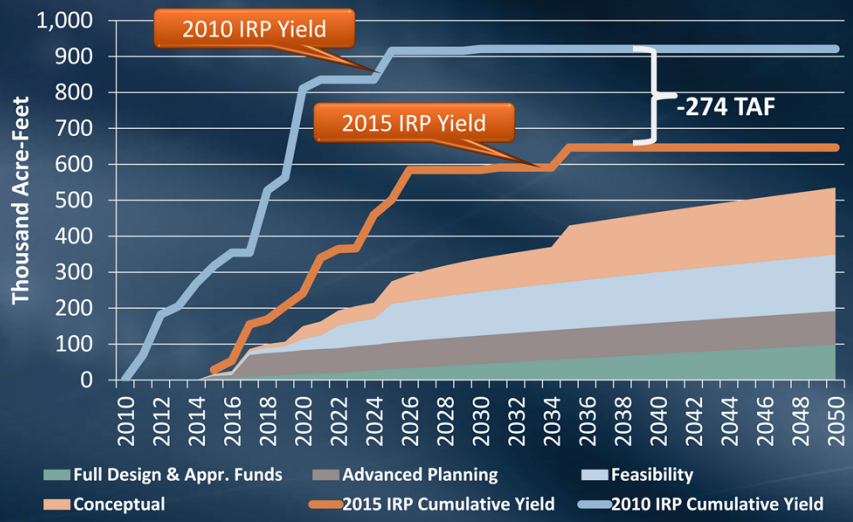
Total Identified 2040 Potential

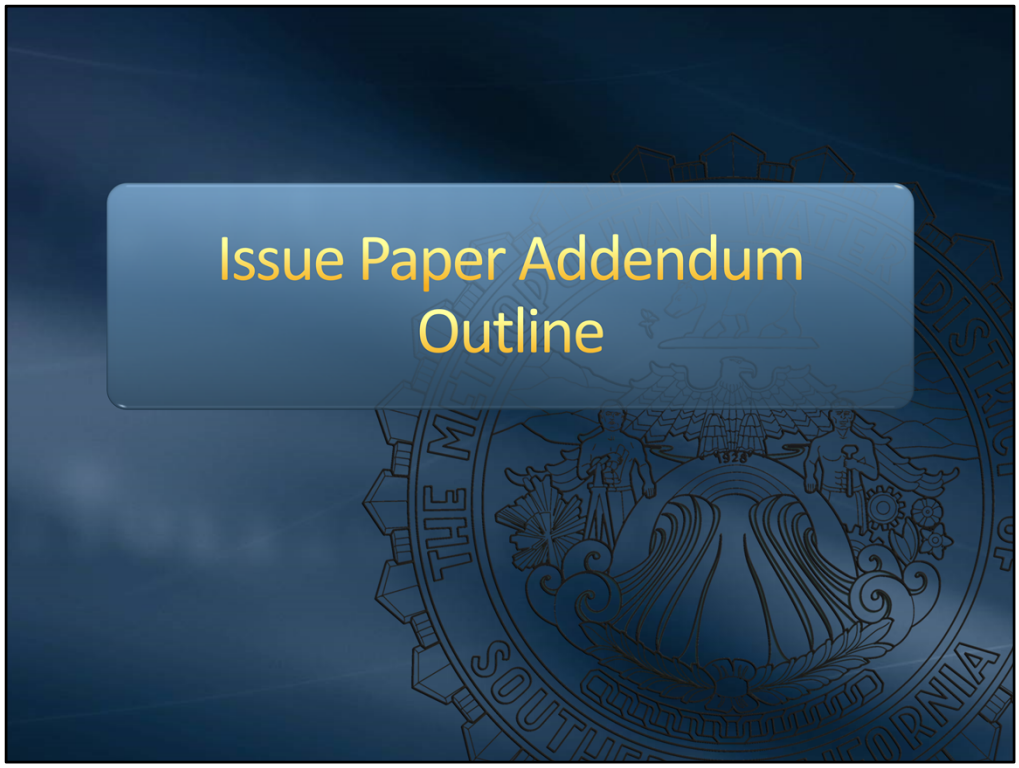
Recycling, Groundwater Recovery, Desalination



Total Local Resources Potential

All Future Projects by Category

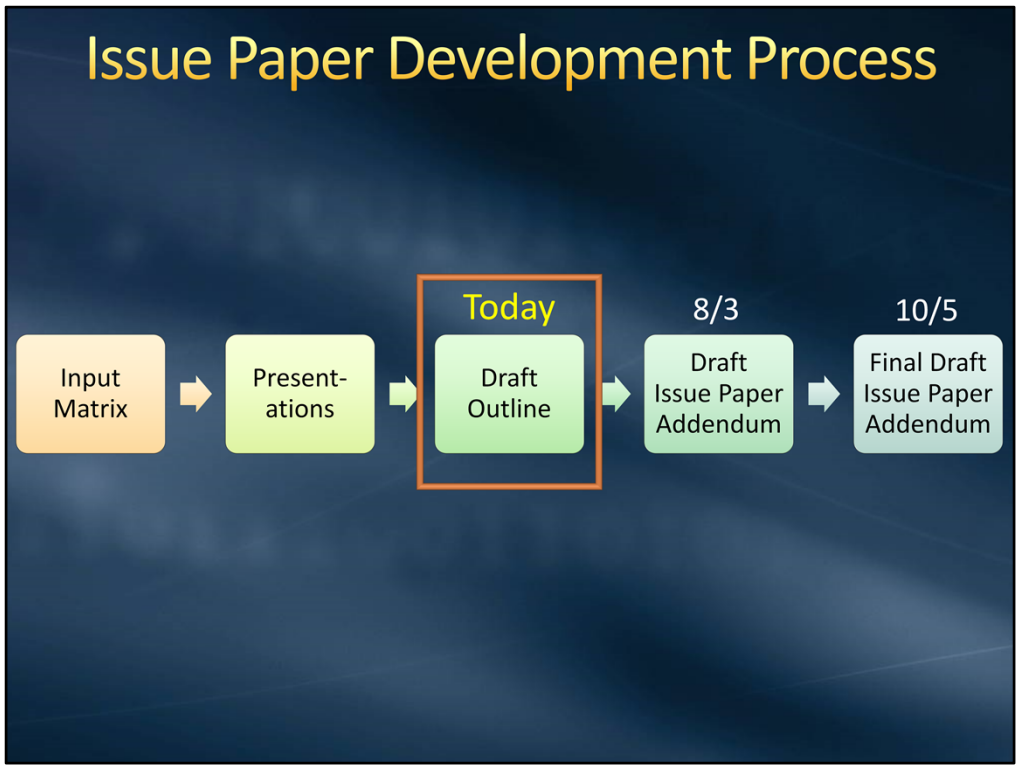



Issue Paper Addendum
Outline

Information for the IRP can be placed into three categories (information that…):

1) Informs the forecast
2) Feeds the issue paper (discuss conservation issues)
3) Will be flagged to add to a subsequent Board discussion on policies and implementation

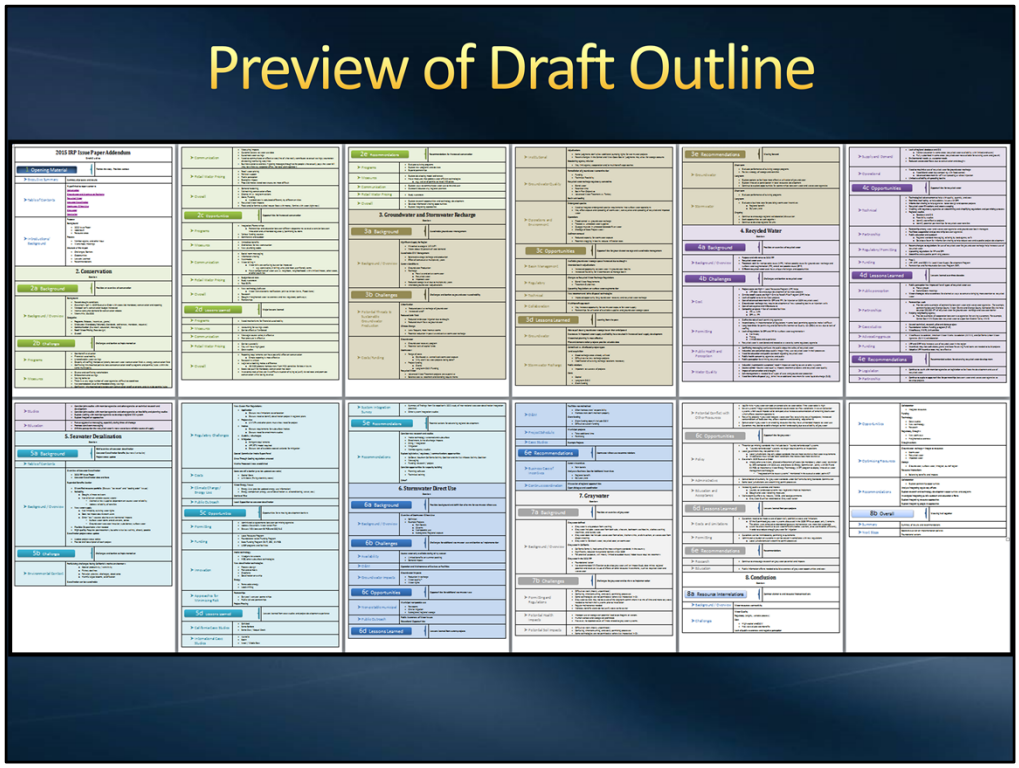
All three feed the policy implementation discussion


Issue Paper Development Process
Today
8/3
10/5
Input Matrix
Present-ations
Draft Outline
Draft Issue Paper Addendum
Final Draft Issue Paper Addendum

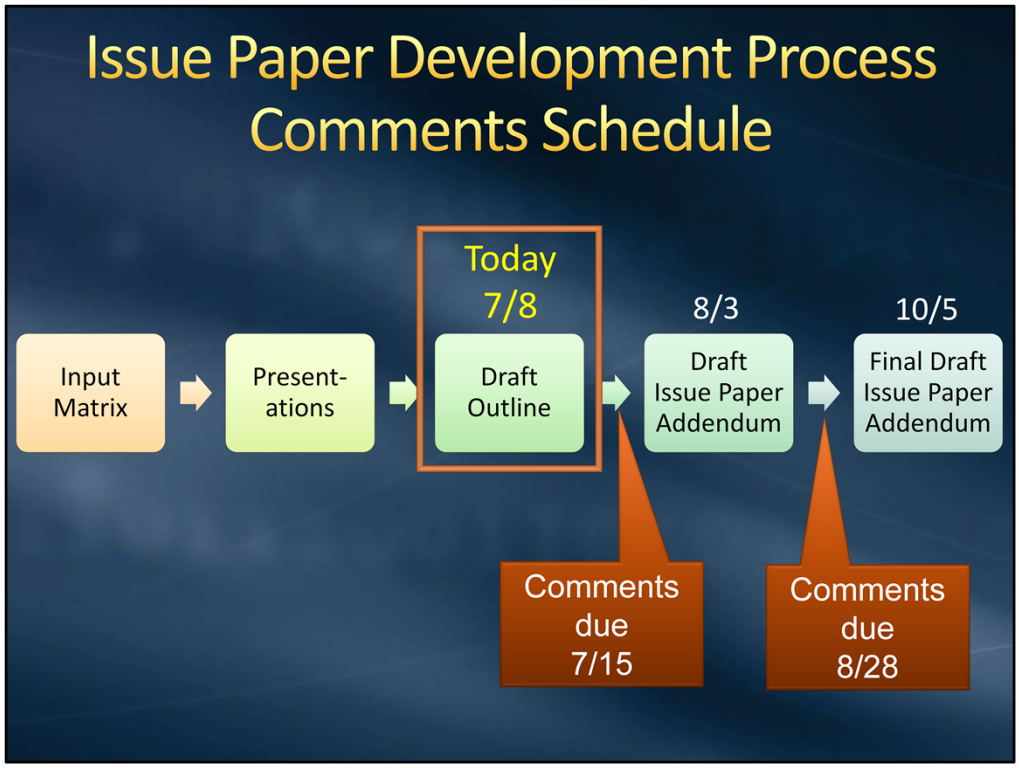
Draft Outline: Sections

- Opening Material (Execute Summary, TOC, Intro)
- Conservation
- Groundwater and Stormwater Recharge
- Recycled Water
- Seawater Desalination
- Stormwater Direct Use
- Graywater
- Conclusion (Resource Interrelations, Overall)

