Colorado's Water
Supply Future

IBCC Meeting

Denver, CO

April 22, 2010

Tribute to Ray Wright

Tribute to Ray Wright

Vision Statement and Vision Goals

Vision Statement

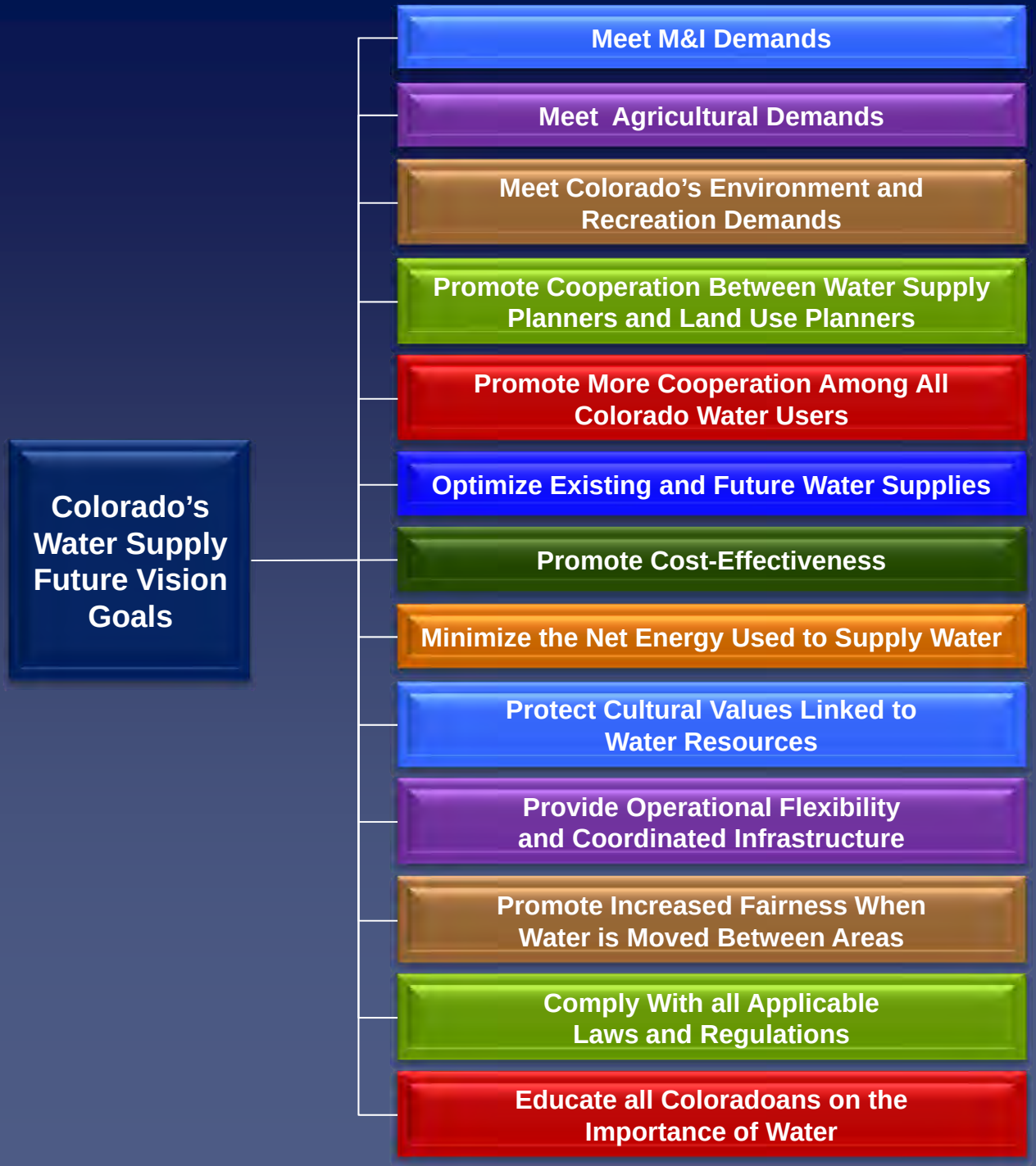
We envision a Colorado that balances municipal, industrial, agricultural, environmental, and recreational water needs and promotes cooperation among all water uses.

