Colorado's Water Supply Future

IBCC Meeting

Crested Butte, Colorado

July 20, 2009

Agenda

- Welcome
- Review Technical Products
- WSRA Criteria and Guidelines
- Next Steps for Water Supply Strategies and Needs Assessments: Input into Colorado River Water Availability Study (CRWAS) Phase II
- Working Lunch
- Develop Additional Details on Water Supply Strategies and Inputs for CRWAS Phase II
- Joint Meeting with Interim Water Committee
- Close of IBCC Meeting

Welcome – 8:30

Review Technical Products – 8:30 to 10:00

The Following Draft Reports are Available

- State of Colorado 2050 Municipal and Industrial Water Use Projections
- Nonconsumptive Needs Assessment Priorities Mapping
- Watershed Flow Evaluation Tool Pilot Study for Roaring Fork and Fountain Creek Watersheds and Site-Specific Quantification Pilot Study for Roaring Fork Watershed
- Evaluation of Water Supply Strategies

To access the reports visit:
http://cwcb.state.co.us/IWMD/COsWaterSupplyFuture/

Key Findings

- Colorado's population will nearly double by 2050 requiring between 830,000 and1.7 million acre-feet of additional water to meet M&I needs
- Environmental and recreational water needs have been identified statewide. Identifying projects and methods to meet those needs will continue to be a priority
- In order to meet these consumptive and nonconsumptive needs, Colorado will rely on a mix of conservation, agricultural transfers, and new water supply development
- Meeting Colorado's consumptive and nonconsumptive needs will require substantial investment. For example, a new water supply project yielding 250,000 acre-feet will cost between $7.5 to $10 billion. This exceeds previous cost projections.

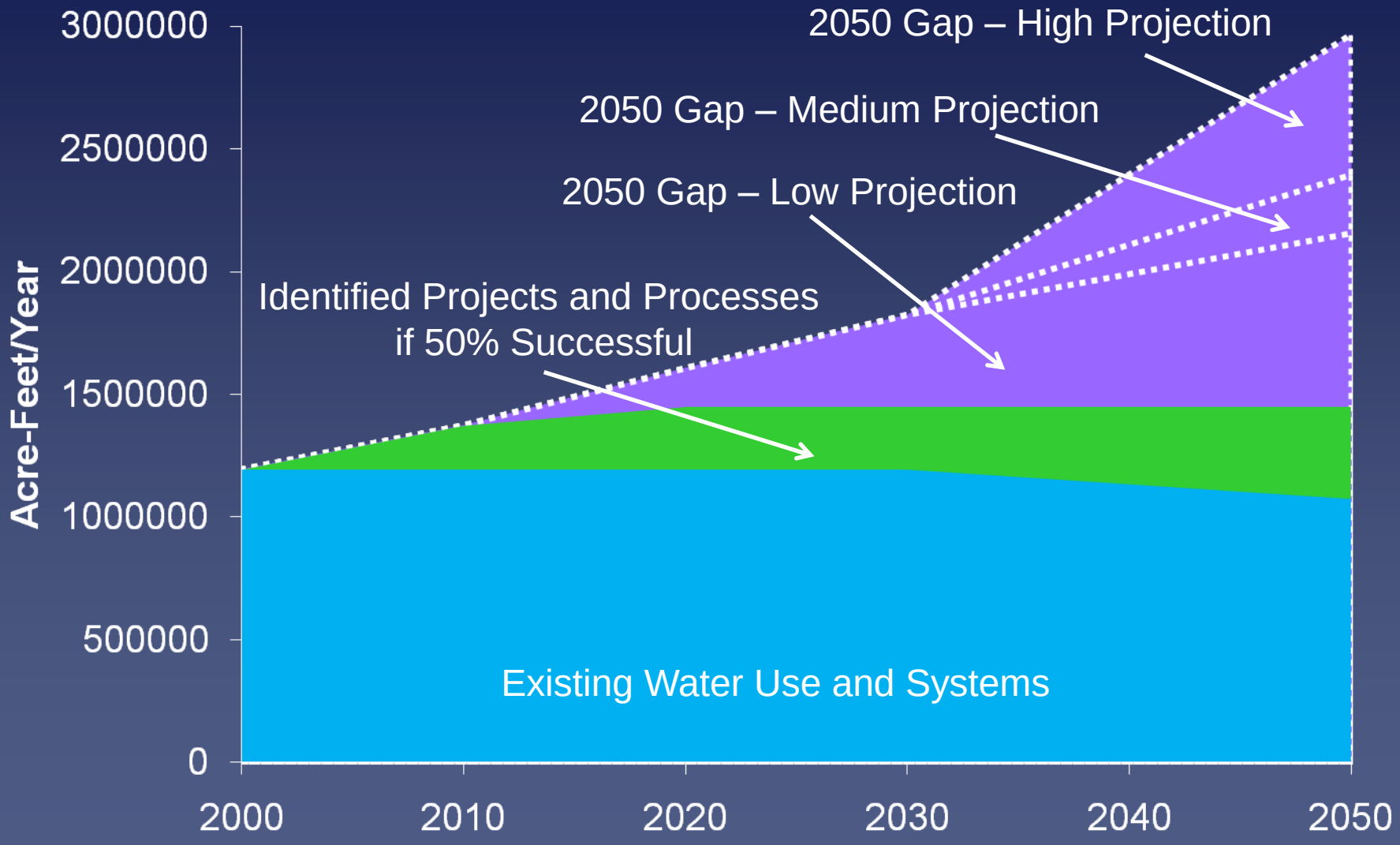
Objective Moving Forward – Build Portfolios

- Identify different mixes of Conservation, Ag Transfer, and New Supply Development to meet Colorado's 2050 consumptive and nonconsumptive needs
  - Examine west-slope needs

- Parts of these portfolios will serve as inputs to the Colorado River Water Availability Study (CRWAS) Phase II

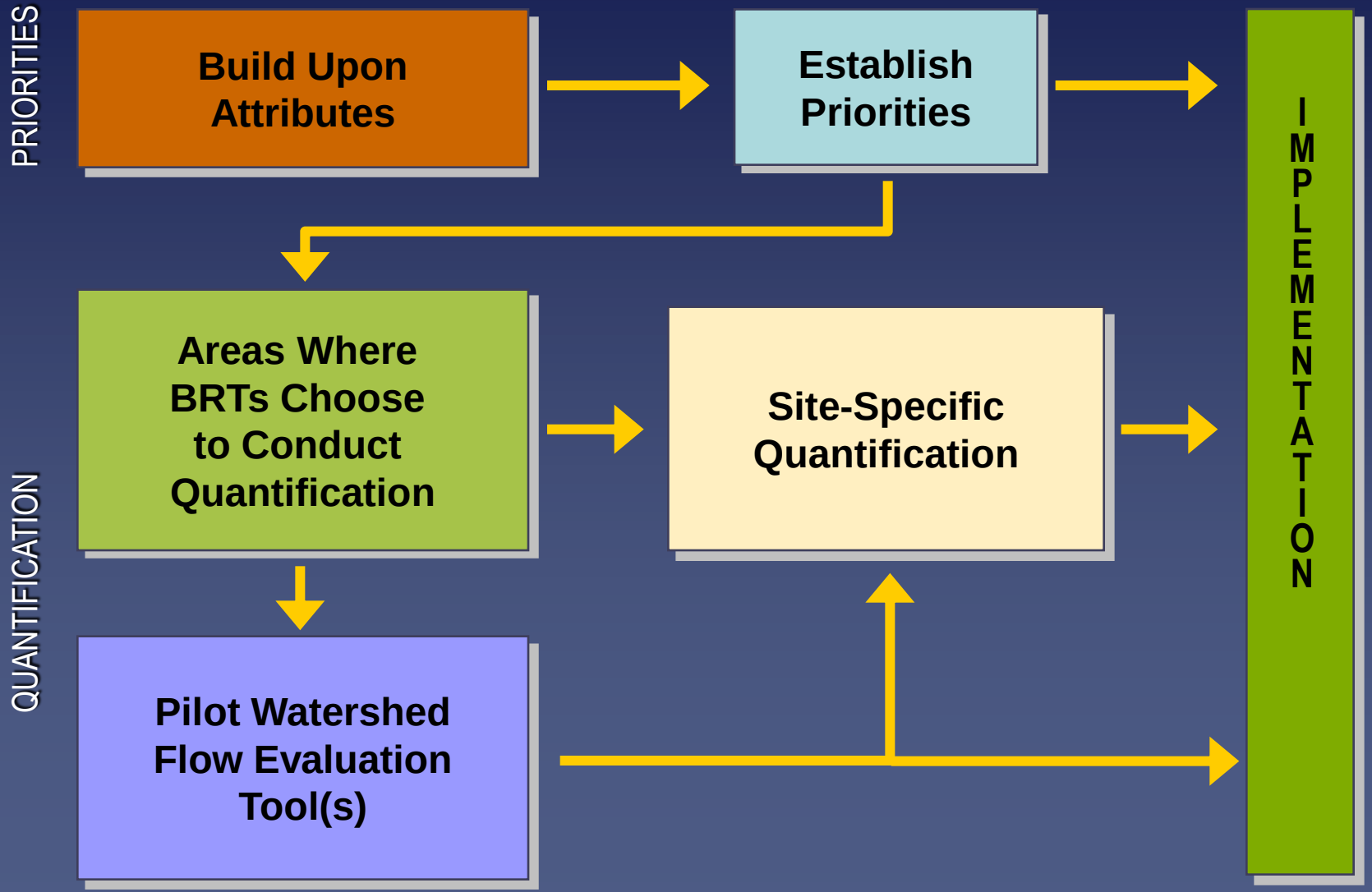
M&I Demands to 2050

State of Colorado Projected M&I Water Use and Gaps



Nonconsumptive Needs Assessment Overview

Nonconsumptive Needs Assessment Methodology



What Phase I of the NCNA is…

- Objective, science-based set of maps representing Colorado's important environmental and recreational attributes
- Map of stream reaches with concentrations of environmental and recreational qualities
- Results of pilot flow evaluation tools and site-specific instream flow quantifications
- This is strictly an informational stage, not reflecting future actions

What the NCNA isn't…

- The NCNA will not identify all streams as important;
  - It will identify a small subset of streams.
- The NCNA will not dictate management actions;
  - The BRTs and other stakeholders will use the NCNA to set goals and determine effective strategies and multi-purpose projects.
- The NCNA will not create a water right for the environment.
  - It will provide tools and data to allow BRTs to integrate environmental protection into water supply planning.
- The NCNA shall not be interpreted to diminish, impair, or cause injury to existing absolute or conditional water rights.

Status of Nonconsumptive Needs Assessments

- **Arkansas Basin:** Approved, WSRA quantification
- **Colorado Basin:** Approved, WSRA quantification
- **Gunnison Basin:** Approved
- **Metro Basin:** Approved, WSRA project
- **North Platte Basin:** Approved
- **Rio Grande Basin:** Approved, WSRA projects
- **South Platte:** Expect Sept. vote, WSRA projects
- **Southwest Basin:** Approved
- **Yampa/White Basin:** Expect July vote

Priorities Mapping Methodology –

ESTABLISH PRIORITIES

Review SWSI 2 Attributes

+

Include Additional Attributes with Basin-Specific Importance

PRIORITY MAPPING

Attribute Count by 12-digit HUC

- ARKANSAS
- RIO GRANDE

Attribute Count by Segment

- NORTH PLATTE
- SOUTHWEST

Major Streams/ Focus Areas

- SOUTH PLATTE/METRO
- YAMPA/WHITE/GREEN
- COLORADO
- GUNNISON

Statewide Nonconsumptive Needs Assessment Priorities Map

Colorado Basins

North Platte Basin

Environmental and Recreational Attribute Count by Stream Segment
- 1 - 2
- 3 - 4
- 5 - 6

Yampa/White/Green Basin

Major Environmental and Recreational Segments
- Environmental Segments
- Environmental and Recreational Segments
- Recreational Segments

Colorado Basin
- Colorado Streams with Attributes at Risk

Gunnison Basin

Major Environmental, Recreational and Scientific/Educational Segments
- Environmental and Recreational Segments
- Recreational Segments
- Scientific and Educational Segments
- Environmental Segments

South Platte/Metro Basin

Candidate Environmental and Recreational Focus Areas
- Environmental Focus Area
- Environmental and Recreational Focus Area
- Recreational Focus Area

Arkansas Basin

Environmental and Recreational Attribute Count by HUC
- 1 - 2
- 3 - 4
- 5 - 7

Southwest Basin

Environmental and Recreational Attribute Count by Stream Segment
- 1
- 2 - 3
- 4 - 6

Rio Grande Basin

Weighted Environmental and Recreational Attribute Count by HUC
- 1 - 3
- 4 - 5
- 6 - 8

Basemap Legend
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- Highways
- Counties
- Basins

0 25 50 100 150

Miles
1 inch = 12 miles

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** Note: See individual basin maps for detailed Needs Assessment information. **