Resource Subsections



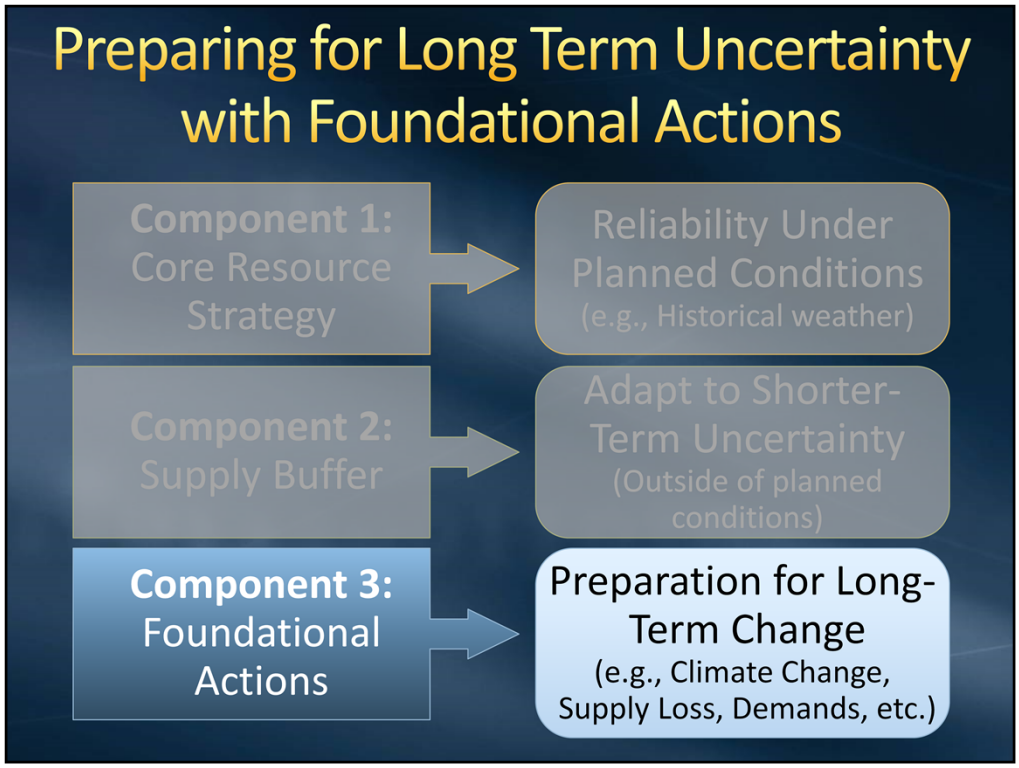
Outline in table form, designed to be easy to read and digest. Color coded per section. Hyperlinks to each section on the first page.
Not necessarily looking for edits to the outline. Looking more for major comments: significant content needs.



Very condensed schedule that we're working with. One week to review the outline for major comments on content. Then an opportunity the review the draft paper.


Other Local Resources Topics

Foundational Actions



What are Foundational Actions?

- Component of our Integrated Water Resources Plan adaptive management strategy for water supply reliability
- That helps us prepare for long term uncertainty/change
    - for example, a loss of a major source of supply

If something like that should happen, performing these relatively low cost, low risk "Foundational Actions" sets the region up to be able to implement, and implement quicker, in time of need.

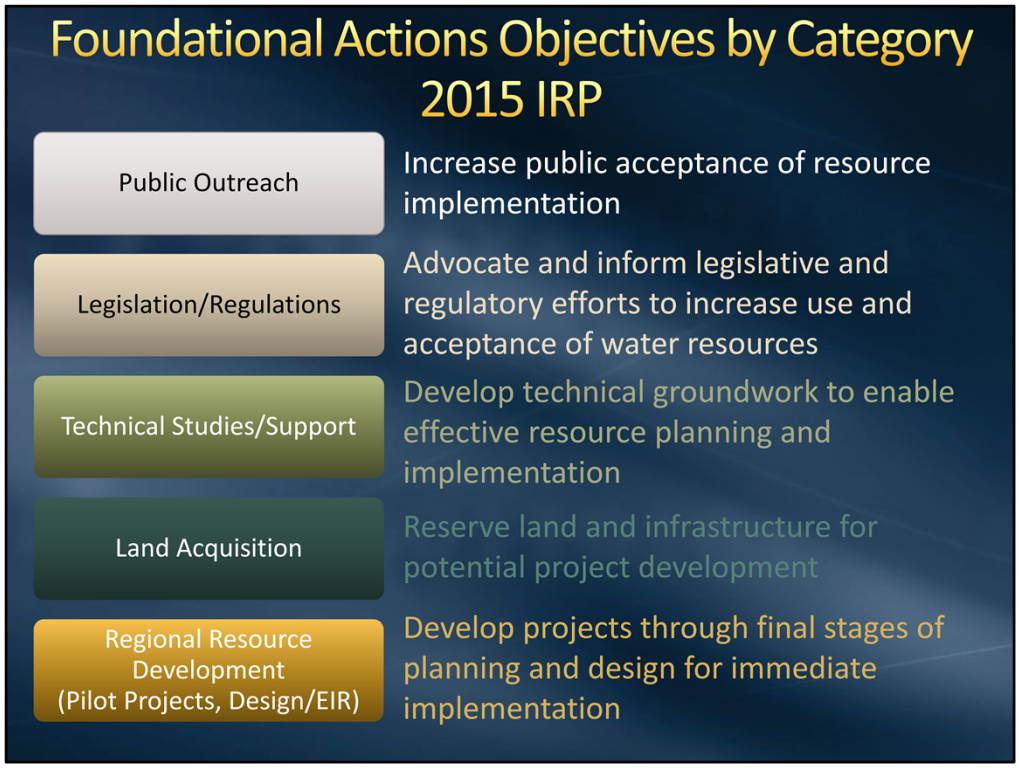
Foundational Actions Resource Areas

Recycled Water

Seawater Desalination

Stormwater

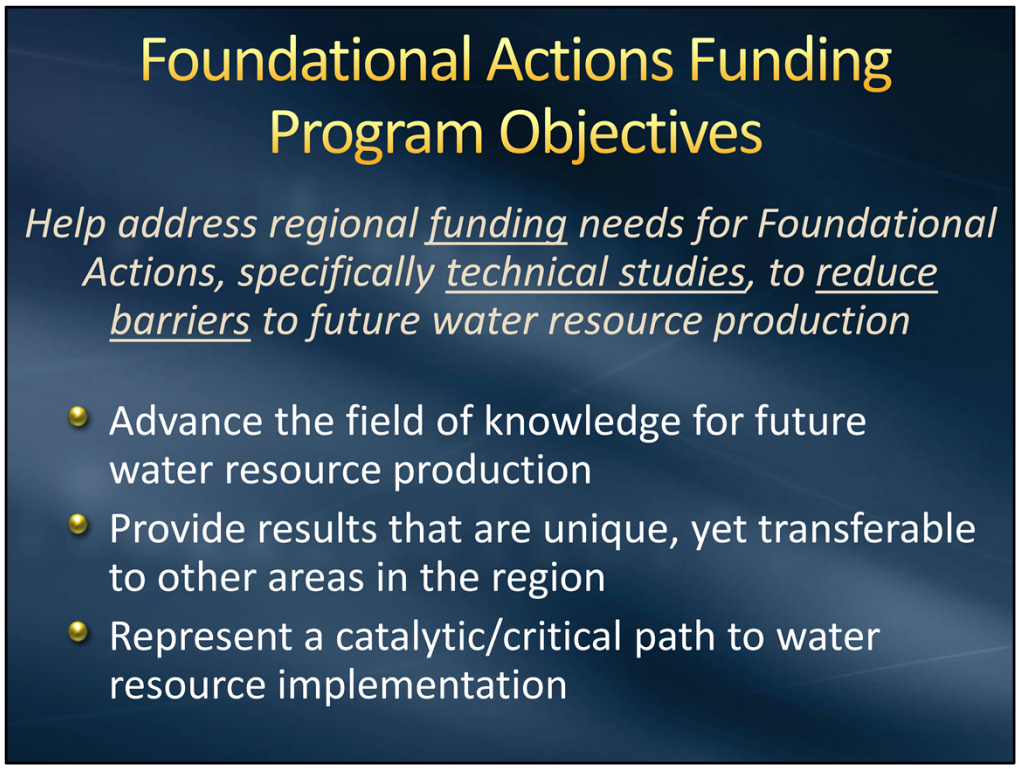
Groundwater



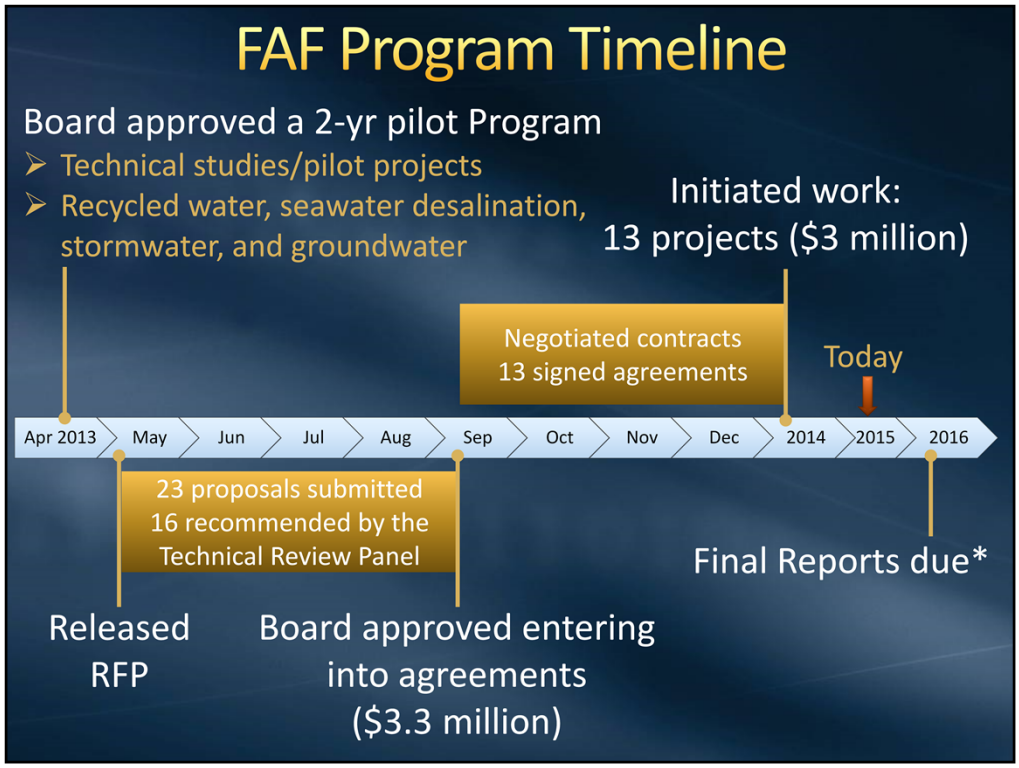
- Since 2010, these categories have evolved to be more condensed and straight-forward