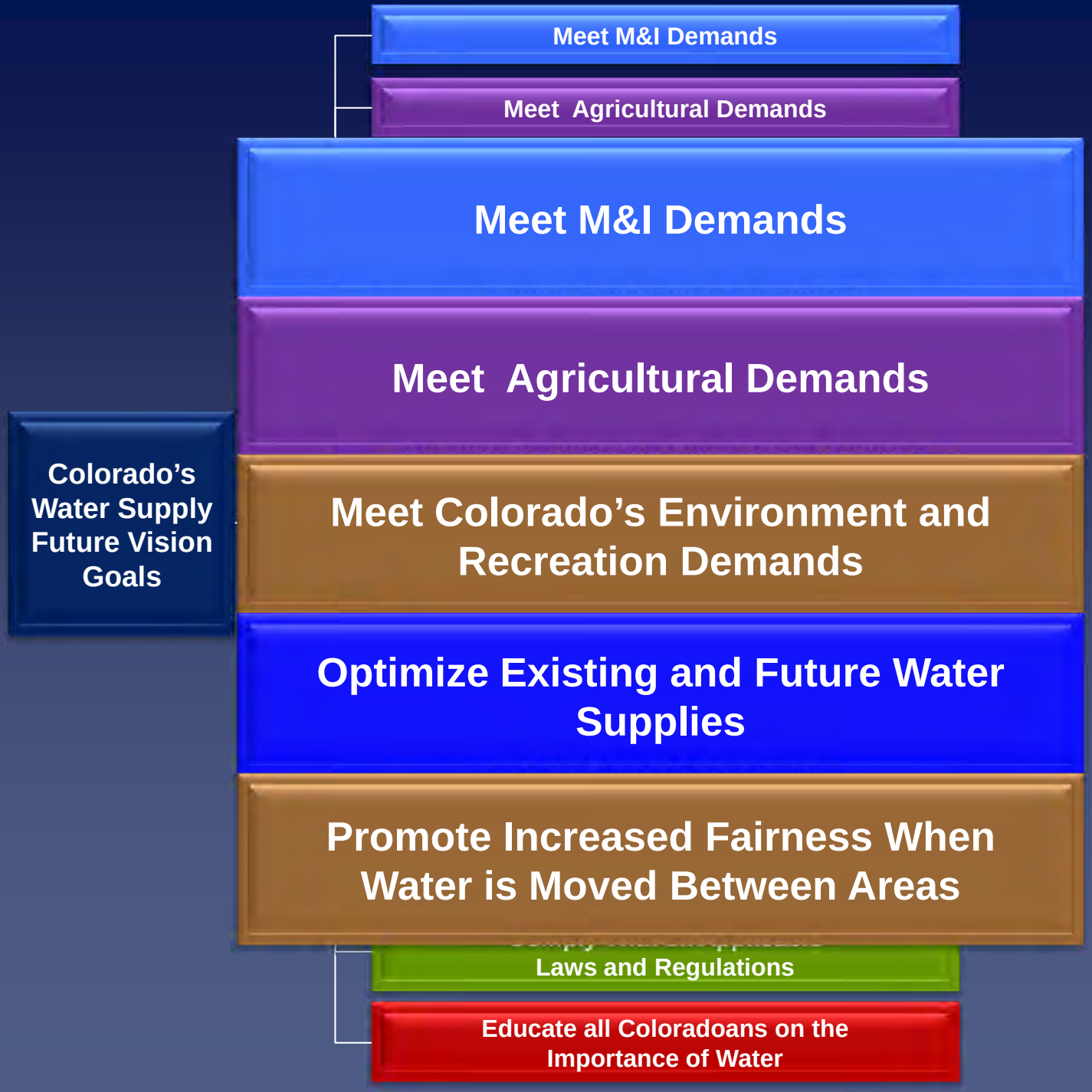
Meeting Goals

Meeting Goals

1. Confirm Vision Statement and Goals, Status Quo Portfolio, and Mid-Demand/Mid-Supply Working Portfolio
2. Discuss New Supply Development and Nonconsumptive Needs Components of the Mid-Demand/Mid-Supply Portfolio
3. Begin examining other scenarios