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Results/Conclusions

- Methodologies differed based on basin-specific needs
- Mapping provides framework for prioritization of recreational and environmental needs
- BRTs now have a tool to assist in determining focus areas where quantifications may be developed
- Mapping also may be used to support future implementation actions for protecting water for nonconsumptive needs

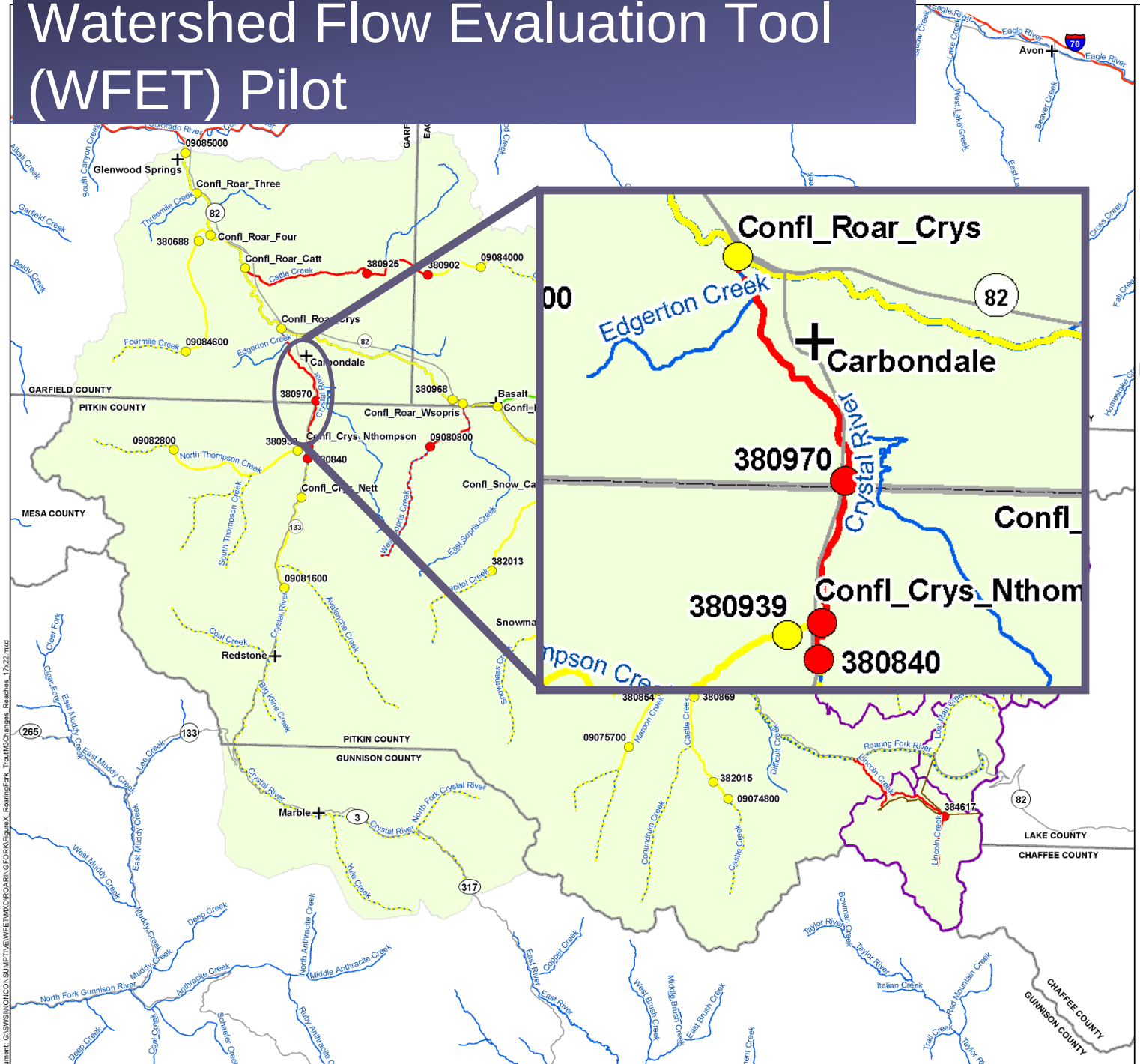
Where Do We Go From Here?

- Final maps and data delivered – July, 2009
  - Some maps may still be in draft form or will be approved in July
- Completed flow evaluation tool pilots June 30th , 2009
- Identify Projects and Methods to meet Nonconsumptive Needs
  - Basin directed “status” of focus areas
  - Basin directed flow evaluations
  - Basin determined identification of nonconsumptive projects or methods

Phase II- Status Determination Questions:

- How do these attributes interface with consumptive needs?
- Are there existing efforts/protections for priority areas?
- Are there areas without protections that need further study?
- What strategies are needed to support nonconsumptive priority areas?
- Are there areas where new flow or water level quantification is appropriate?
- Are there areas where a project, whether structural (e.g. river restoration) or nonstructural (e.g. instream flow or voluntary flow management) can be identified and implemented; and
- Are their areas no action is needed at this time?

Watershed Flow Evaluation Tool (WFET) Pilot



WFET Pilot Findings – Technical

- Flow-ecology relationships derived for several key environmental and recreational attributes across the state
- Ecological risk mapping developed for key attributes
- For Roaring Fork, preliminary validation shows that WFET results are comparable with site-specific data
- For Roaring Fork, results build upon and support previous watershed efforts

WFET Pilot Findings – Tool Application

- WFET is best utilized in areas with detailed hydrologic data or models for pre and post water management conditions
- WFET could be used in a predictive capacity to examine potential future water management using conditions today as a baseline
- WFET can be used to generate a range of seasonal flow conditions based on ecological risk
- WFET could be used to target Instream Flow acquisitions as well as restoration efforts

Water Supply Strategies

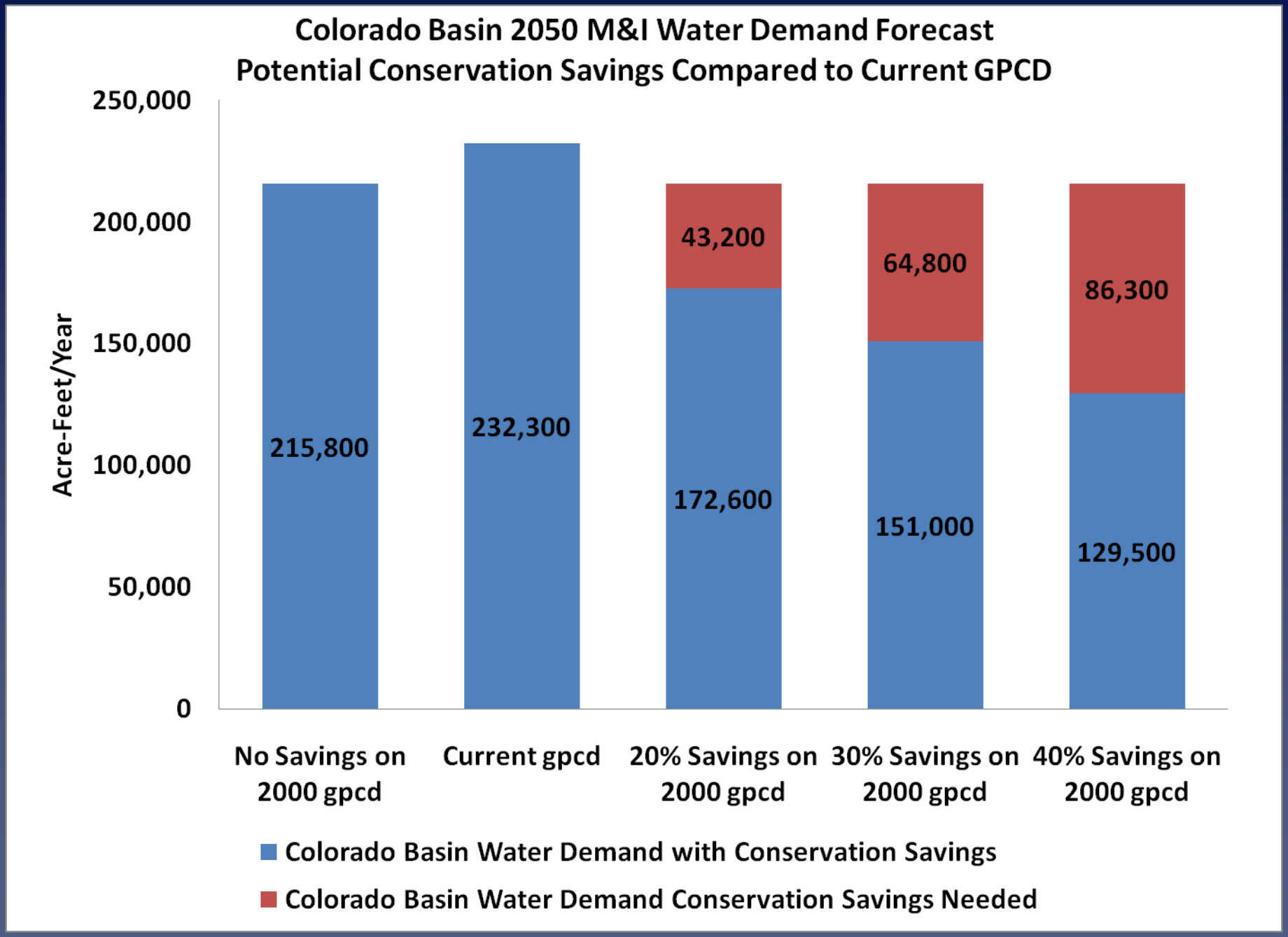
Water Supply Strategies

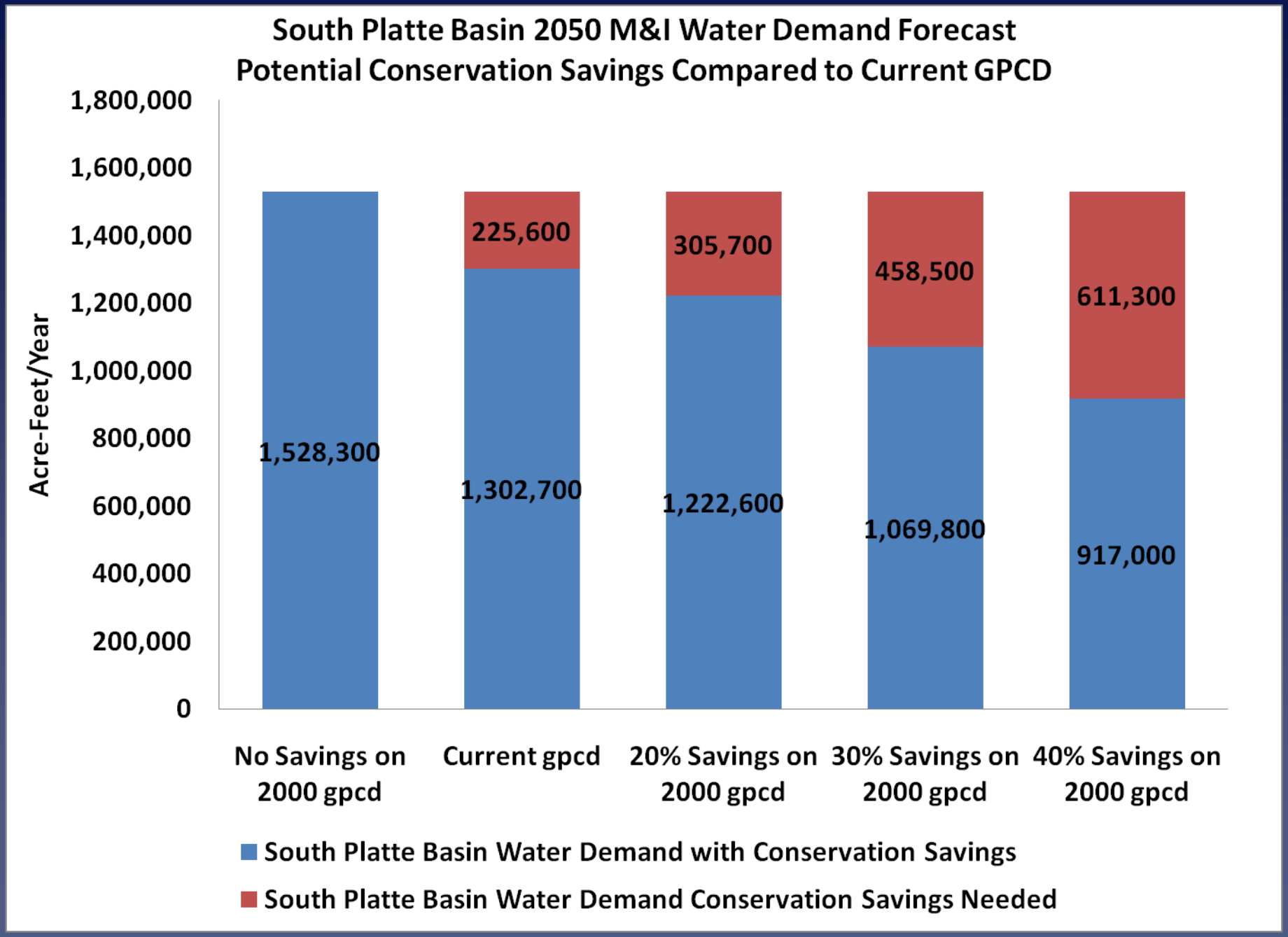
- Water Conservation
- Agricultural Transfers
  - Conventional and alternative transfers
- Development of New Supplies
  - West Slope M&I and Energy
  - Transbasin