Performing Foundational Actions Examples

- Continued to carry out public outreach and legislative/regulatory efforts (e.g., CalDesal)
- Technical Studies
  - Seawater Desalination Assessment of Integration Practices
  - Joint Groundwater Replenishment Study (LACSD)
  - Seawater Desalination Water Quality Integration Study
- Foundational Actions Funding Program

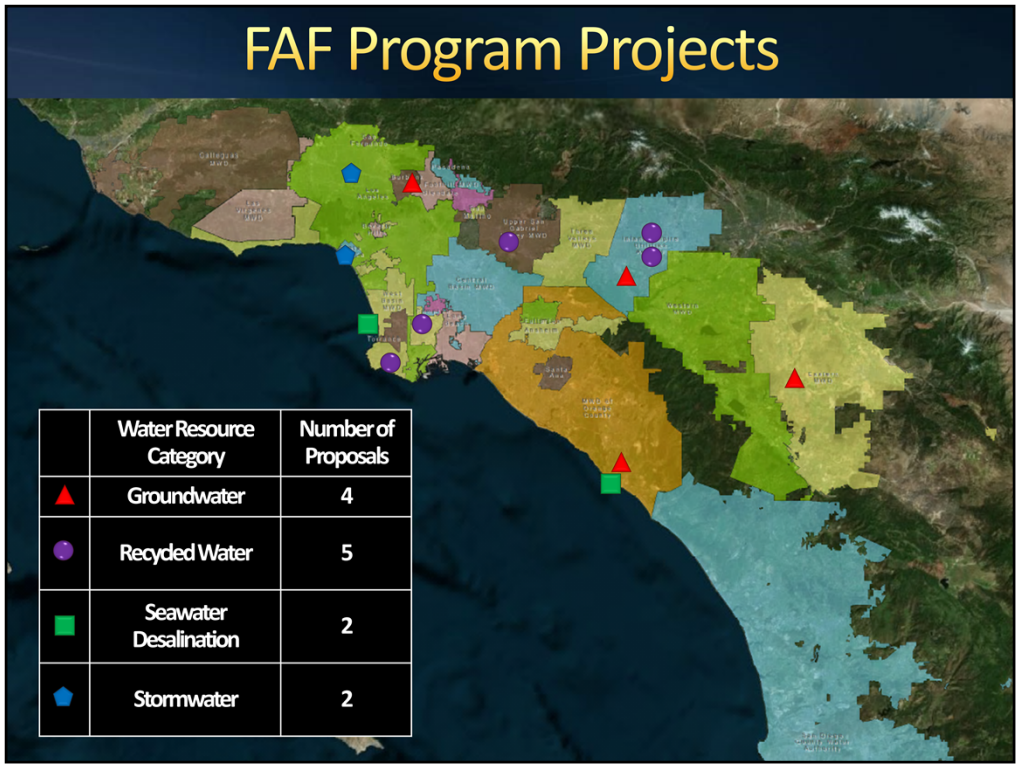


- Provides funding to lay the **technical** groundwork to reduce barriers to **future** water resource production.
- Specifically, the Program seeks to:
    - Advance the field of knowledge
    - Provide results that are unique, regionally applicable
    - And be catalytic to water resource implementation



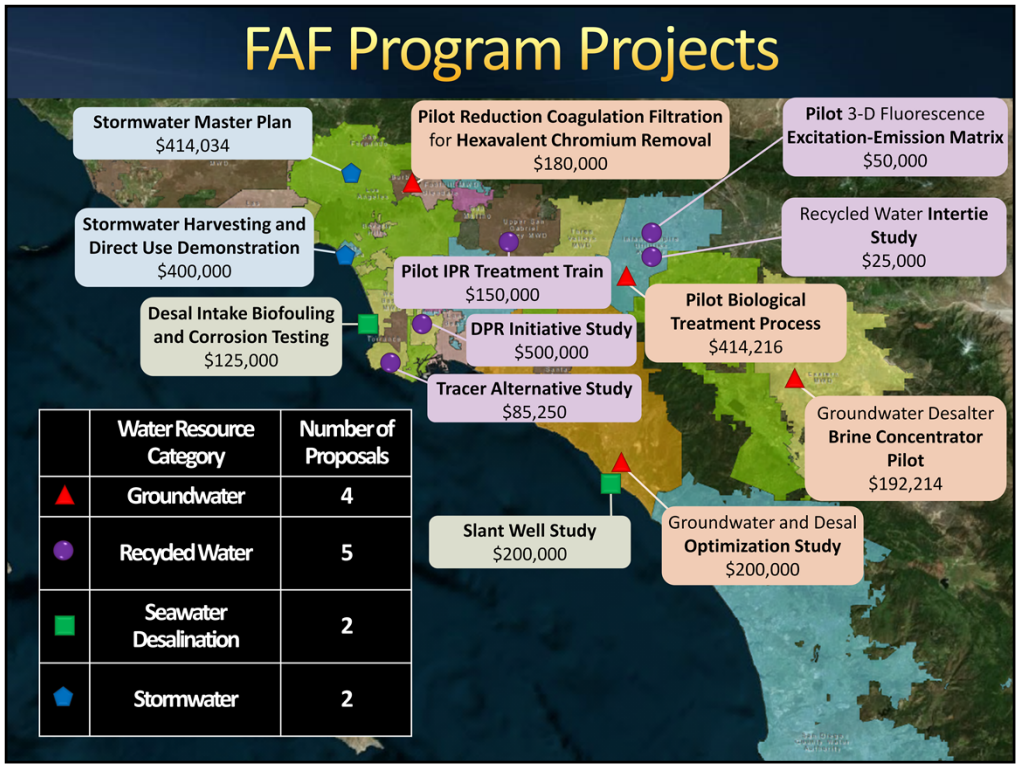
- With those goals, the Board approved this exciting Program in April of 2013
    - This Program is a pilot 2-year non-competitive funding program
    - This Program focused on technical studies/pilot projects pertaining to recycled water, seawater desal, stormwater, groundwater
- By the following month, we released the RFP
    - Open only to Metropolitan member agencies, who could partner with other entities of their choosing
    - For up to $500,000 per member agency or proposal
- By Sept 2013, the Board approved entering into agreements for the proposals that esteemed Technical Review Panel found to have met the criteria in the RFP
- By early 2014, we were able to execute agreements for 13 projects for about $3 million
- And today, we are over halfway between project start and the scheduled due date for Final Reports

- 23 proposals were submitted, 16 recommended by the Technical Review Panel
    - A 5-person technical review panel, comprised of recognized industry experts (3 internal to Metropolitan and 2 external), reviewed each proposal to ensure the Program goals and criteria are being met
- Execute agreements for 13 projects
    - 13 member agencies participating (as the lead or partner) for a total funding match of about $3 million



- So what are these exciting projects in this program?
- 4 in the area of groundwater
- 5 in RW
- 2 in Desal
- 2 in Stormwater

FAF Program Projects



	Water Resource Category	Number of Proposals
▲	Groundwater	4
●	Recycled Water	5
■	Seawater Desalination	2
⬟	Stormwater	2

FAF Program Progress
Early Results/Accomplishments

Recycled Water USGV, WB, IEUA Total organic carbon reduction; produced a communication plan for DPR; determined feasibility	**Seawater Desalination** MWDOC, WB Developed coastal models; reduced biofouling of intake pipes
Stormwater LADWP, Santa Monica Determined capture potential and developed projects, programs, and cost-benefits; obtained CEQA	**Groundwater** Eastern, Glendale, IEUA, MWDOC Increased recovery; reduced retention times for Cr6 removal; sustained removal of nitrate and organic contamination

FAF Program Next Steps

Let's say, for the purposes of discussion, that we are moving forward with about the same comfort level of risk as in 2010 (since we haven't seen two or more uncertainties turn out unfavorably thus far).

Tie to issue paper recommendations? Tied to what's needed for Metropolitan to implement local resources?
Member agencies only?
Multi-tiered?

Local Resources and the WSAP

How Does Local Supply Affect WSAP Allocation?

- Wholesale Minimum Allocation
  - Reduces “Demand on MWD”
  - WMA Factor is multiplied into a smaller number
  - This is the major part of the MWD allocation until Level 10
- Retail Impact Adjustment Allocation
  - Reduces “Demand on MWD”
  - Reduces “Dependence on MWD”
  - RIA Factor is smaller AND is multiplied into a smaller number

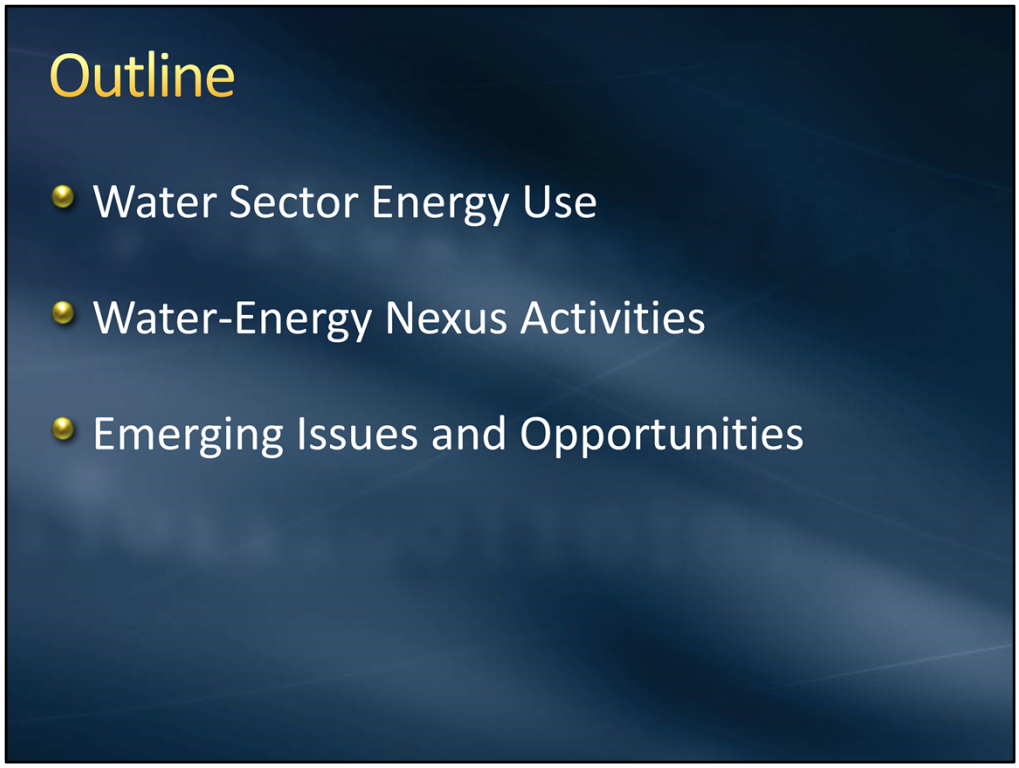
Is New Local Supply Treated the Same as Existing Local Supply?