Vision Goals


Colorado's Water Supply Future Vision Goals
Meet M&I Demands
Meet Agricultural Demands
Meet Colorado's Environment and Recreation Demands
Promote Cooperation Between Water Supply Planners and Land Use Planners
Promote More Cooperation Among All Colorado Water Users
Optimize Existing and Future Water Supplies
Promote Cost-Effectiveness
Minimize the Net Energy Used to Supply Water
Protect Cultural Values Linked to Water Resources
Provide Operational Flexibility and Coordinated Infrastructure
Promote Increased Fairness When Water is Moved Between Areas
Comply With all Applicable Laws and Regulations
Educate all Coloradoans on the Importance of Water


Meet M&I Demands
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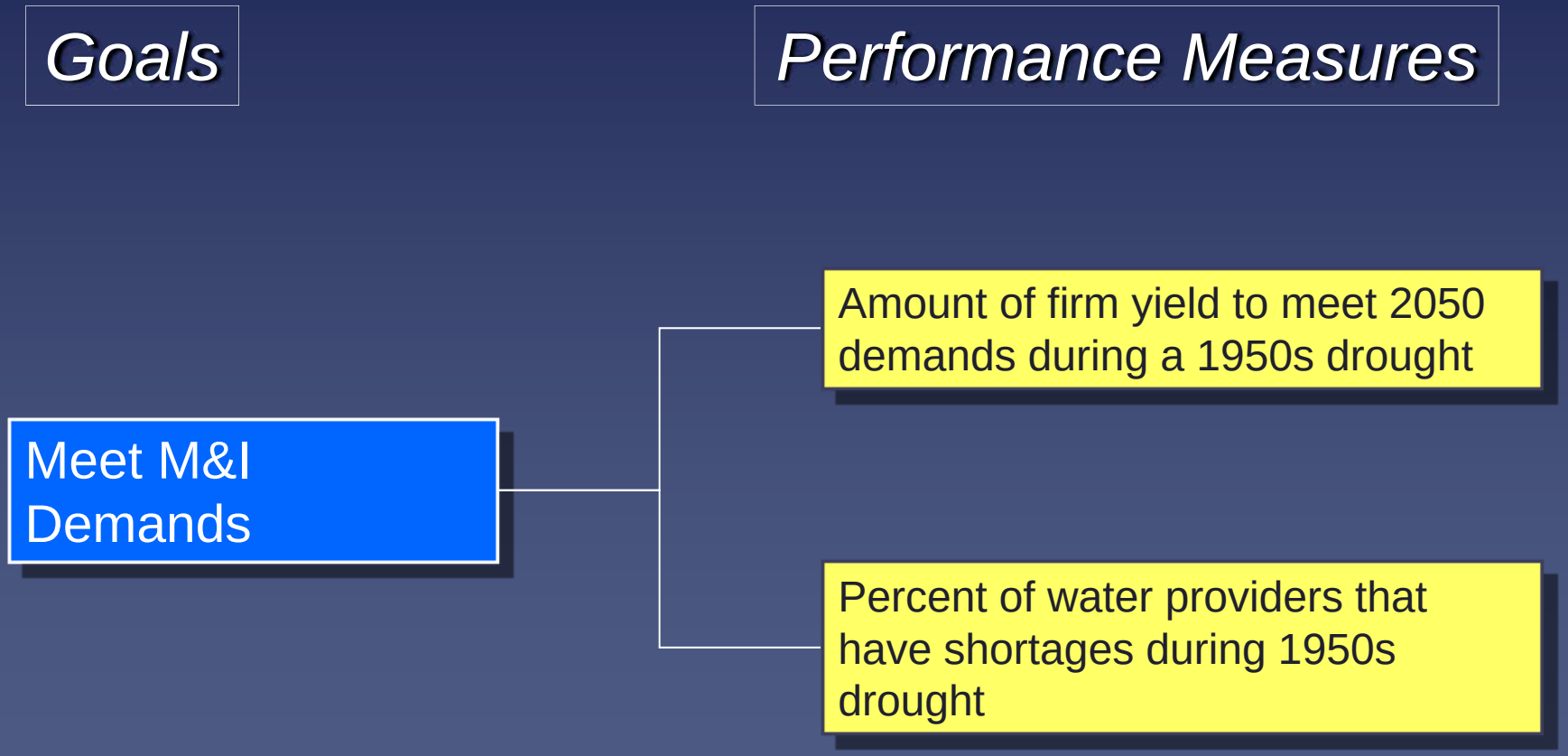
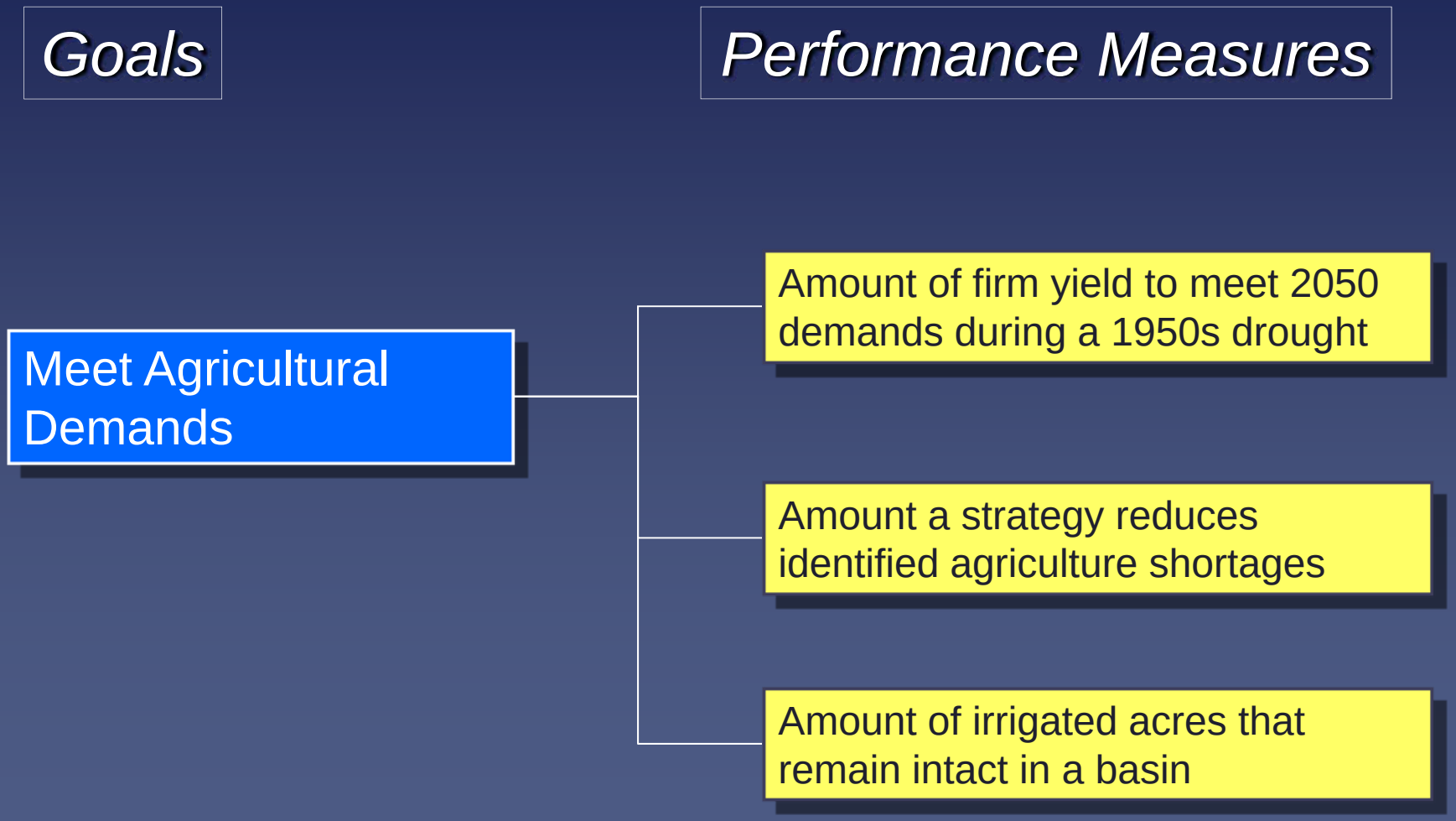
Colorado's Water Supply Future Vision Goals
Meet Colorado's Environment and Recreation Demands
Optimize Existing and Future Water Supplies
Promote Increased Fairness When Water is Moved Between Areas
Laws and Regulations
Educate all Coloradoans on the Importance of Water