These strategies address M&I needs, and options to address agricultural and nonconsumptive needs will be added as strategies are evaluated

- Linking Land Use Planning and Water Supply Planning – Colorado Report and WSWC Symposium

Conservation Strategy


Colorado Basin 2050 M&I Water Demand Forecast
Potential Conservation Savings Compared to Current GPCD
Acre-Feet/Year
250,000
200,000
150,000
100,000
50,000
0
215,800
232,300
43,200
172,600
64,800
151,000
86,300
129,500
No Savings on 2000 gpcd
Current gpcd
20% Savings on 2000 gpcd
30% Savings on 2000 gpcd
40% Savings on 2000 gpcd
Colorado Basin Water Demand with Conservation Savings
Colorado Basin Water Demand Conservation Savings Needed


South Platte Basin 2050 M&I Water Demand Forecast
Potential Conservation Savings Compared to Current GPCD
Acre-Feet/Year
1,800,000
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
1,528,300
225,600
1,302,700
305,700
1,222,600
458,500
1,069,800
611,300
917,000
No Savings on 2000 gpcd
Current gpcd
20% Savings on 2000 gpcd
30% Savings on 2000 gpcd
40% Savings on 2000 gpcd
South Platte Basin Water Demand with Conservation Savings
South Platte Basin Water Demand Conservation Savings Needed

Overview of Agricultural Transfer Strategy and New Supply Development Strategy

Engineering Evaluation Elements for Strategies

- Description of strategy or project elements – water source, conveyance and storage, water quality

Purpose

Ability to start comparing tradeoffs between strategies

Evaluation of Strategies Include:

- Identification of:
  - Project benefits
  - Implementation issues
  - Opportunities
  - Potential attributes/additional options
  - Acceptability
- Other evaluation elements:
  - Capital costs – permitting, mitigation, land acquisition, pumps, pipe, treatment
  - Annual O&M costs – energy, equipment maintenance and replacement
  - Additional cost elements (water rights or storage)
  - Discuss potential attributes/additional options for ag transfer and new supply development options with Basin Roundtables
  - Incorporate other conservation elements such as sharing of conserved water and the infrastructure and institutional arrangements required
- Qualitative description of how each strategy meets the Vision Statement and Vision Goals

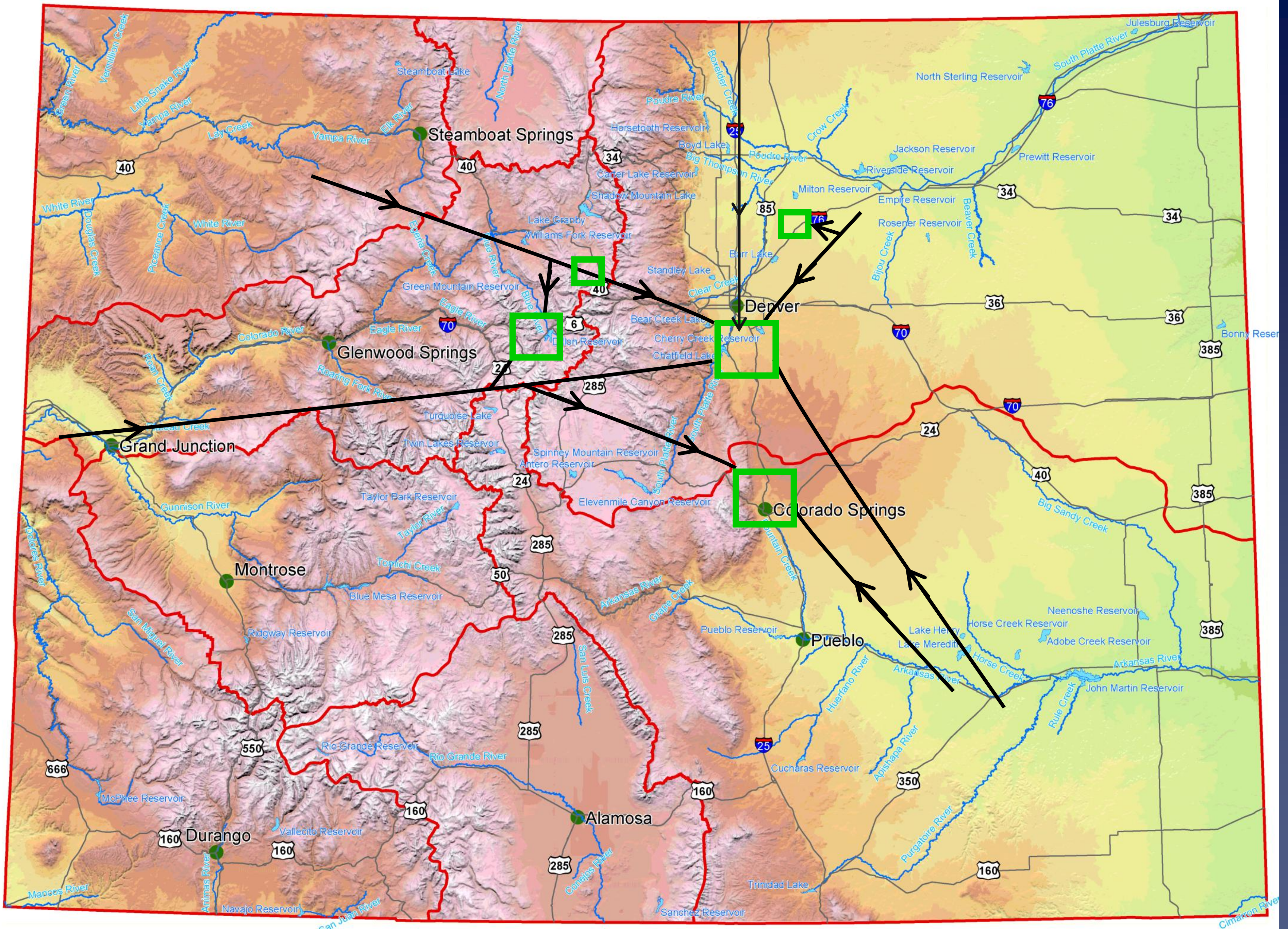
Assumptions for Analysis of the Agricultural Transfer Strategy and New Supply Development Strategy

- Delivery of similar water quality
- With exception of Green Mountain concept, strategies will deliver water in the range of 100KAF to 250KAF

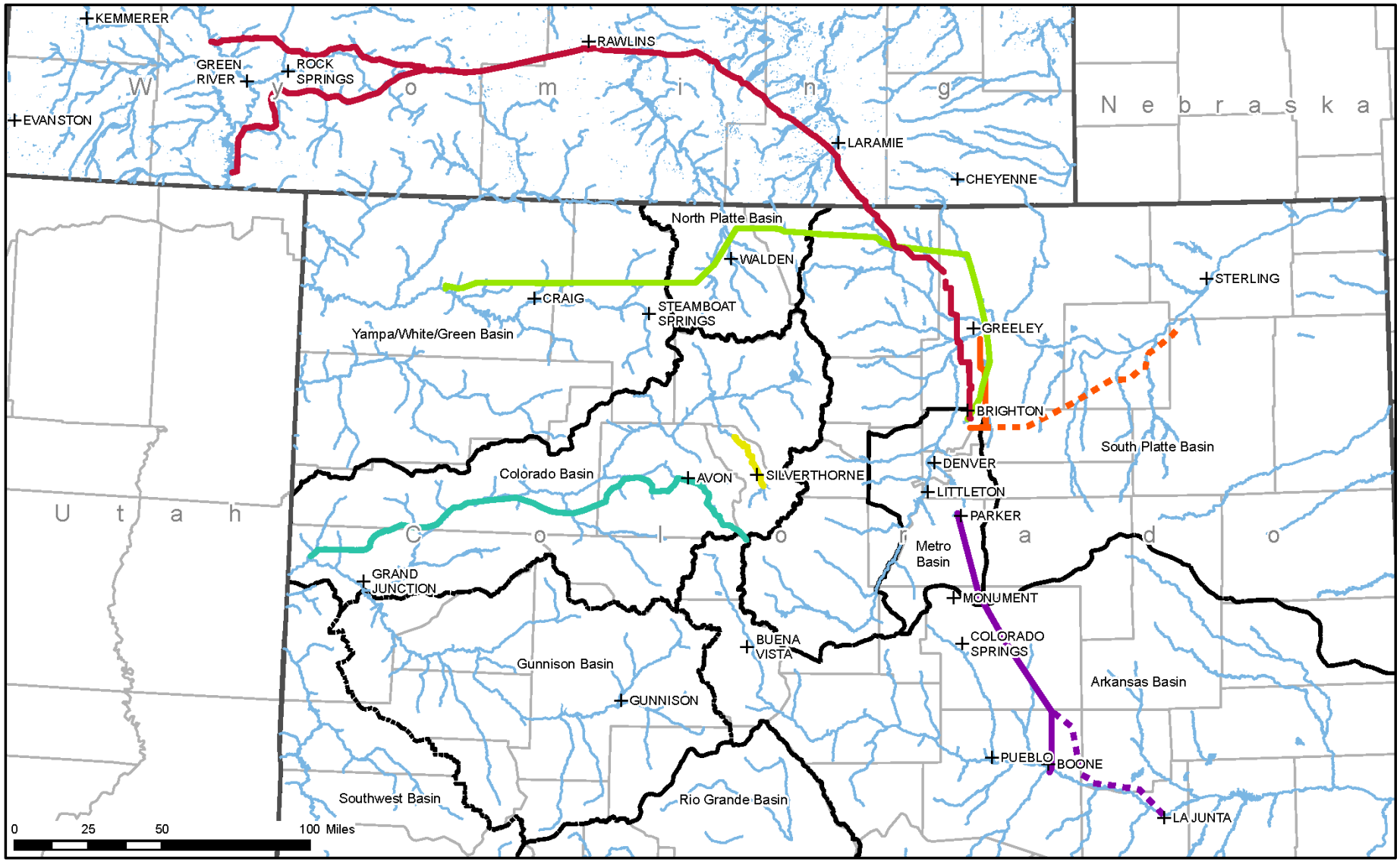
Water Supply Concepts

- Two Lower South Platte concepts
- Two Lower Arkansas concepts
- Green Mountain concept
- Yampa concept
- Flaming Gorge concept
- Colorado River Return Reconnaissance concept

Asked by the IBCC to evaluate additional small-to-medium sized new water supply projects



Steamboat Springs
Glenwood Springs
Grand Junction
Montrose
Durango
Alamosa
Denver
Colorado Springs
Pueblo
Steamboat Lake
North Platte River
Poudre River
Horsetooth Reservoir
Boyd Lake
Big Thompson River
Carter Lake Reservoir
Shadow Mountain Lake
Lake Granby
Williams Fork Reservoir
Green Mountain Reservoir
Eagle River
Colorado River
Roaring Fork River
Dillon Reservoir
Standley Lake
Clear Creek
Bear Creek Lake
Cherry Creek Reservoir
Chatfield Lake
Barr Lake
Milton Reservoir
Empire Reservoir
Riverside Reservoir
Jackson Reservoir
Prewitt Reservoir
North Sterling Reservoir
South Platte River
Julesburg Reservoir
Crow Creek
Boxelder Creek
Beaver Creek
Bijou Creek
Rosener Reservoir
Bonny Reser
Big Sandy Creek
Turquoise Lake
Twin Lakes Reservoir
Spinney Mountain Reservoir
Antero Reservoir
Elevenmile Canyon Reservoir
Taylor Park Reservoir
Taylor River
Tomichi Creek
Blue Mesa Reservoir
Gunnison River
Ridgway Reservoir
San Miguel River
Dolores River
McPhee Reservoir
Vallecito Reservoir
Navajo Reservoir
San Juan River
Animas River
Mancos River
Rio Grande Reservoir
Rio Grande River
San Luis Creek
Conejos River
Arkansas River
Grape Creek
Pueblo Reservoir
Fountain Creek
Huerfano River
Cucharas Reservoir
Apishapa River
Purgatoire River
Trinidad Lake
Sanchez Reservoir
Lake Henry
Lake Meredith
Horse Creek
Horse Creek Reservoir
Neenoshe Reservoir
Adobe Creek Reservoir
John Martin Reservoir
Rule Creek
Cimarron River
Yampa River
Little Snake River
Vermillion Creek
Green River
Elk River
Lay Creek
White River
Douglas Creek
Piceance Creek
Roan Creek
Plateau Creek
Egeria Creek
Blue River
40
34
85
25
76
36
70
6
24
285
50
550
160
666
350
385