- All Local Supplies are treated the same
  - Reduces Demand on MWD
    - Smaller Wholesale Minimum Allocation
    - Smaller Retail Impact Adjustment Allocation
- Total Supplies and Retail Reliability Increases
  - Agency increases in total supply
    - Local Supply increase is larger than MWD Allocation decrease
  - Agency improves in Retail Reliability by producing local supply than staying dependent on MWD

Policy Issue

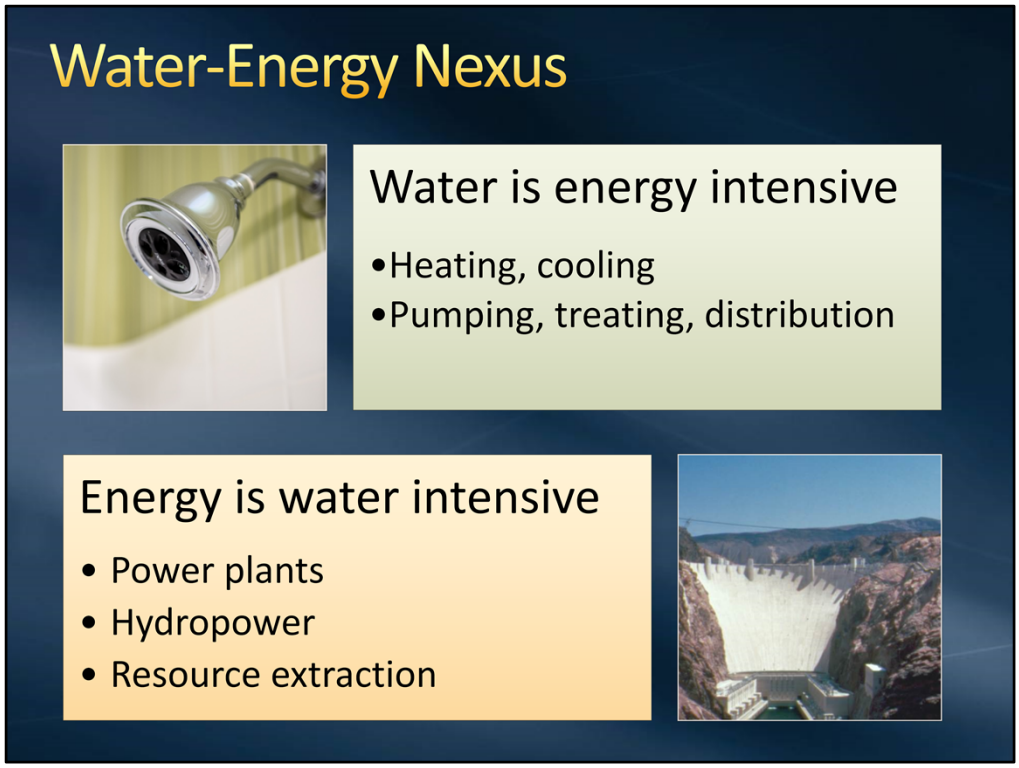
Does the treatment of new local supply development in the WSAP (or future shortage allocation approaches) affect IRP local supply targets or development policies?

Water-Energy Nexus



We could literally spend all day discussing various aspects of this issue, but today I will be focusing on three:

- Facts about energy use in the water sector
- Metropolitan's activities in this arena
- Opportunities and emerging issues moving forward.



Water is energy intensive and energy is water intensive, and this is the essence of the Water Energy Nexus

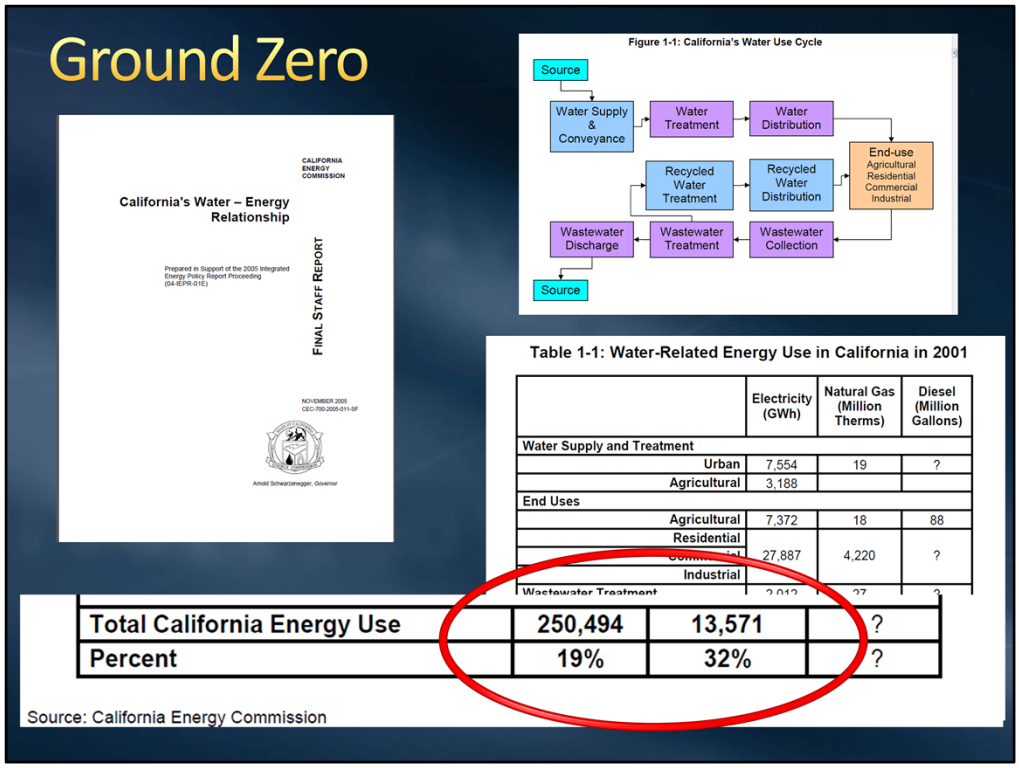
The challenges we are facing in the water industry are impacting the energy industry, and their challenges are affecting our industry.

Over the past five years, this relationship has become a major policy issue at the National level, and especially here in California.

At virtually every water conference or workshop there is a water energy nexus panel.

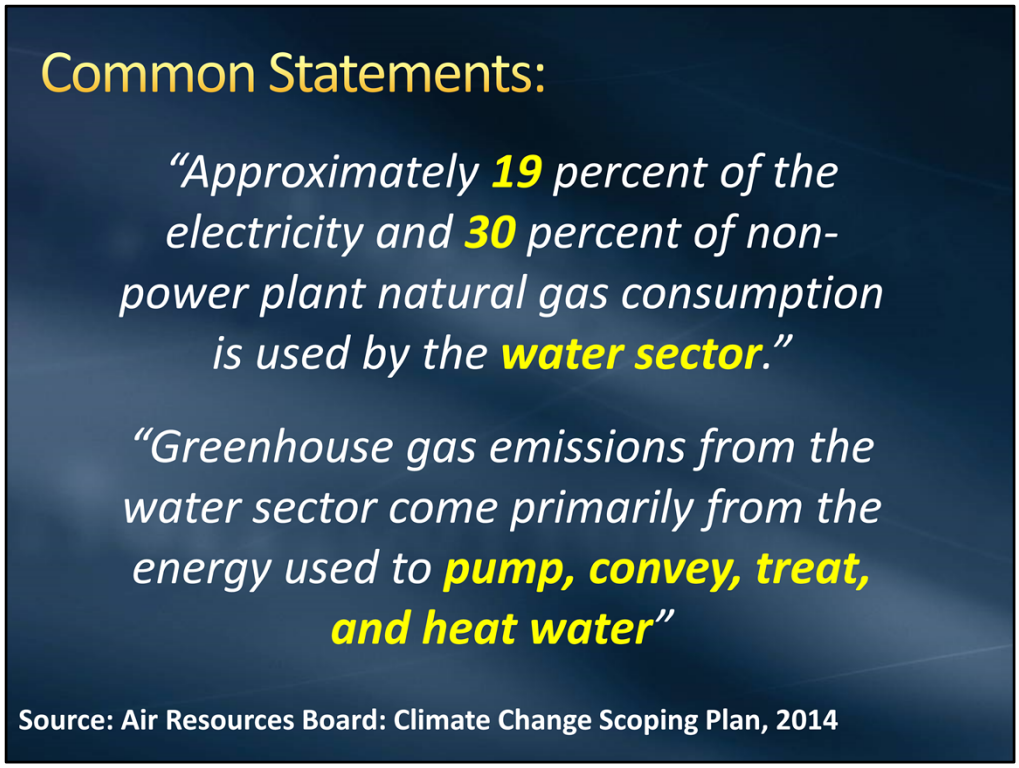
There have also been dozens of reports and white papers on the subject.

More often then not, you may here that water utilities use 19% of the state's energy or electricity, or some variation of this.



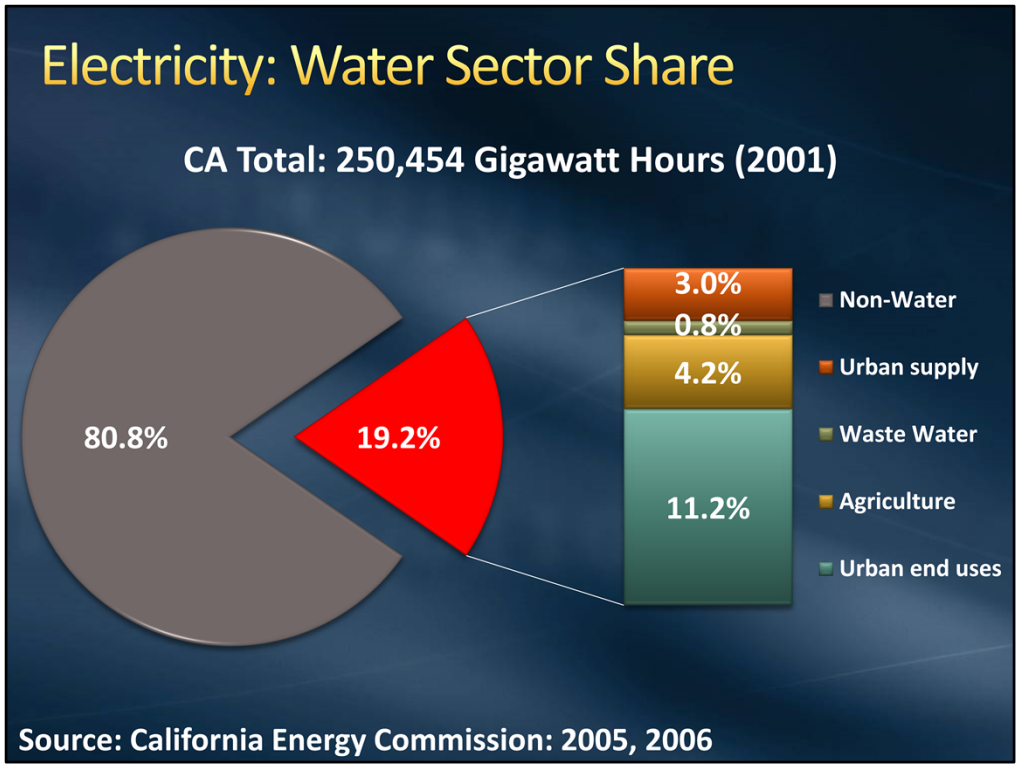
CEC Quote

As shown in Table 1-1, these estimates indicate that total water-related consumption is large – 19 percent of all electricity used in California, approximately 30 percent of all natural gas, and more than 80 million gallons of diesel fuel.