Legend

- Colorado River Return Reconnaissance Study Concept
- Flaming Gorge Concept
- Yampa River Concept
- Middle South Platte Concept
- Lower South Platte Concept
- Lower Arkansas Concept 1
- Lower Arkansas Concept 2
- Green Mountain Concept
- Colorado Basins

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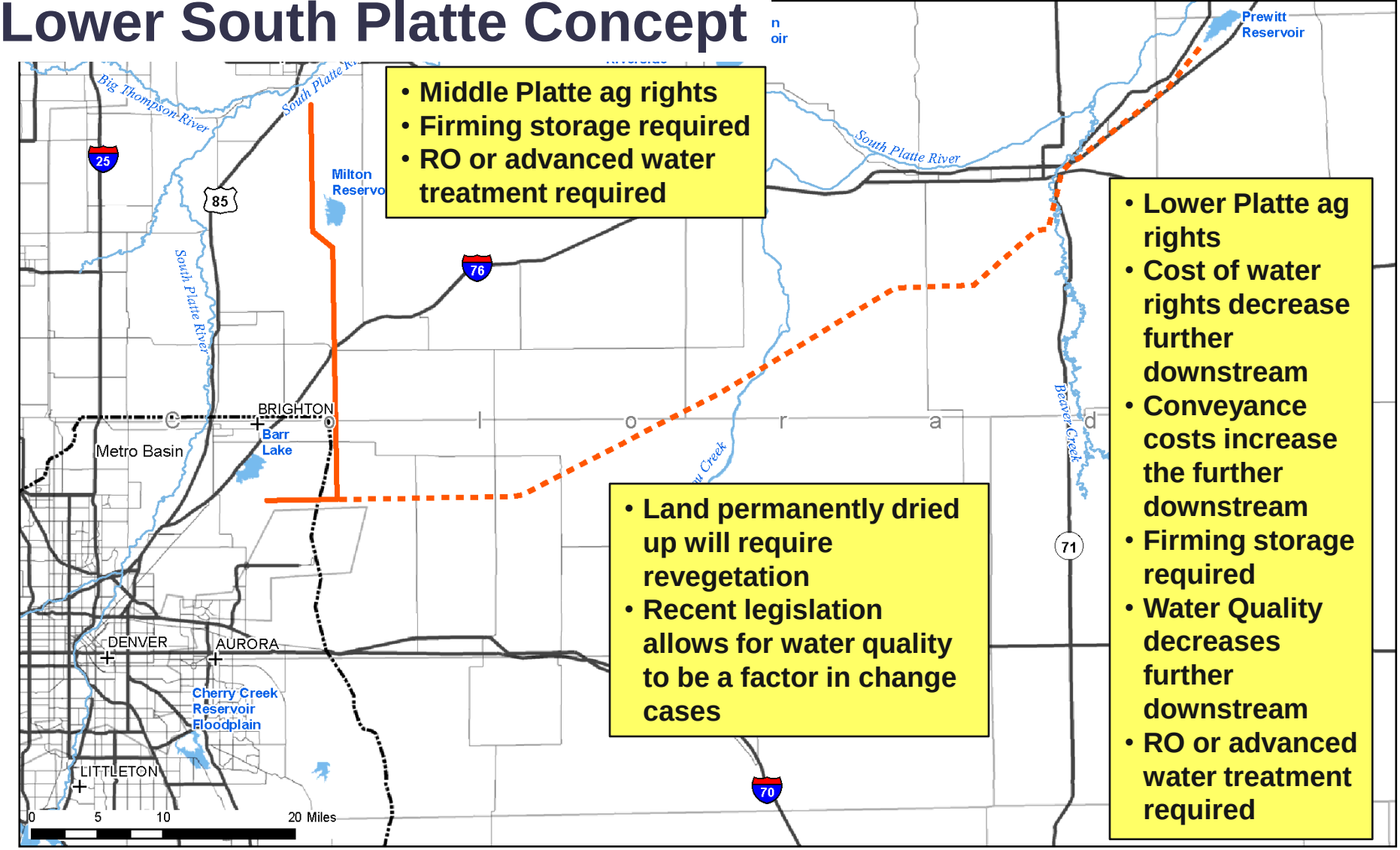
Agricultural Transfer Strategy

Lower South Platte Concept



Legend

- Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Middle South Platte Concept
- Lower South Platte Concept

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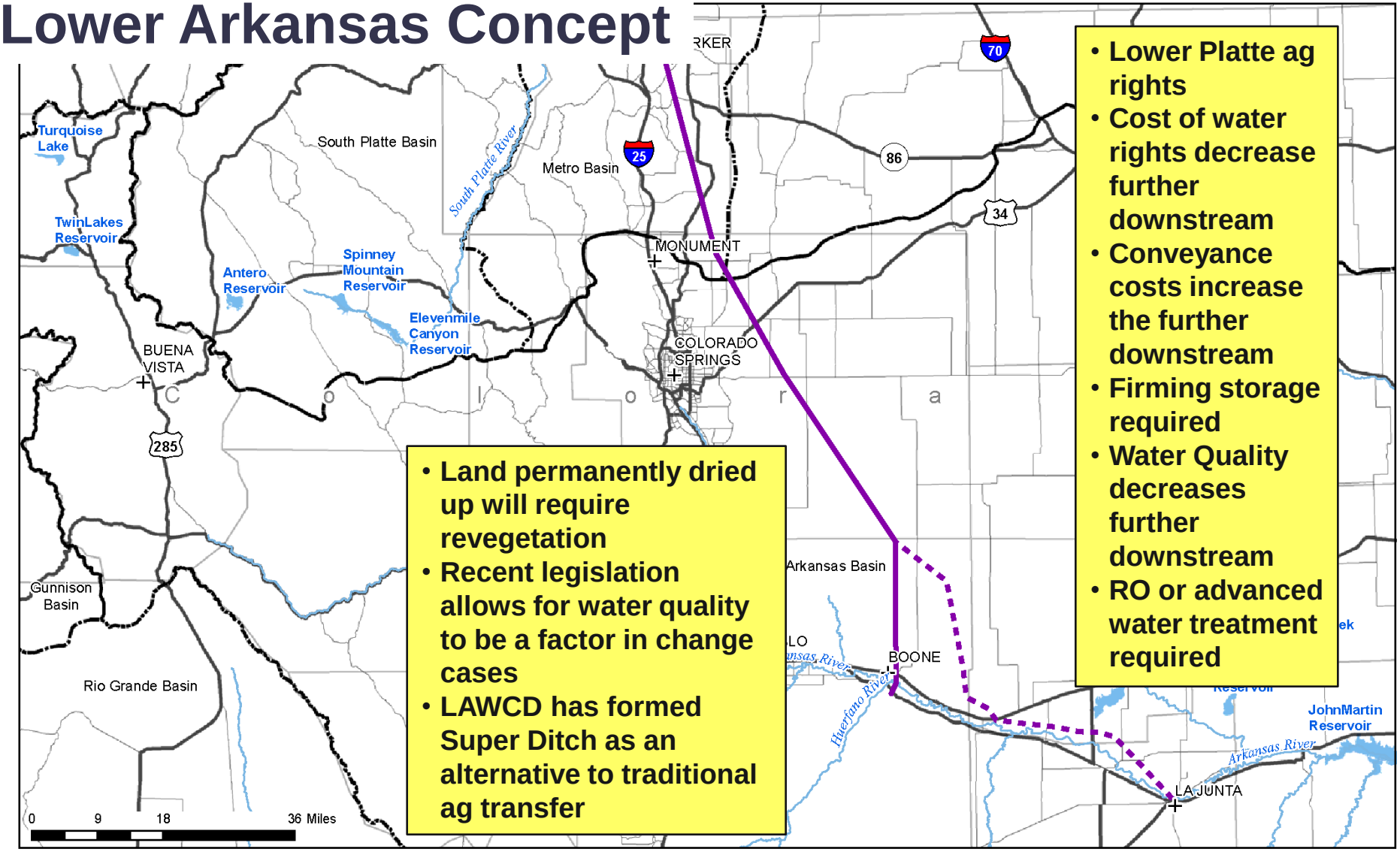
Lower Arkansas Concept



Legend

- Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Lower Arkansas Concept 1
- Lower Arkansas Concept 2

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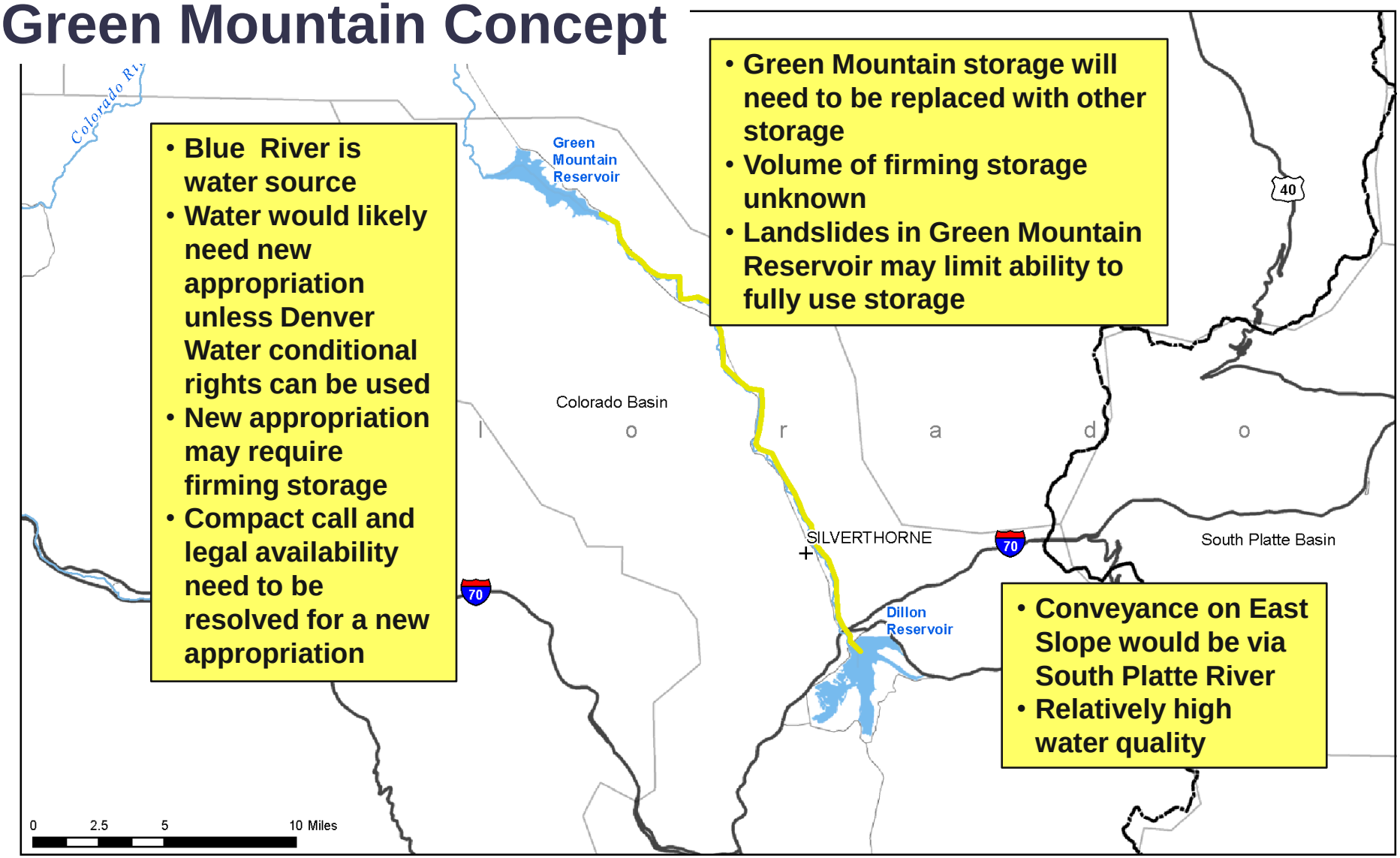
New Supply Development

New Supply Development Strategy Overview

- Engineering Evaluation Elements
  - Green Mountain concept <100,000 acre-ft
  - Yampa concept 100,000 to 250,000 acre-ft
  - Flaming Gorge concept 100,000 to 250,000 acre-ft
  - Colorado River Return Reconnaissance concept 100,000 to 250,000 acre-ft

- Additional small-to-medium projects are included in Section 4.3 of the Strategies Report

Green Mountain Concept



- Blue River is water source
- Water would likely need new appropriation unless Denver Water conditional rights can be used
- New appropriation may require firming storage
- Compact call and legal availability need to be resolved for a new appropriation

- Green Mountain storage will need to be replaced with other storage
- Volume of firming storage unknown
- Landslides in Green Mountain Reservoir may limit ability to fully use storage

- Conveyance on East Slope would be via South Platte River
- Relatively high water quality

Legend

- Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Green Mountain Concept

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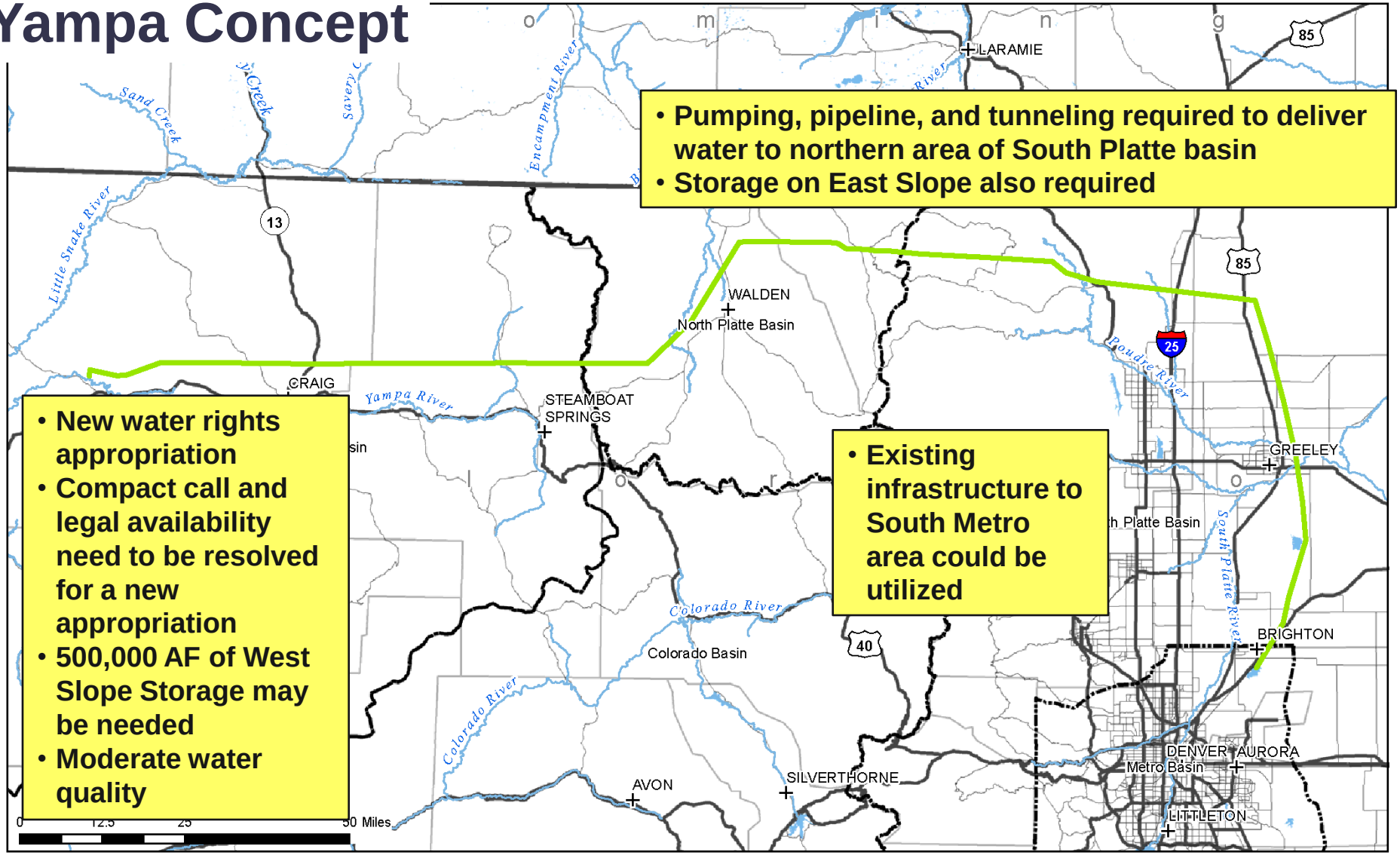
Yampa Concept



Legend

- Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Yampa River Concept

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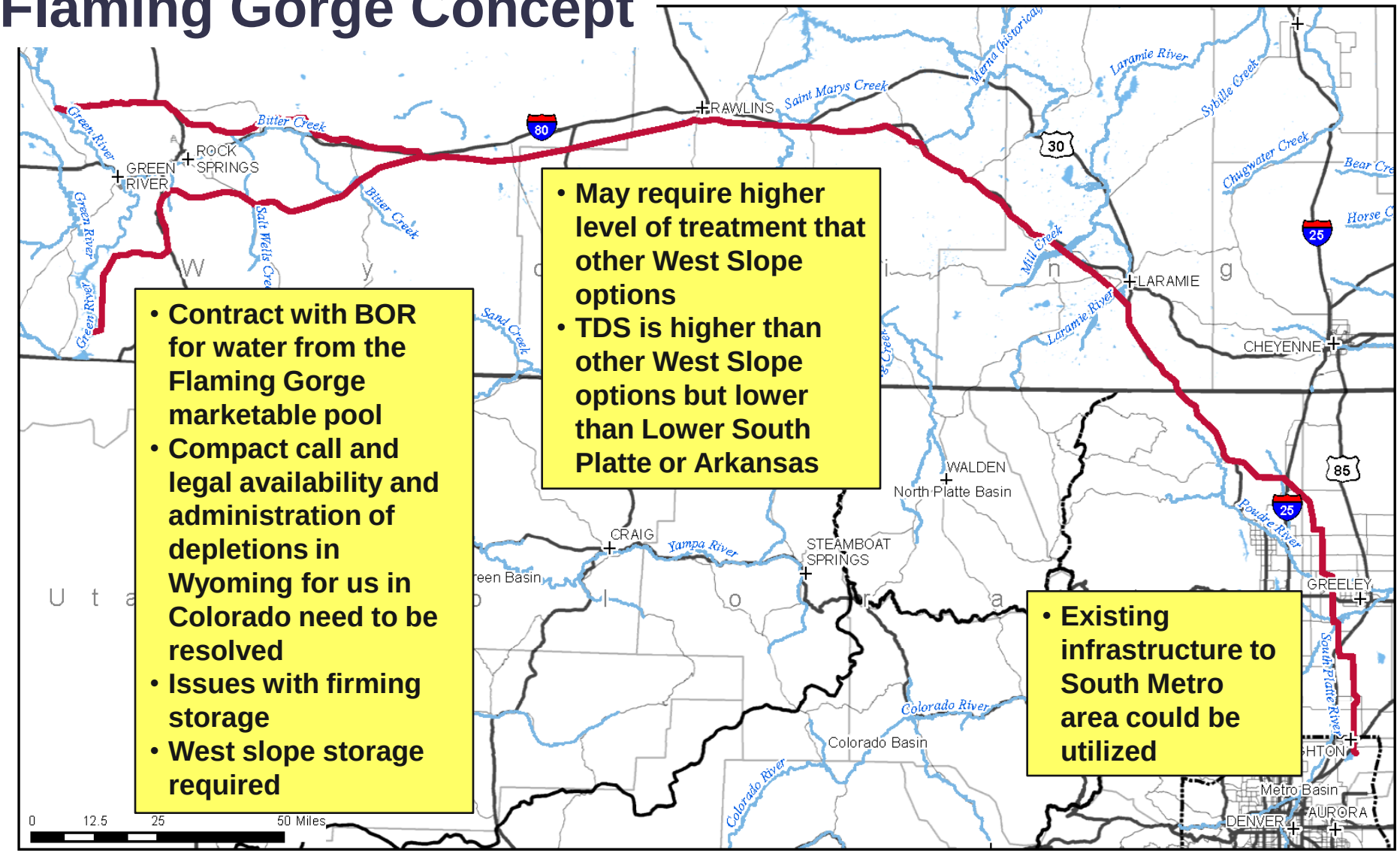
Flaming Gorge Concept



- **May require higher level of treatment that other West Slope options**
- **TDS is higher than other West Slope options but lower than Lower South Platte or Arkansas**

- **Contract with BOR for water from the Flaming Gorge marketable pool**
- **Compact call and legal availability and administration of depletions in Wyoming for us in Colorado need to be resolved**
- **Issues with firming storage**
- **West slope storage required**

- **Existing infrastructure to South Metro area could be utilized**

Legend

- Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Flaming Gorge Concept

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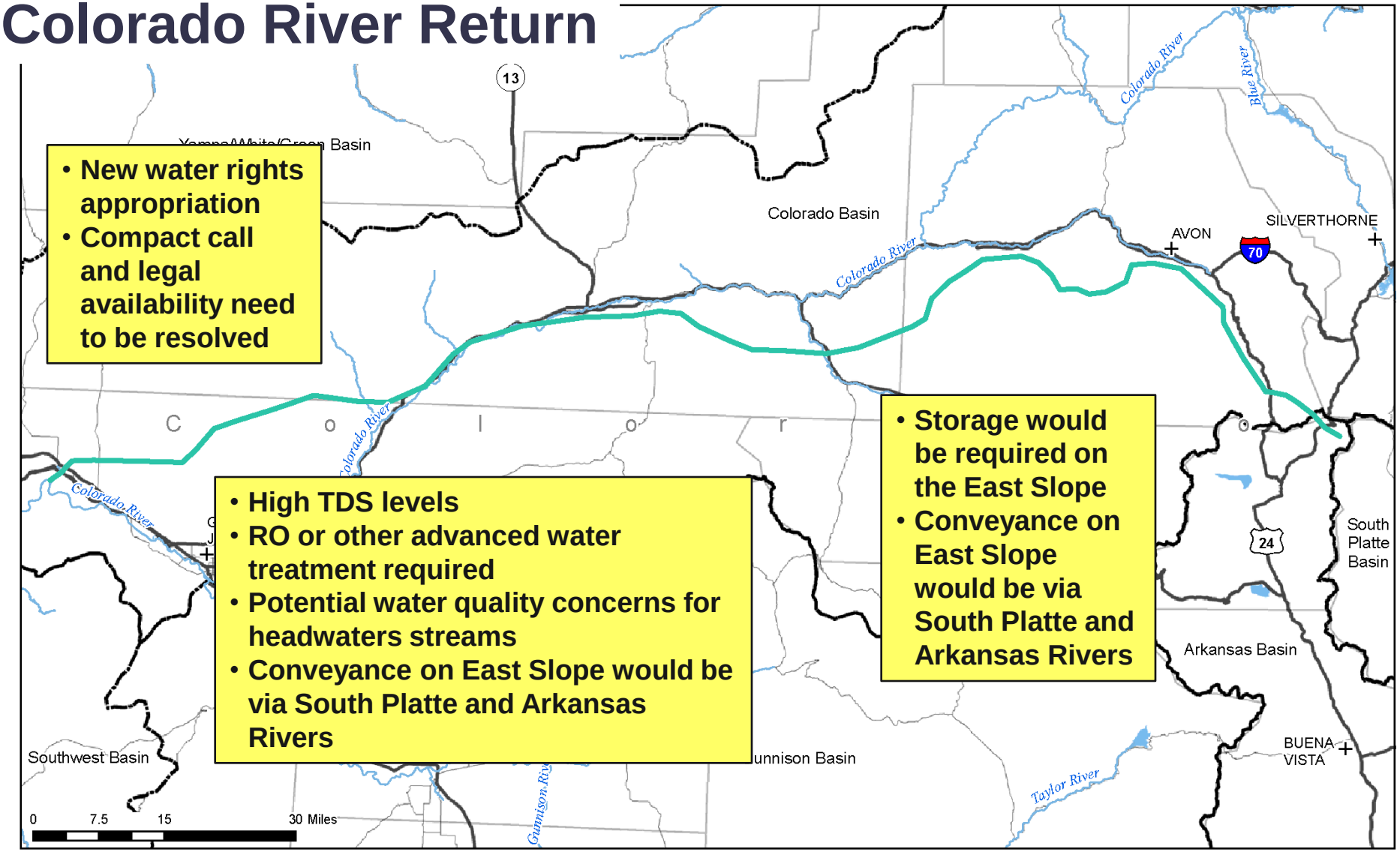
Colorado River Return



Legend

- Cities
- Highways
- Other Roads
- Rivers and Streams
- Lakes and Reservoirs
- Colorado Basins
- Colorado River Return Reconnaissance Study Concept

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Updated Cost Information

Updates to Cost Estimates Since March 2009 Meeting

- Added water rights costs
- Added storage costs
- Considered reuse costs
- Considered blend water in treatment costs
- Consistent costing methodology for all concepts except Green Mountain
- For 250KAF increment considered 1-phase and 2-phase construction
- Details documented in Strategies Report