Hear is an example from a 2014 Air Resources Board report.

"Greenhouse gas emissions from the water sector come primarily from the energy used to **pump, convey, treat, and heat water**"

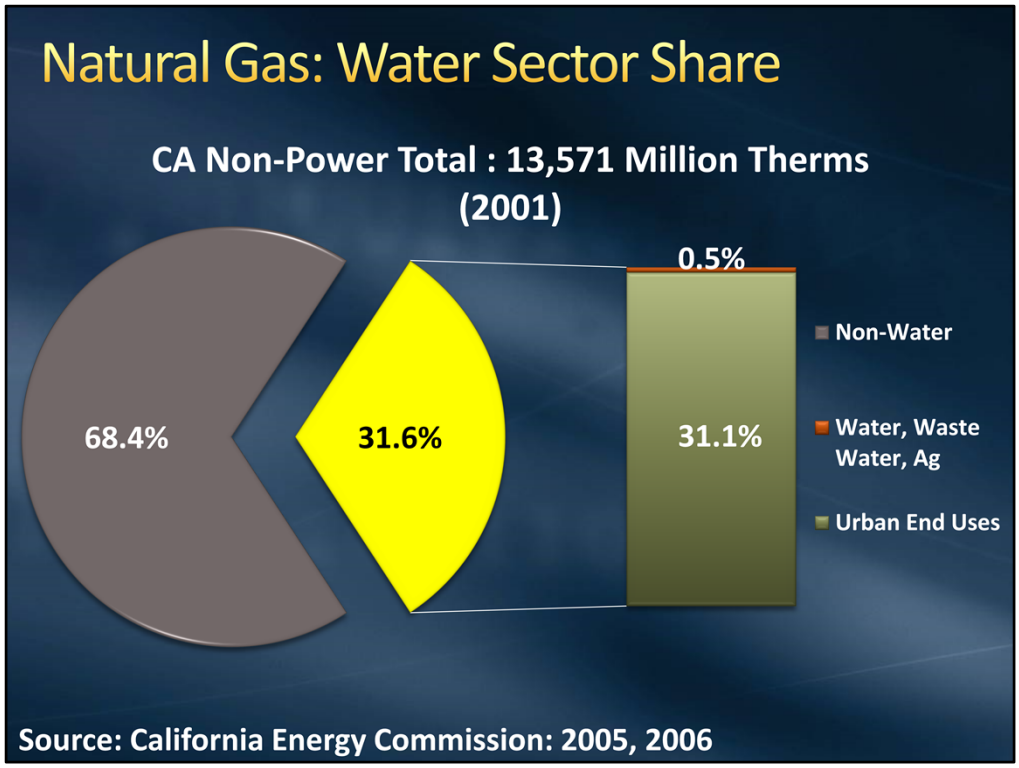


This graph shows California's electricity use for 2001 and here is the 19% - this is the source

Breaking the water sector down, pumping and treating and distribution account for 3% the total. This represents water utilities like Metropolitan, your agencies and the SWP.

Consumer end uses account for the majority – 11% not the water utilities!

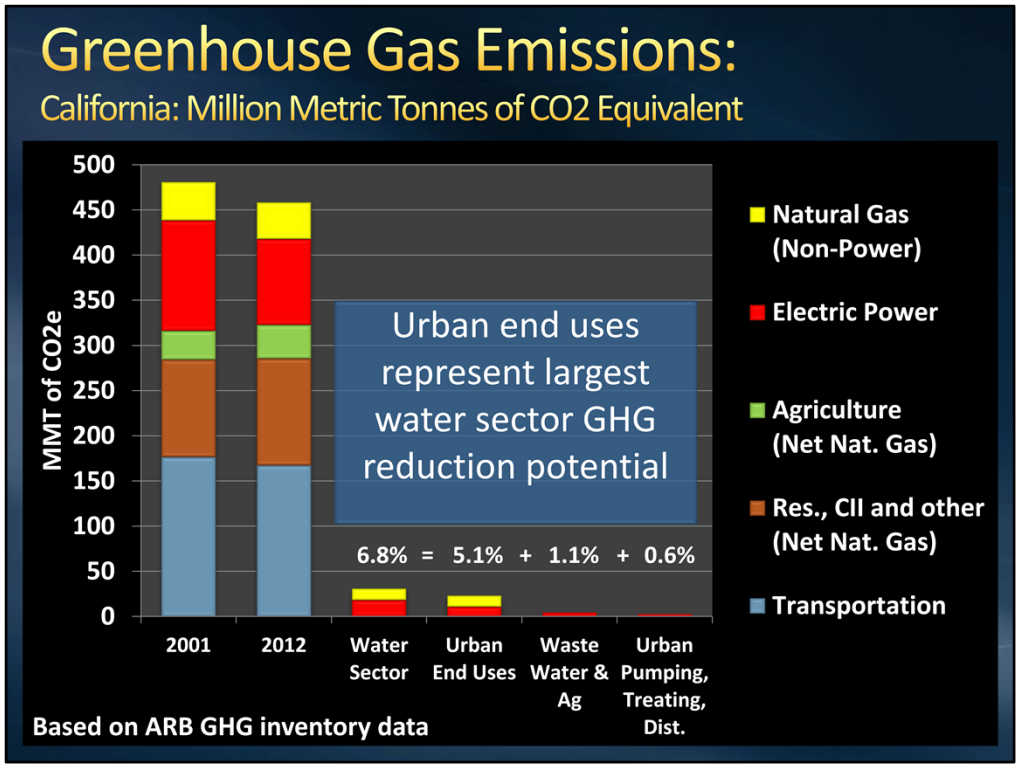
Clothes washer, water heaters, industrial processes



So here is the breakdown of natural gas use from the same CEC report:

The water sector represents 31%.

Over 99% of is due to consumer end uses – heating, cooling and processing water.



So what does this mean in terms of California's GHG emissions?

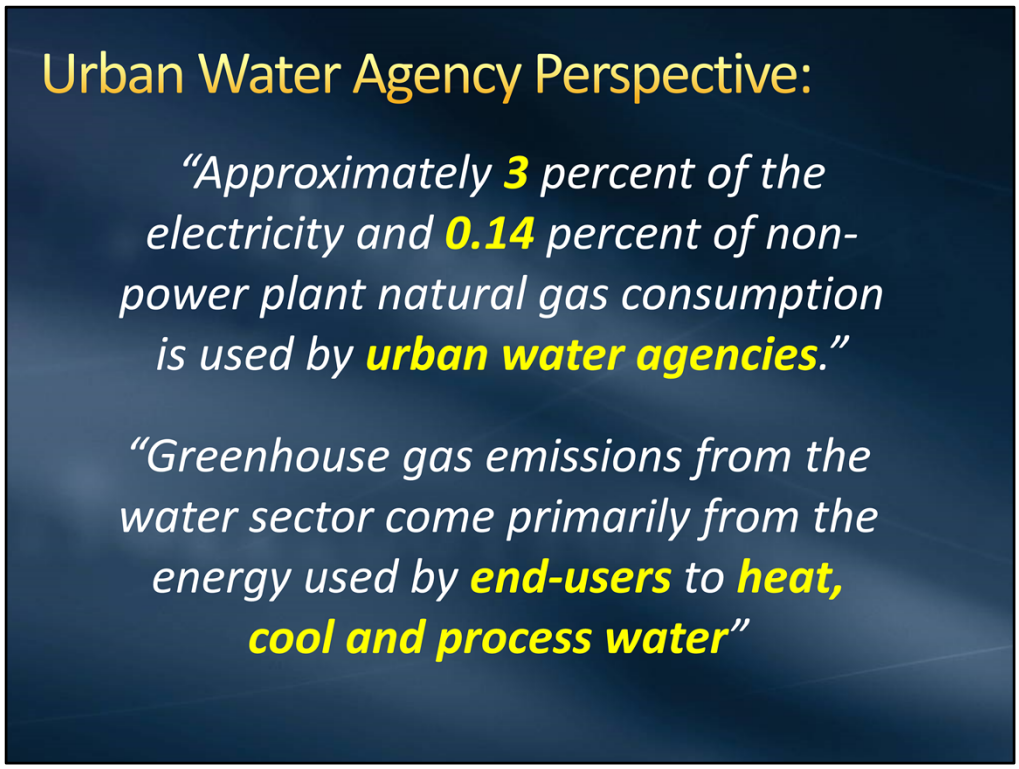
This is data from the Air Resources Board from showing emissions 2001 and 2012. As you can see, California has done a good job reducing GHG emissions.

- Red represents electricity, and this has seen a deep cut due to renewables
- Yellow represents natural gas not used for power generation

Applying the water sector percentages to this data gives you a proxy for GHG emissions

Water utilities are not quite non-detect, but a high percentage of our electricity comes from hydropower.

Key take-away: energy intensive end uses represent the greatest potential for reducing Urban water ghg emissions



These quotes better reflect the facts

This slide is busy, but it reflects California's Water Energy Nexus activity. In fact, these agencies are the tip of the iceberg.

The interest in the W-E Nexus is driven by the drought of course, but also by California's goals for GHG gas reductions and other state policies.

In the past few years we have seen the concept of loading orders for water resources

Loading orders are sequential development of resources based on energy use - you can only develop one resource after you exhaust resources that use less energy

Loading orders are used in the energy industry

But loading orders are conflict with our long-term planning philosophy of developing diversified resource portfolios.

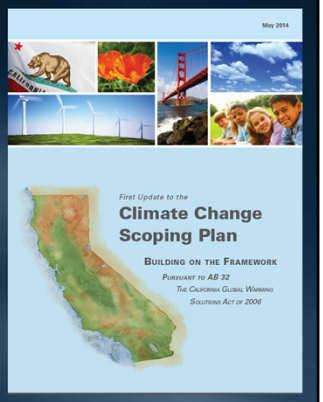
In fact loading orders are the opposite of portfolios.

Our drivers include reliability quality cost, integration
We balance dozens of factors: Imported vs Local, core supply versus dry year

Energy is one of many factors we consider in resource development.