Green Mountain Concept

- Anticipated yield less than <100,000 AF
- Did not include in cost estimates for other concepts with increments of 100,000 AF and 250,000 AF
- CRWCD et al. 2007 Report presents costs for 68,600 AF; however, project is currently projected to yield ~40,000 AF

Green Mountain Concept Costs

- For 68,600 AF cost $687,000,000 Total Project Capital Cost or $10,000/AF
- Cost estimate does not include:
  - Facilities to convey water to end users
  - Water treatment costs
  - Mitigation

Figure A-6. Total Capital Unit Costs Breakdown: Option 1 (100 KAF)

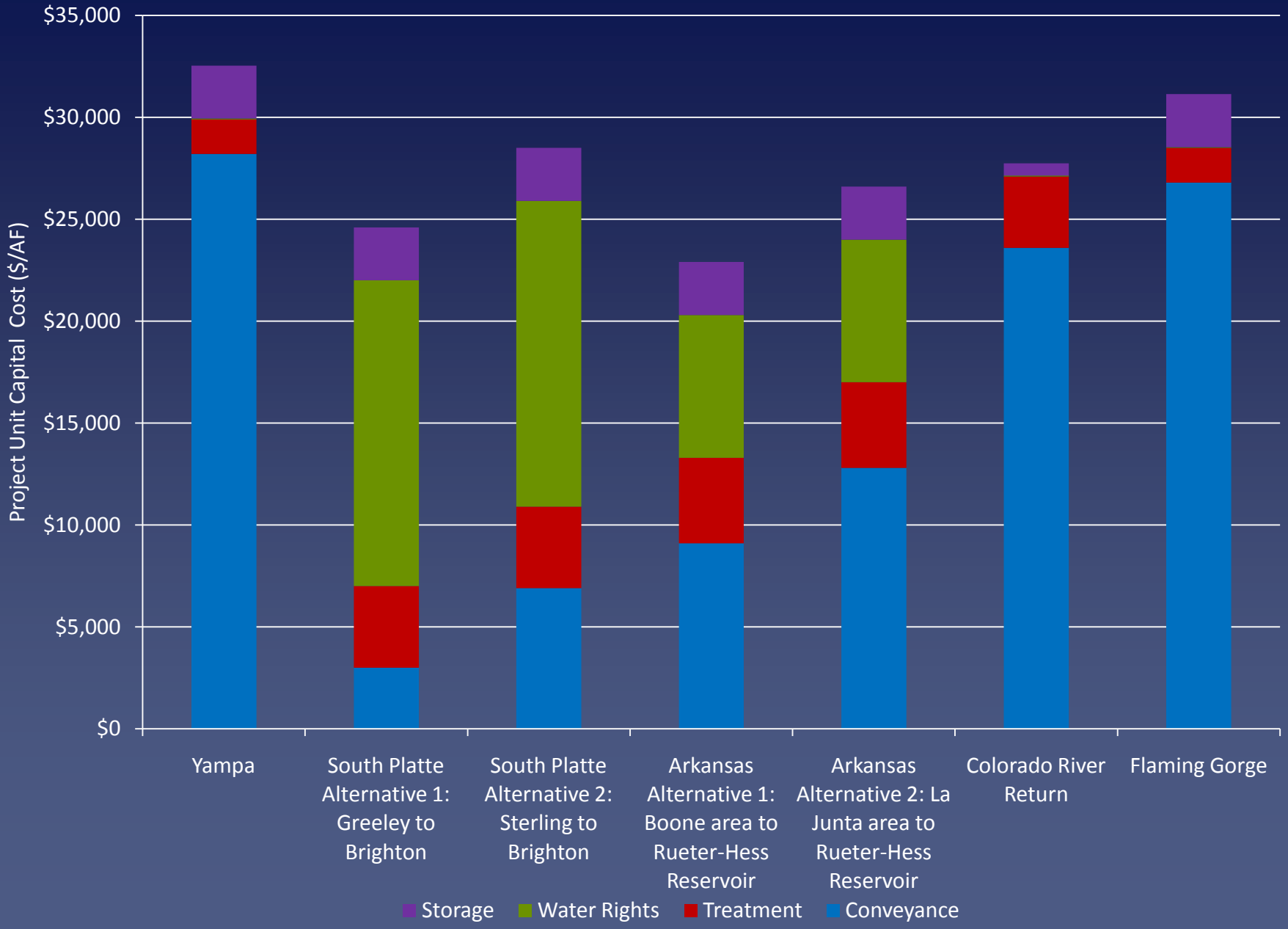


Figure A-8. Total Capital Unit Costs Breakdown: Option 3 (250KAF 2 Phases)

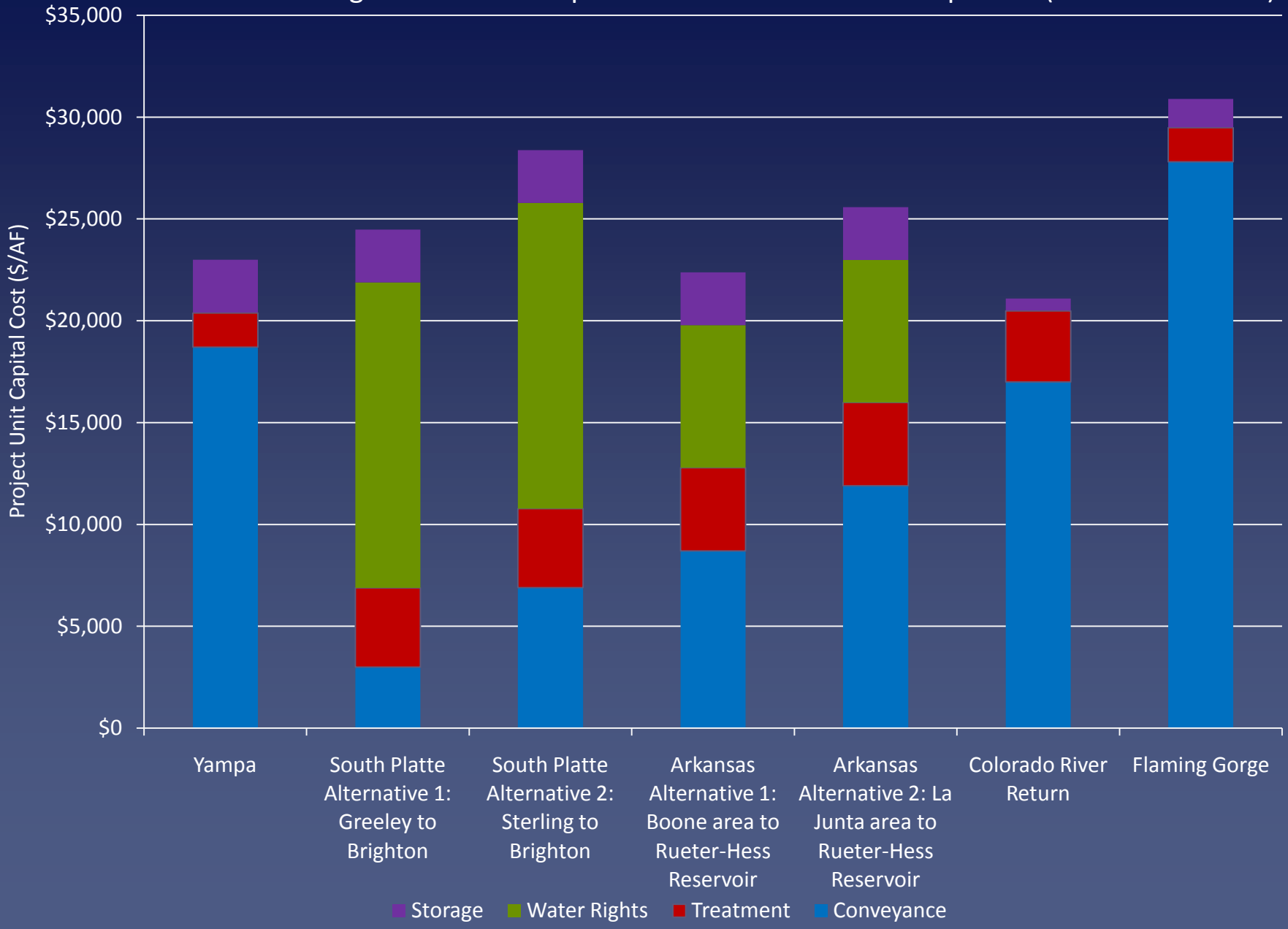


Figure A-11. Total O&M Cost Breakdown: Option 1 (100 KAF)