Example: Air Resources Board (CARB)

- AB-32 Climate Change Scoping Plan update
- Referenced "loading orders"
- Metropolitan collaborated with member agencies, CUWA, CMUA
- CARB issued clarifying letter:
  - "One-size fits all approach would not work in the water sector"

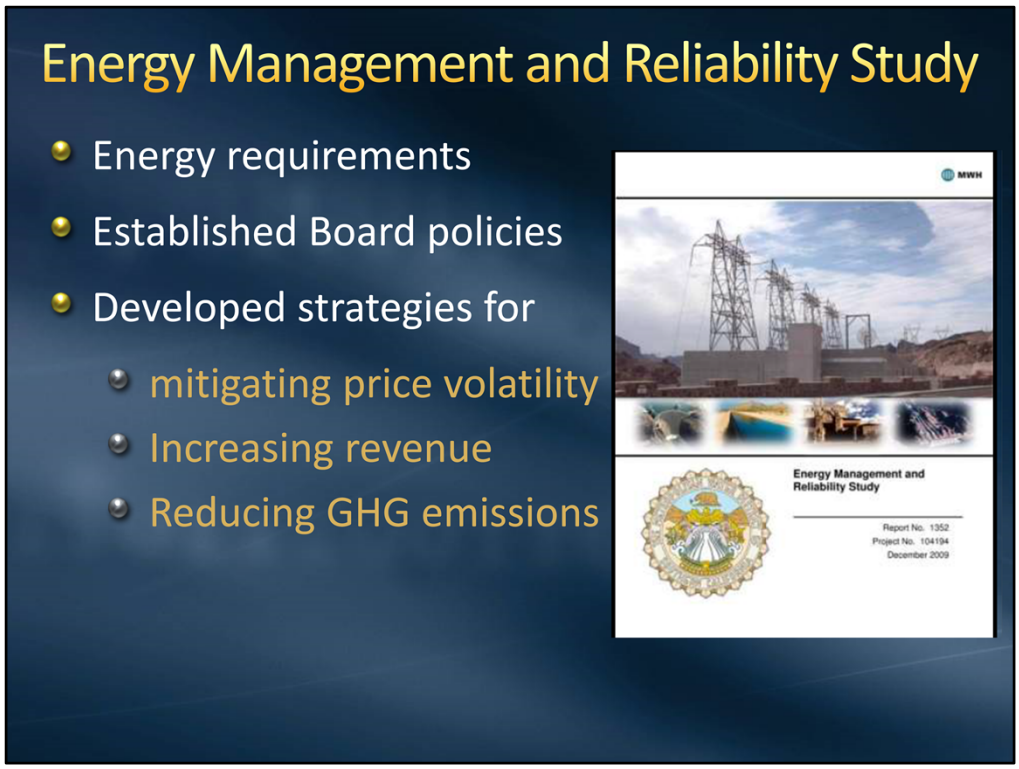


Last year we collaborated with the member agencies and associations after the Air Boards climate change plan referenced loading orders as an example that could be applied to water agencies.

Air Board staff worked with us to resolve this issue, and they ultimately issued a letter clarifying that one-size fits all loading orders wouldn't work in the water industry

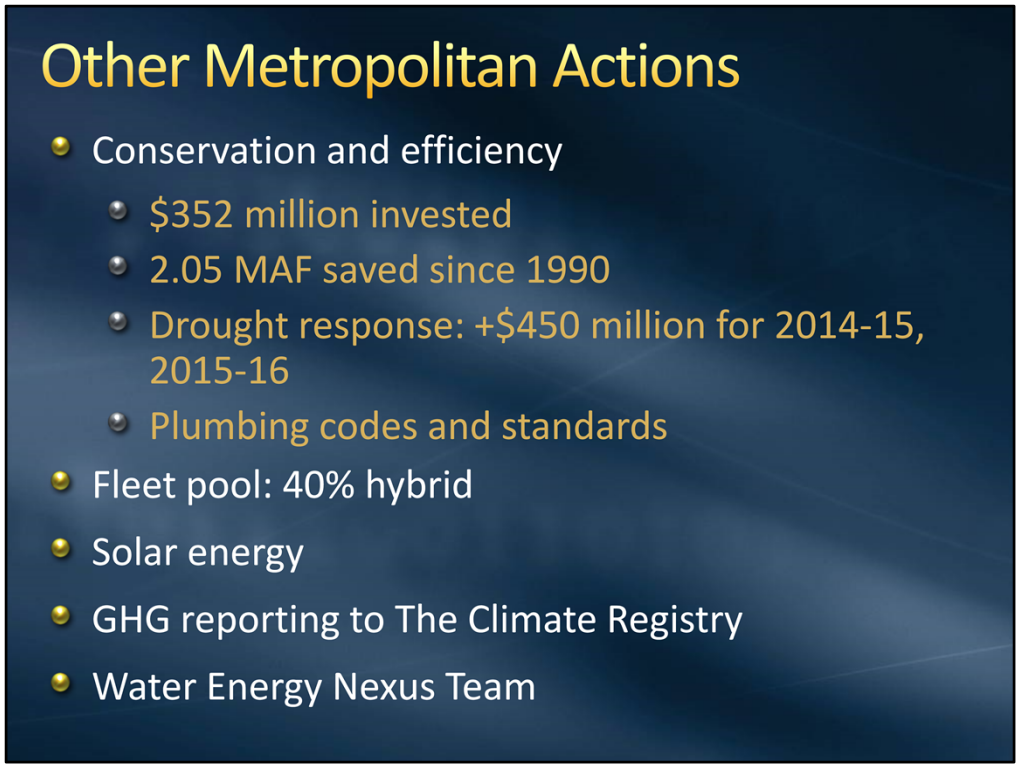
Thank Board staff for addressed our issue.

With the increased state and federal activity, Metropolitan has stepped up own efforts as well.



Energy Management and reliability study

- Sets strategies for managing power costs and reducing greenhouse gas emissions



All of our water conservation programs save energy

The 2 million AF Saved since 1990 represents 4,000 Gigawatts of embedded energy alone, and many more from the end uses

- The $450 million we are adding over the next two years will increase that further
- Fleet pool is 40% renewable
- Solar energy
- Facility upgrades
- Since 2005 voluntary reporting to The Climate Registry

Member agencies have demonstrated leadership

Many have studied energy intensity and GHG emissions

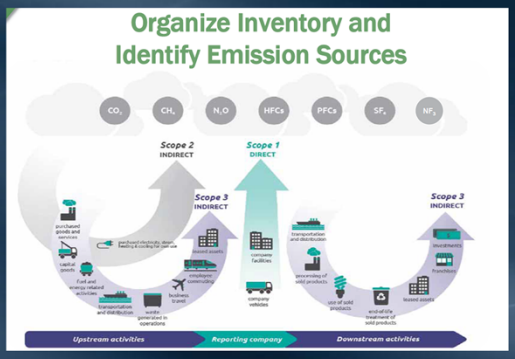
Renewable energy development as well

Please send us your studies and renewable energy projects!
- Would a worksheet help?

Numerous emerging issues and opportunities in the near future

Emerging Issues

- PUC: energy funding for water conservation
- Climate Registry: GHG reporting protocols
- ARB: early Scoping Plan update
- Legislation
  - 2014: UWMPs
  - 2015: several bills
- Energy costs



The Climate Registry: GHG Protocols

- The Public Utilities Commission currently has a proceeding that would increase the ability of Investor-Owned Utilities – like Southern California Edison to fund water conservation

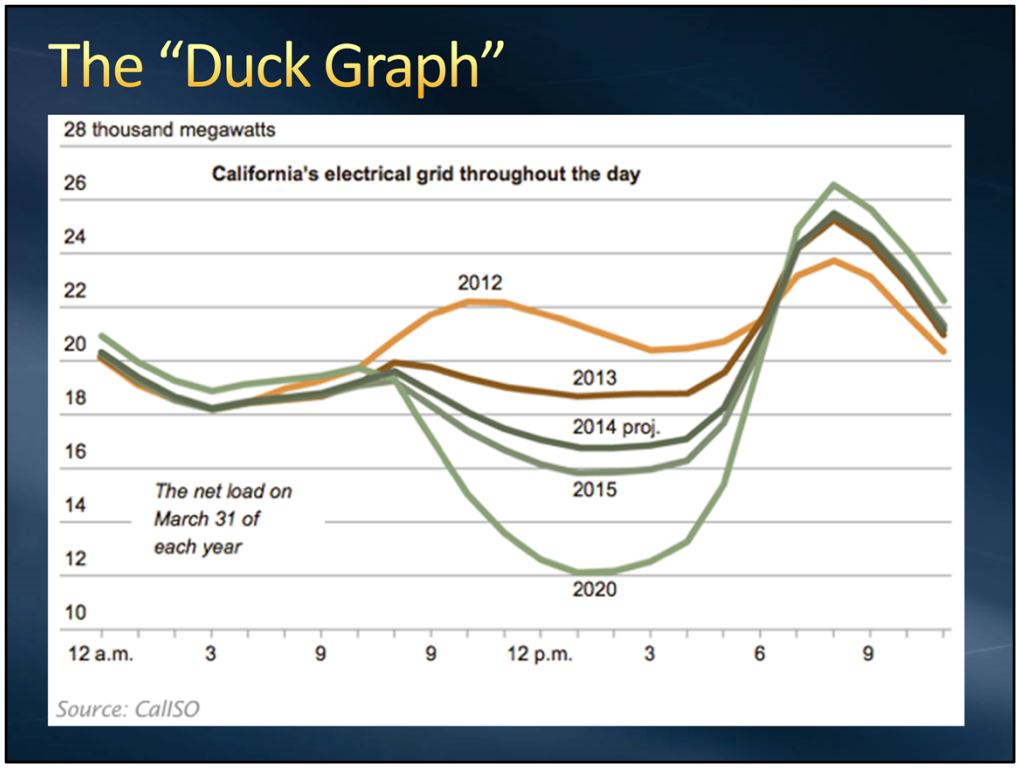
- The Climate Registry is in the process of developing GHG reporting protocols specifically for the water industry.
  - Opportunity to communicate our GHG emissions

Some emerging issues include legislation and energy costs.

- Legislation passed in 2014 makes it voluntary for water agencies to report energy use in UWMPS

- External Affairs is also tracking several Water-Nexus bills this year

- There are also a number of factors affecting energy costs in California
  - The drought is one
  - State goals for renewable energy are also a factor
- **Solar energy transforming the energy industry in profound ways that will affect the water industry**



An example is the impact of solar energy on California's electrical grid.

This is known as the Duck Graph – It shows the projected daily demand for electricity Thousands of megawatts on y axis

- by 2020 the afternoon peak becomes a valley with steep ramps.
- But many powerplants, take time to cycle on and off
- This causes two problems
  - The first is the ramping up and down – the ISO is looking for ways to smooth out the valley
  - The other is over-generation. If supply exceeds demand during the valley, our ISO has to pay other states to use the energy due to lack of storage.
- Regulators are looking at the water industry as part of the solutions
- California is going to have a new off-peak period

- Metropolitan recently signed an MOU with Southern California Gas Company that is a potential model for other IOUs in our service area

- CEC Funding
  - Agriculture
  - Consumer incentives
  - Renewable desalination
- DWR: MWD and several member agencies shut out!

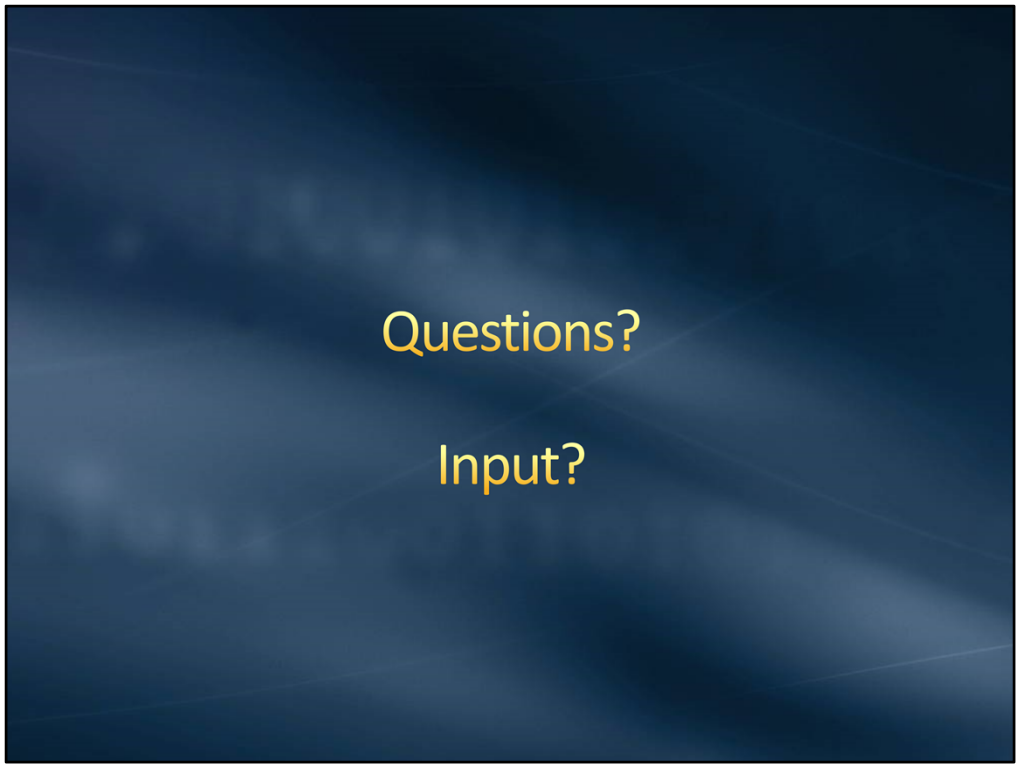
- Metropolitan's Business Service Unit has taken a leadership role in actively bringing water agencies and innovators together – and we've seen some exciting new technologies
  - Big Data!!

Summary

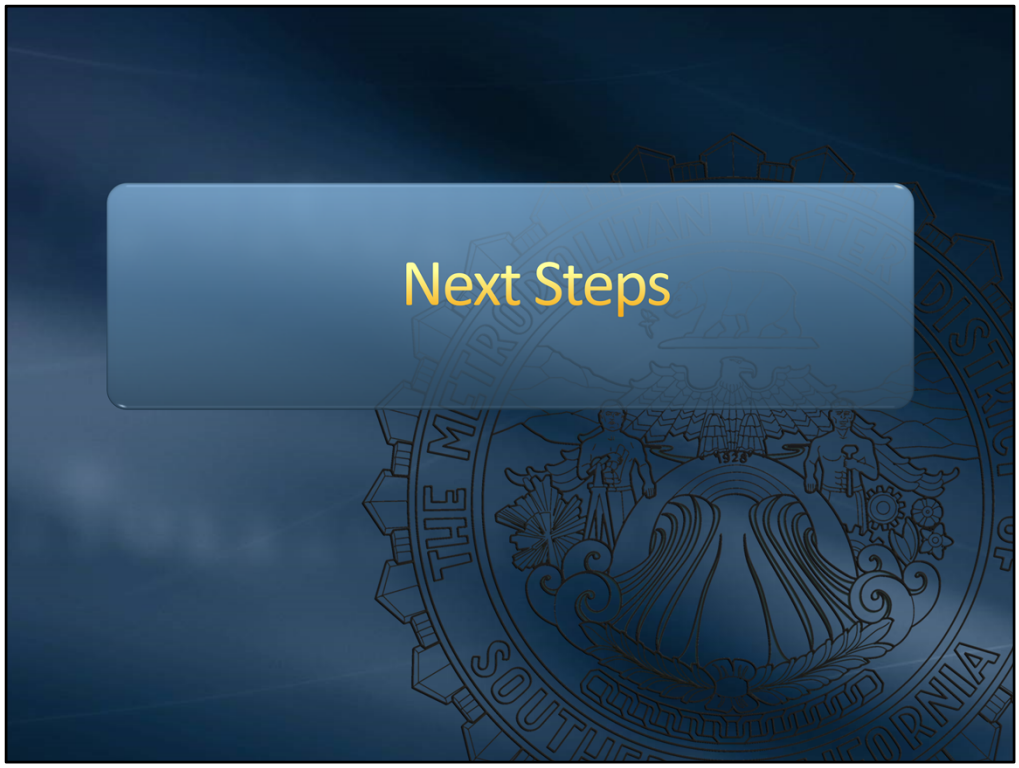
- Water conveyance and distribution does not use 19% of the State's energy
- Consumer end uses represent the largest share of water-related energy use
- Metropolitan and member agencies are addressing the water energy nexus

Water-Energy Nexus in the IRP

- Facts about water-related energy use
- Under consideration:
  - MWD and member agency activities
  - Estimates of energy intensity
    - Metropolitan system?
    - Regional portfolios?
- Uncertainty and long-term planning
  - Loading orders



Numerous emerging issues and opportunities in the near future


Next Steps

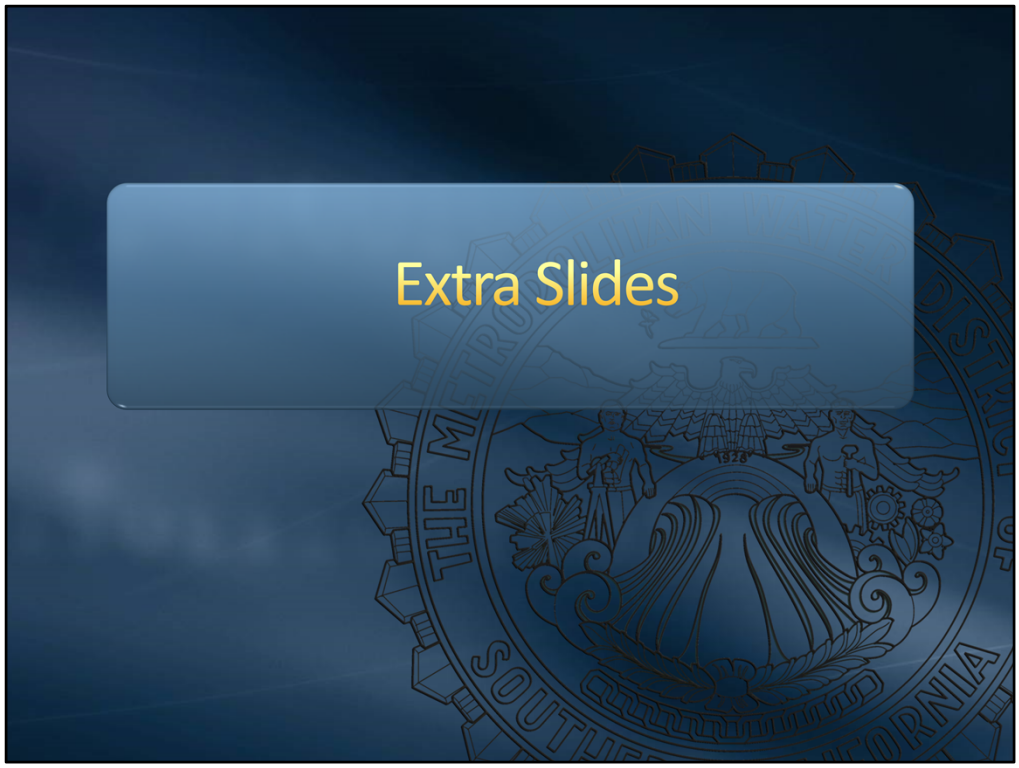
IRP Technical Update Next Steps

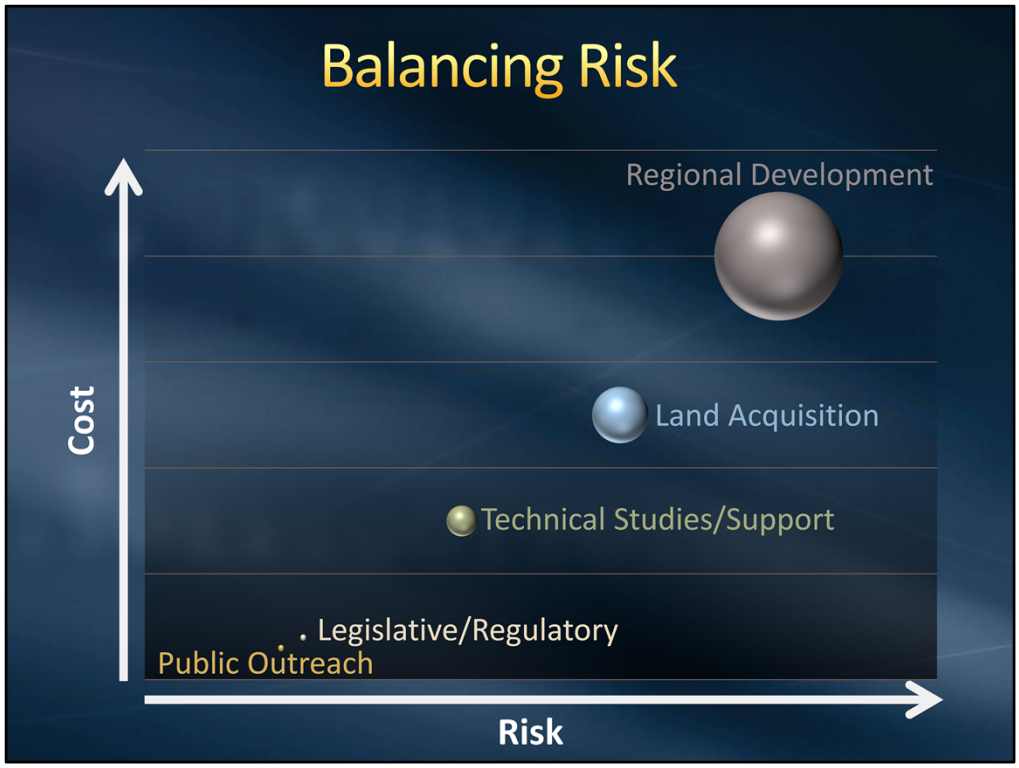
- Incorporate feedback from this workgroup
- Return with preliminary results in early August
- IRP Issue Paper Addendum
  - Review draft – August 3rd
- Compile policy and implementation issues for Board policy process