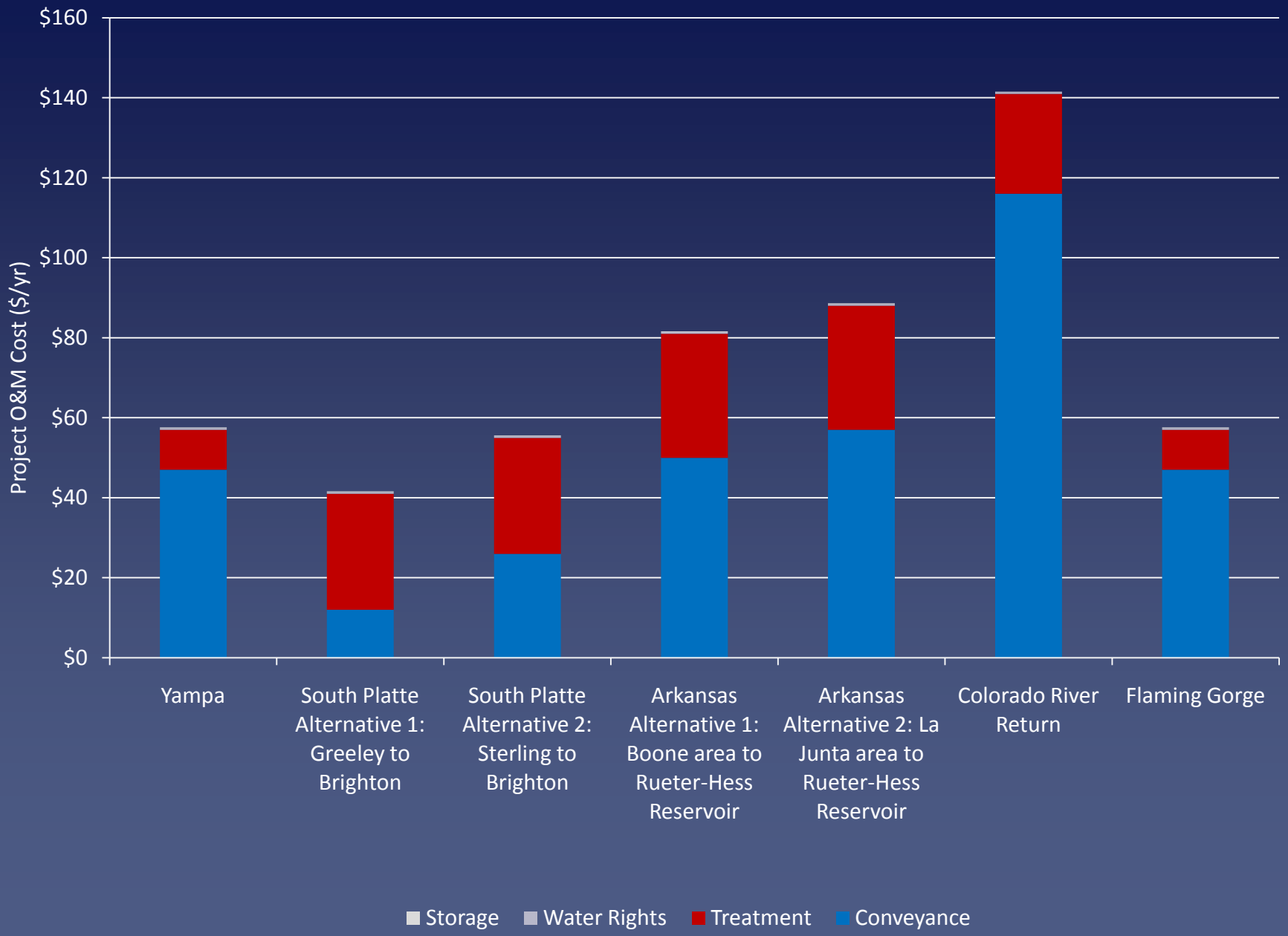


Figure A-12. Total O&M Cost Breakdown: Option 2

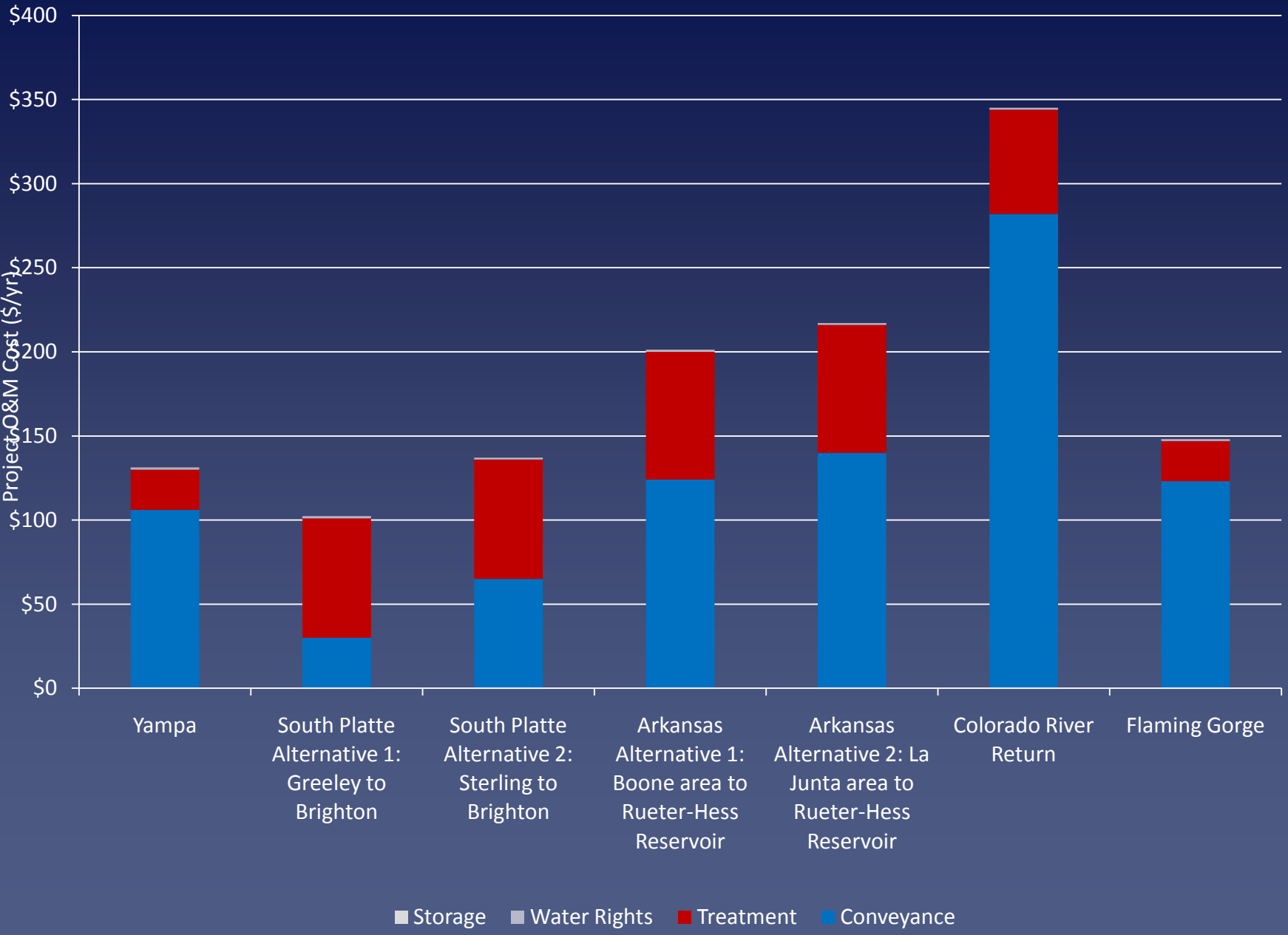


Figure 5-6. Summary of Total Life Cycle Costs

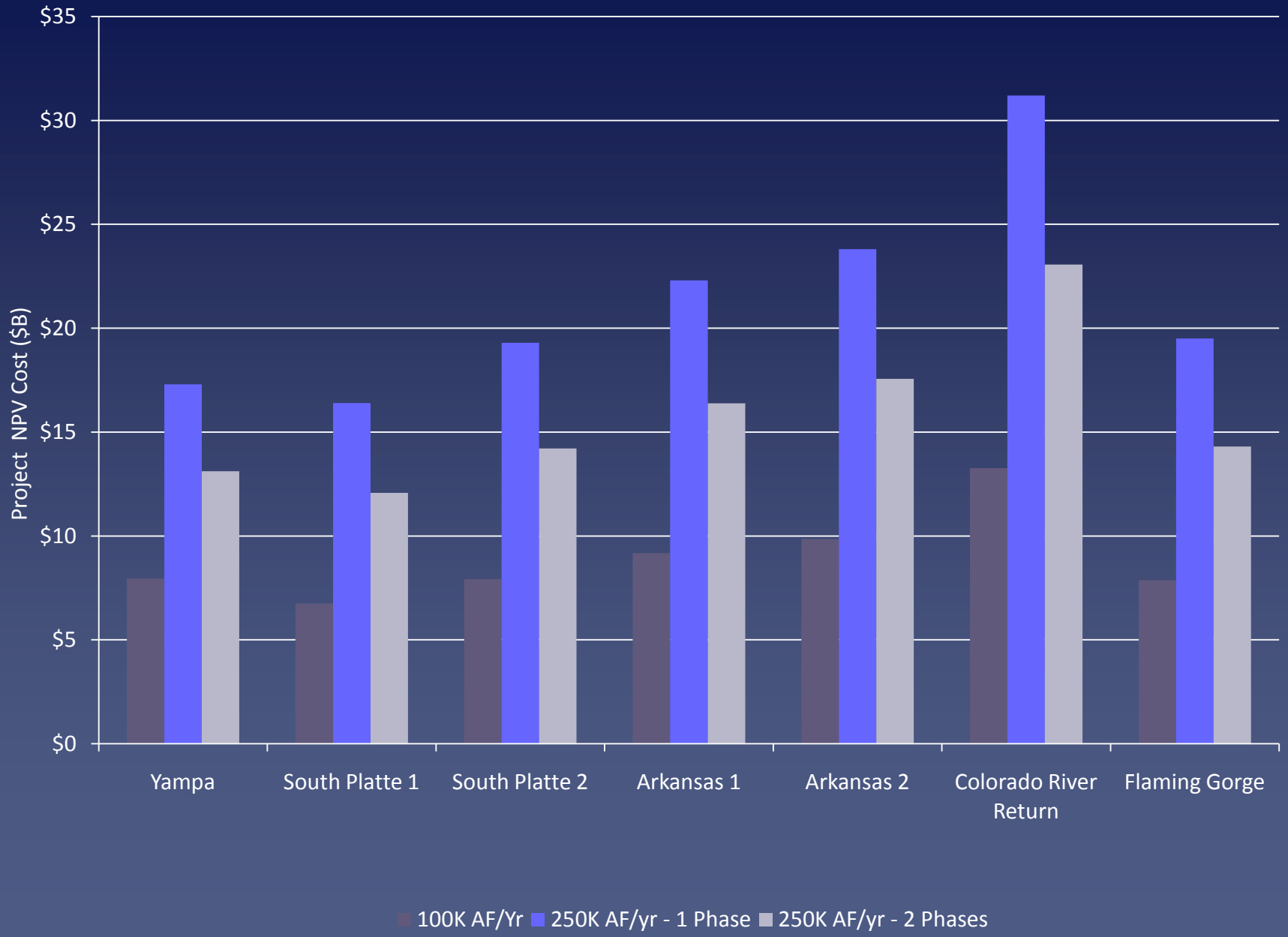
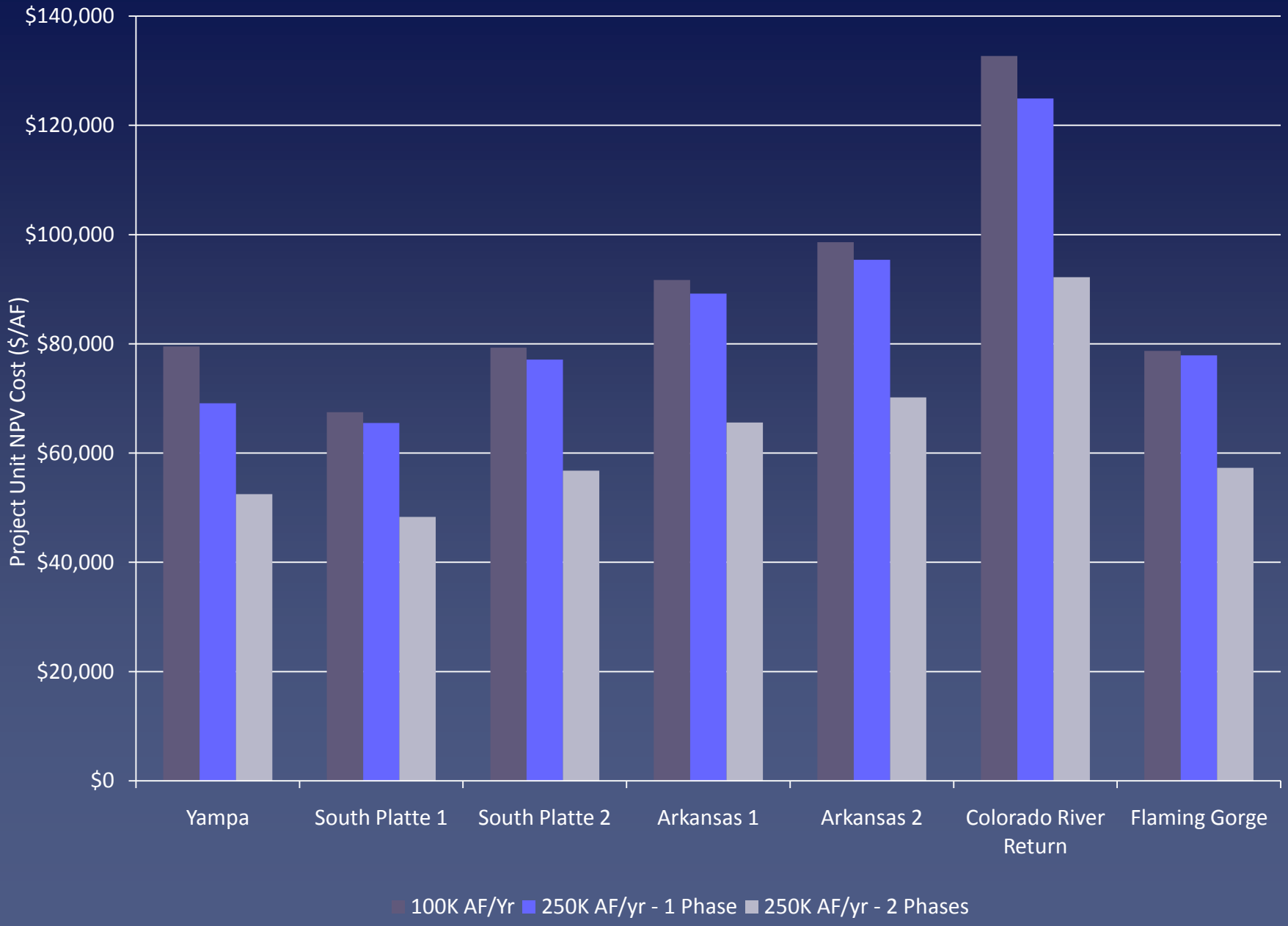


Figure 5-7. Summary of Total Life Cycle Unit Costs



IPP Database

IP&P Database
Purpose and History

- “IP&P” term comes from SWSI – “Identified Projects and Processes” – providers’ plans for meeting new demands
- New CWCB database to catalogue, query, and monitor progress of IP&P’s
- Includes existing IP&P information collected during SWSI
- Collecting additional information on new and existing IPP’s via provider surveys
- Identify projects and areas where CWCB support is helpful
- Will be expandable and compatible with other CWCB tools & products
- Will ultimately provide more detail on water supply trends and gaps

IP&P Database
Current Status

- Initial database completed
- Majority of existing SWSI baseline data loaded
- Data includes projects, conservation programs, provider demands (actual and projected), and population (actual and projected), as available
- Issues of data consistency, complexity, and quality
- Specific provider and project data is relatively sparse
- Database needs refinement and additional functionality

IP&P Database
Next Steps

- Database Phase II currently in procurement and RFP process
- Phase II divided into 2 parts
  - Provider Survey Development
  - Database Enhancements
- Major enhancements include
  - Database layout and structural improvements
  - Incorporation of nonconsumptive water projects
  - Improved query and reporting capabilities
  - Capability to link to other CWCB tools and products
  - Preliminary planning for an interactive “Gap Analysis Tool”
  - Preliminary planning for a geospatial component

WSRA Criteria and Guidelines – 10:00 to 10:15

Next Steps for Water Supply Strategies and Needs Assessments – 10:30 to 11:30

Next Steps for Water Supply Strategies and Needs Assessments: Inputs into CRWAS Phase II

- CRWAS Update and Status
- Additional CRWAS Outreach Efforts
- CRWAS Phase II Outline from Original Scope