Upcoming Technical Process Activities
July/August 2015

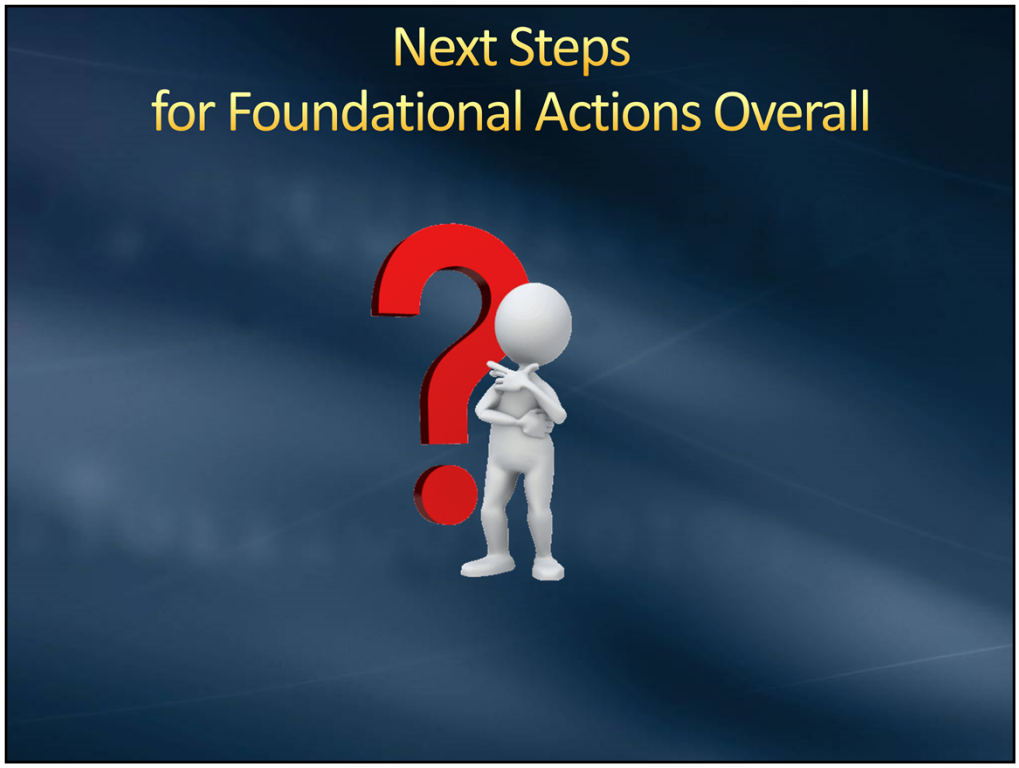
- Water Use Efficiency Meeting July 16th
- Member Agency Workgroup July 22nd
  - Retail Demands and Conservation
- IRP Committee Meeting July 28th
  - Dr. Patrick Reed, Cornell University – Uncertainty Planning
  - Brad Udall, Colorado State University – Climate Change Science
- Member Agency Workgroup August 3rd
  - Review of initial results


THE METROPOLITAN WATER DISTRICT OF
SOUTHERN CALIFORNIA

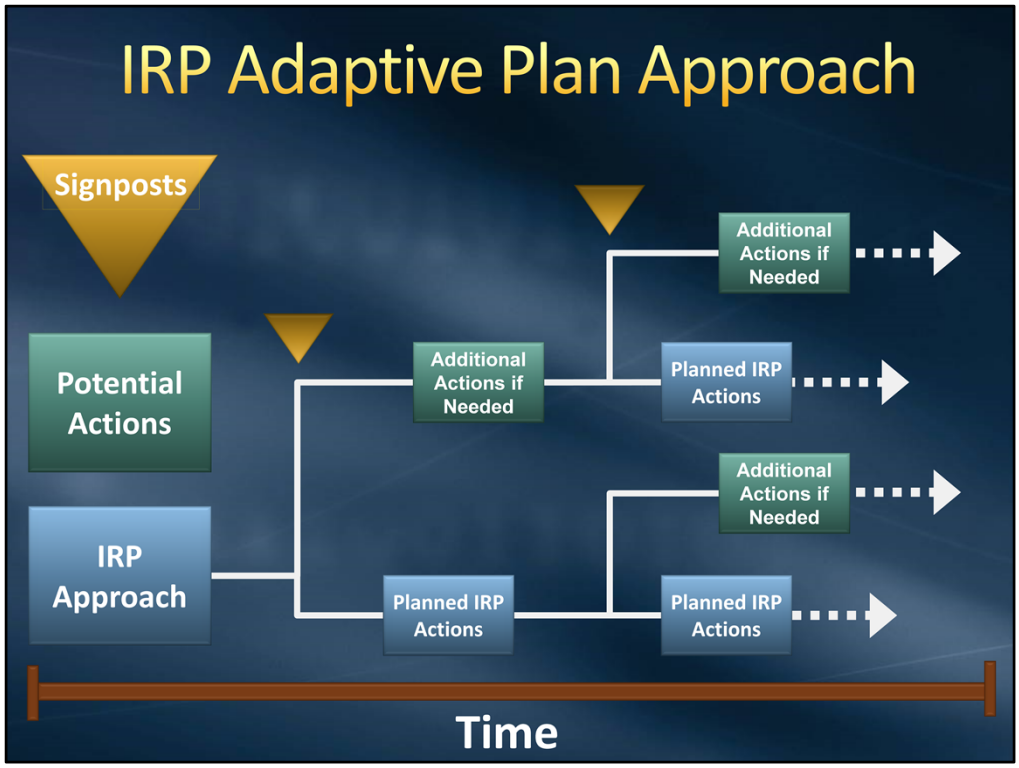

Extra Slides



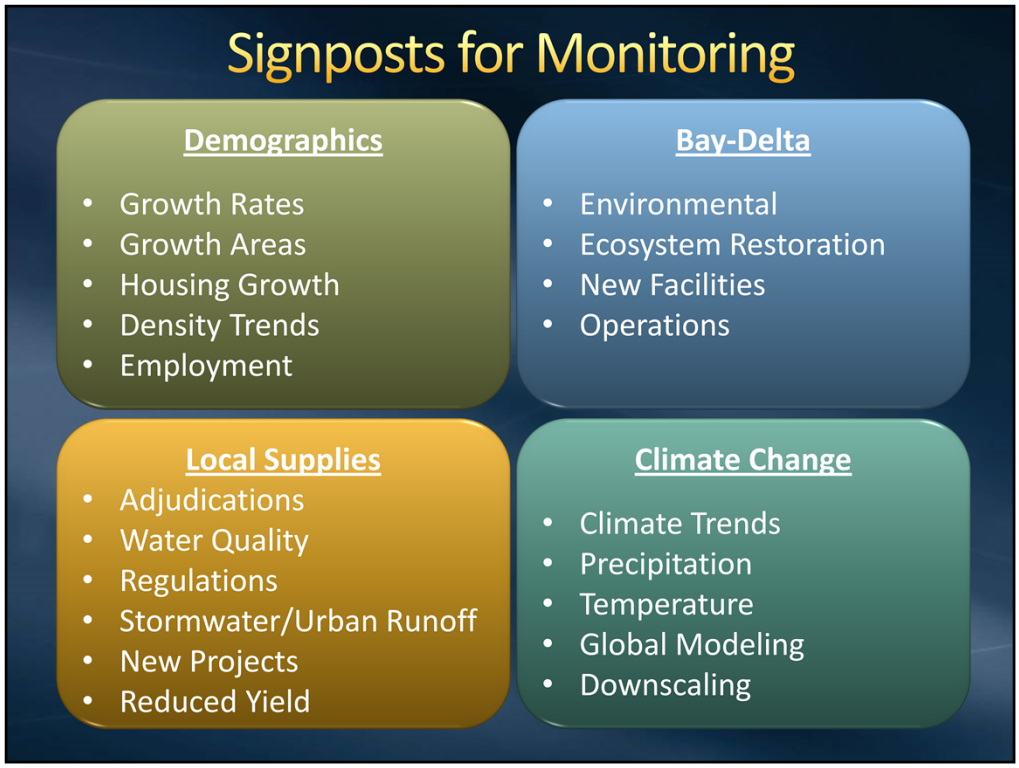
Looking at Balancing costs, risks of needing action, risk of stranding assets
Balancing resource diversity
When do we do what? How do we assess the risk of needing action?
What are the triggers?



- What's next for Foundational Actions overall?
- The answer to that question ties us back to Uncertainty



You may recognize this from Brandon's presentation earlier (in April) on uncertainty. We go along with our planned actions (lower cost actions) until a signpost appears that indicates a higher risk of needing additional supplies. Then we perform additional actions.

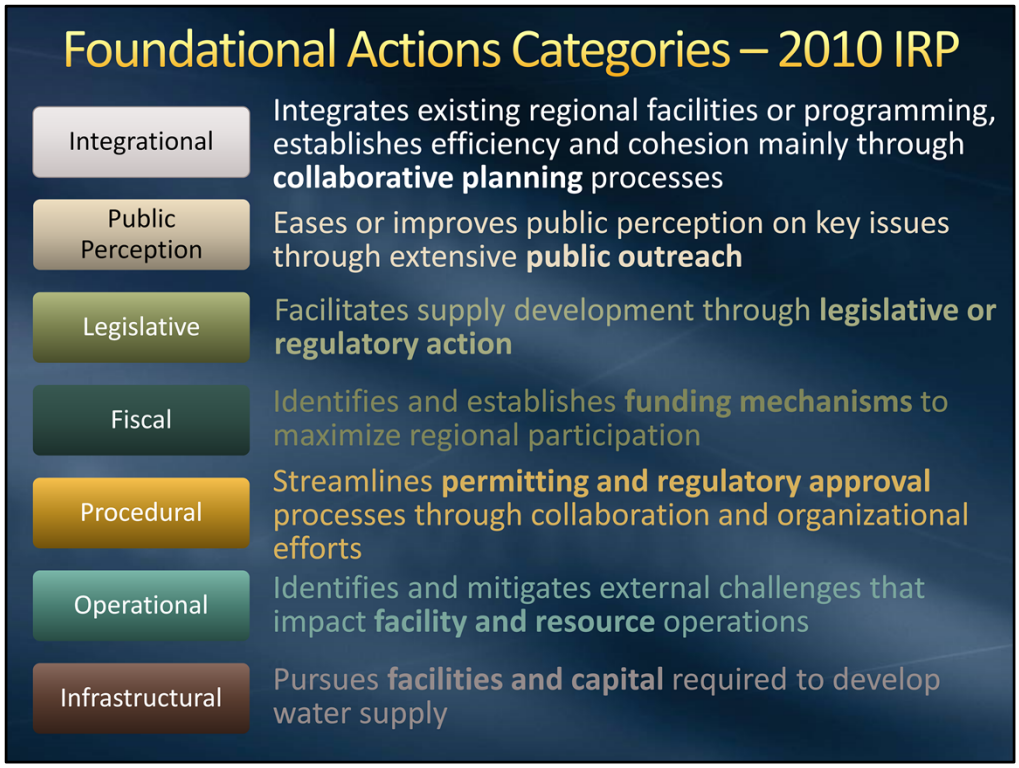


Through the Robust-Decision-Making analysis, 4 key uncertainties were identified to monitor : Demographic trends, Future Delta conditions, Groundwater yields, and climate change

It was found that the IRP approach is vulnerable when two or more uncertainties turn out unfavorably

- Which leads us to a Board policy discussion

- Board presentation on uncertainty (28th Committee)
- Is something we will pursue in a concrete way: impacts FAs, development level
- Policy: yes, monitor and report on signpost (and develop further?) and make recommendations as to if and what additional development needed at that time
    - More foundational actions funding, etc.
    - Implementation approaches
    - Approach for determining what to do based on signposts
- Categorize levels of risk, develop various suite of potential actions?
- May tie to issue paper recommendations



- These are the categories identified in the 2010 IRP. There are some overlaps. "Integrational"?