Working Lunch – 12:00 to 1:30

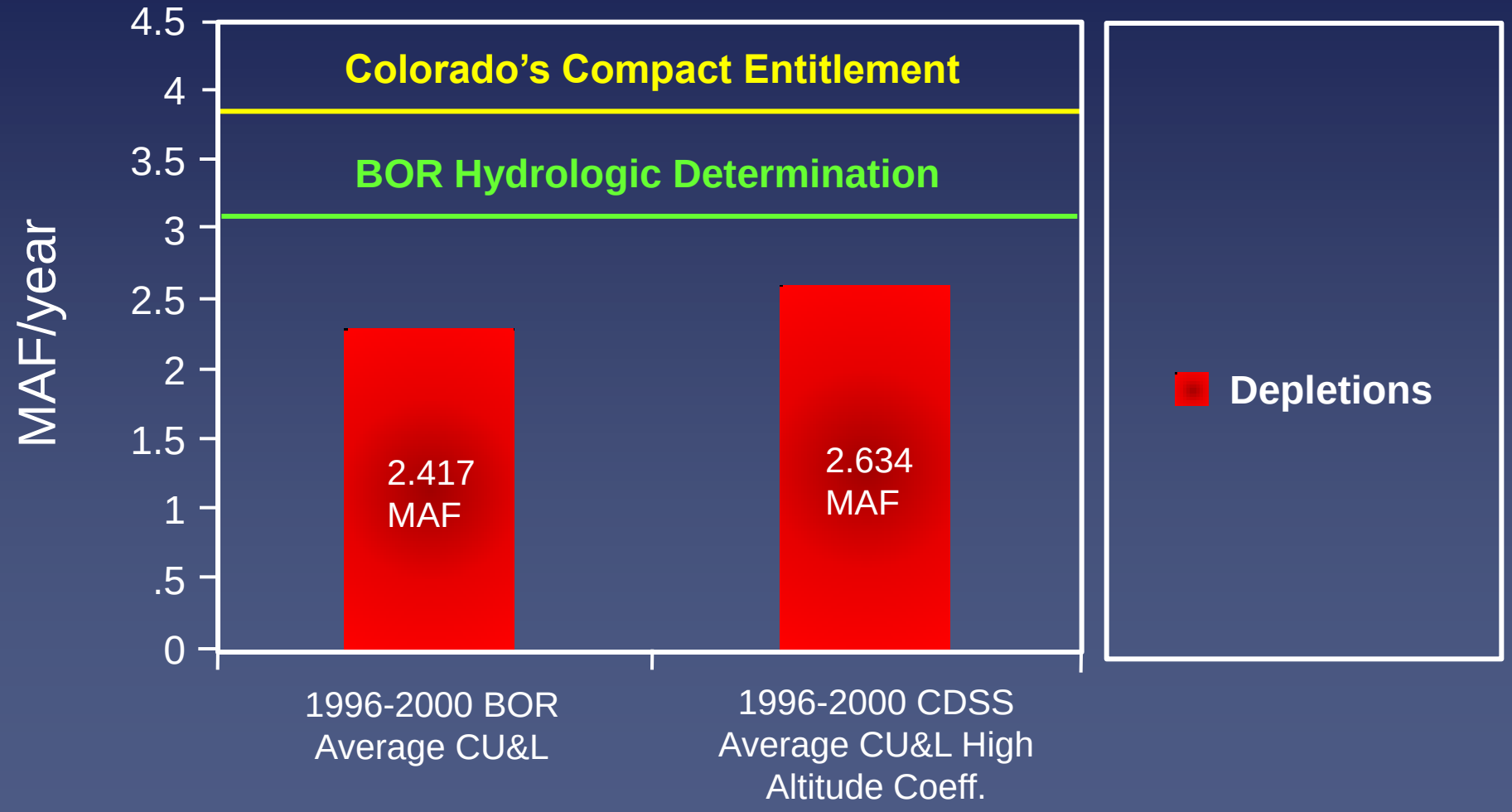
Colorado River Compact Entitlements

	Colorado River Compact "Full Development" Scenario	BOR Hydrologic Determination Scenario
Consumptive Use Available to Upper Basin States	7.5 MAF	6.0 MAF
Colorado's Share (51.75%) of Upper Basin CU Allocation	3.85 MAF	3.08 MAF

Range for Supply on Colorado River System

- Quantitative estimates may be further refined by CRWAS (including climate change considerations) and risk management strategies

1996-2000 State of Colorado – Colorado River Depletions



Colorado River Water Compact
CU Allocation Available to Colorado
(Allocation – existing CU = Remaining Allocation)

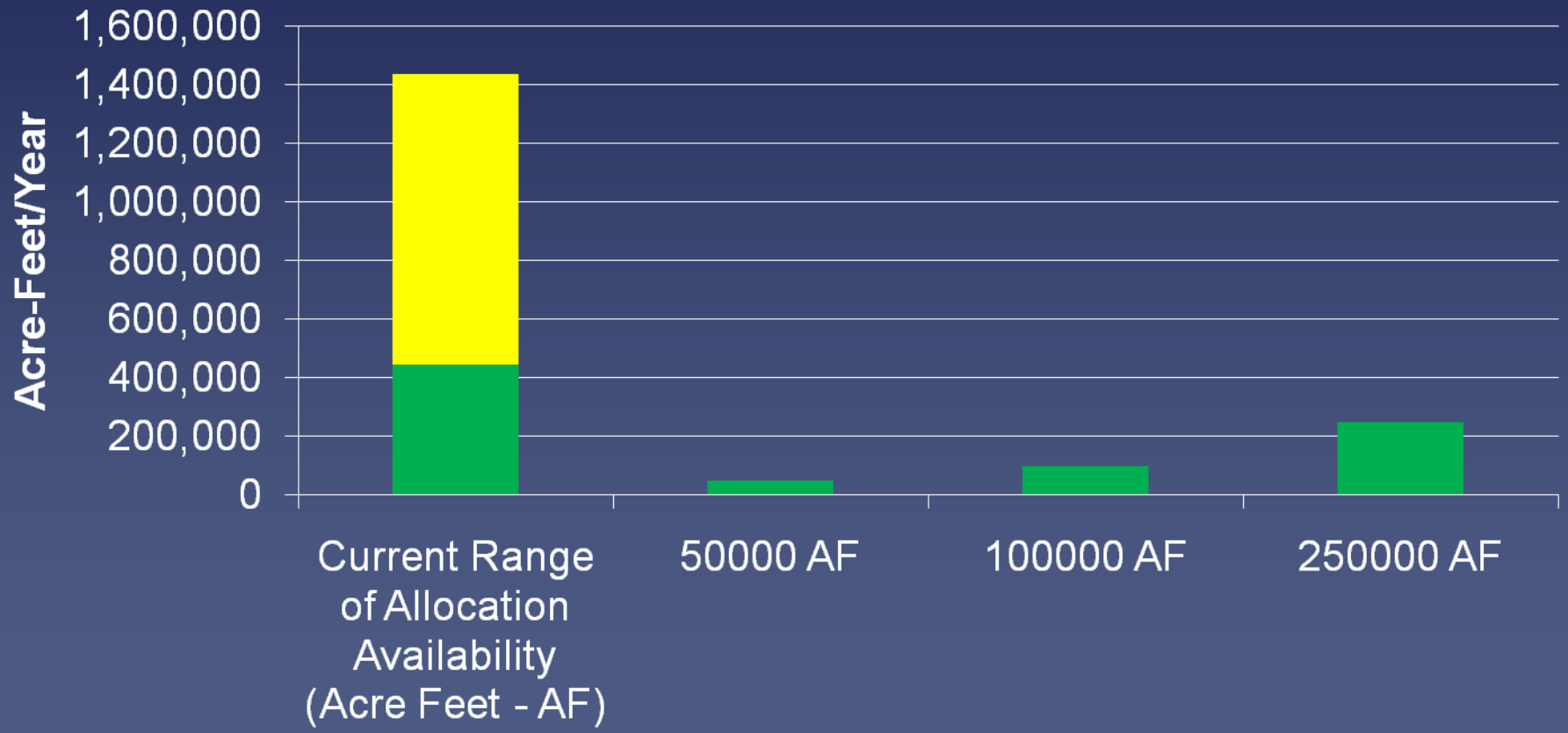
- Scenario 1 - Full Supply
  - 3.855 MAF - 2.417 MAF = 1.438 MAF remaining using BOR CU&L
  - 3.855 MAF - 2.634 MAF = 1.221 MAF remaining using CDSS with High Altitude Coeff.

Colorado River Water Compact
CU Allocation Available to Colorado
(Allocation – existing CU = Remaining Allocation)

- Scenario 2- BOR Hydrologic Determination
  - 3.079 MAF – 2.417 MAF = 662,000 AF remaining using BOR CU&L
  - 3.079 MAF – 2.634 MAF = 445,100 AF remaining using CDSS High Altitude Coeff.

Currently, depending on the planning scenario Colorado has between 445,000 AF and 1,438,000 AF of future development opportunity on the Colorado River System

Colorado River Development is within the Range of Colorado's Remaining Allocation



Basin Roundtable and Stakeholder Feedback on Strategies

Review Section 6 of Strategies Report

- Refer to Handout

Next Steps for Water Supply Strategies and Needs Assessments: Inputs into CRWAS Phase II (cont.)

- Review Basin Roundtable feedback on Strategies and May CWCB Workshop
  - Given the results of the technical work, Roundtable feedback, and Board feedback, what specific strategies/concepts/projects should be further developed so they can be modeled in CRWAS Phase II?
  - The goal of the 10:30-1:30 work session is to develop a revised list of inputs for CRWAS Phase II including which water supply strategies need additional refinement

Develop Additional Details on Water Supply Strategies and Inputs for CRWAS Phase II – 1:30 to 2:45

Demonstration of Portfolio Tool

Portfolio Assumptions

- 2050 Medium M&I Demand Scenario
- 75% Identified Projects & Processes success rate
- 30% M&I Conservation for new growth
- Colorado River System Increment of 100KAF to 250KAF

Develop Additional Details on Water Supply Strategies and Inputs for CRWAS Phase II

- The following sample questions will help guide the discussion. Based on the revised list of inputs for CRWAS Phase II what additional attributes need to be added to each strategy?
  1. Should the New Supply Development strategies be modeled as stand alone projects or should they include additional attributes to benefit the basin of origin (in-basin M&I, Agricultural, Environmental/ Recreational)?

Develop Additional Details on Water Supply Strategies and Inputs for CRWAS Phase II (cont.)

2. If additional attributes should be modeled, what are they and how should the details be developed? These should be specific to each project.
3. Should the New Supply Development strategies be modeled in conjunction with different levels of conservation by the end users?
4. How should M&I demands be included?
5. How should nonconsumptive demands be included?
6. How should agricultural water demands be included?
7. How should energy (specifically oil shale) demands be included?

Potential Next Steps

Needs Assessments – Statewide Update of Consumptive and Nonconsumptive Needs

Nonconsumptive

- Identify next steps for basin roundtable priority areas (Projects and Methods)
  - Restoration projects
  - Quantification methods
- Track and Monitor these nonconsumptive projects/methods through IPP Database

Consumptive

- Implement IPP Database
- Refine M&I Demands to 2050
- Update Ag Needs

Strategies Moving Forward – Build Portfolios

- Identify different mixes of Conservation, Ag Transfer, and New Supply Development to meet Colorado's 2050 consumptive and nonconsumptive needs

- Parts of these portfolios will serve as inputs to the Colorado River Water Availability Study (CRWAS) Phase II

Ag Transfer

- Continue refinement of the Arkansas and South Platte concepts as alternative ag transfers and/or with other methods for protecting rural economies and benefiting the remaining ag
- Analyze Alt. Ag. Grants to help answer “What would it take to make an alternative agricultural transfer program work in Colorado?”

New Supply Development

- Focus efforts on Flaming Gorge and Yampa at 100,000 AF and 250,000 AF and Green Mt. concept at <100,000 AF
- Maintain a comparative portfolio of smaller projects
- Develop as inputs to CRWAS Phase II.

Key Findings

- Colorado's population will nearly double by 2050 requiring between 830,000 and1.7 million acre-feet of additional water to meet M&I needs
- Environmental and recreational water needs have been identified statewide. Identifying projects and methods to meet those needs will continue to be a priority
- In order to meet these consumptive and nonconsumptive needs, Colorado will rely on a mix of conservation, agricultural transfers, and new water supply development
- Meeting Colorado's consumptive and nonconsumptive needs will require substantial investment. For example, a new water supply project yielding 250,000 acre-feet will cost between $7.5 to $10 billion. This exceeds previous cost projections.

Joint Meeting with Interim Water Committee – 3:00 to 5:00

Joint Meeting with Interim Water Committee

- Overview of Interbasin Compact Process
- The Visioning Process and Evaluation of Water Supply Straegies
- Basin Roundtable Needs Assessments: Consumptive Needs, Nonconsumptive Needs, and Identified Projects and Processes to meet those needs
- Use of the Water Supply Reserve Account

Close of IBCC Meeting – 5:00

Next Meeting : September 14, 2009
in Steamboat Springs