Vision Statement and Vision Goals

Performance Measures Indicate How Well Goals are Being Achieved in 2050



Performance Measures Indicate How Well Goals are Being Achieved in 2050



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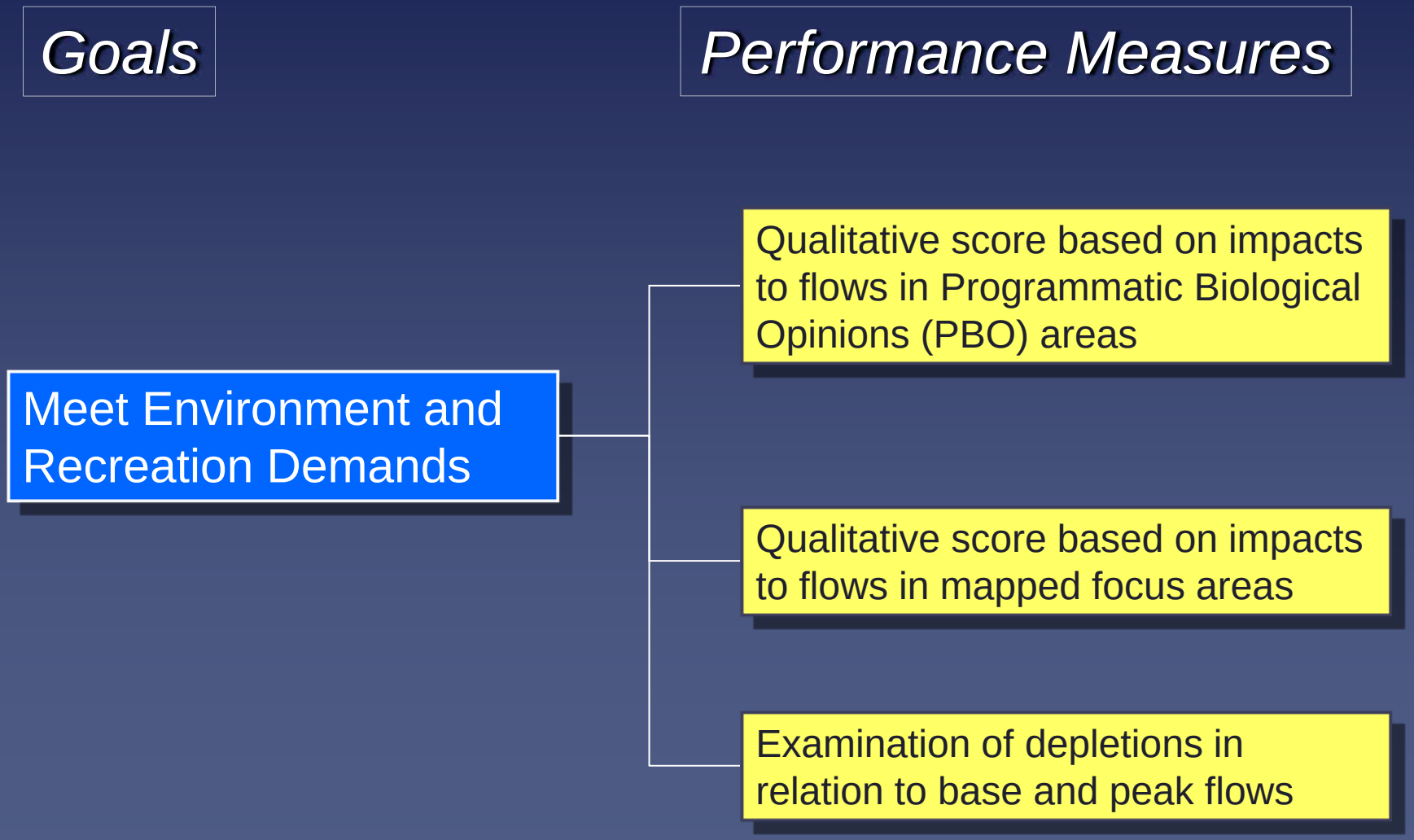
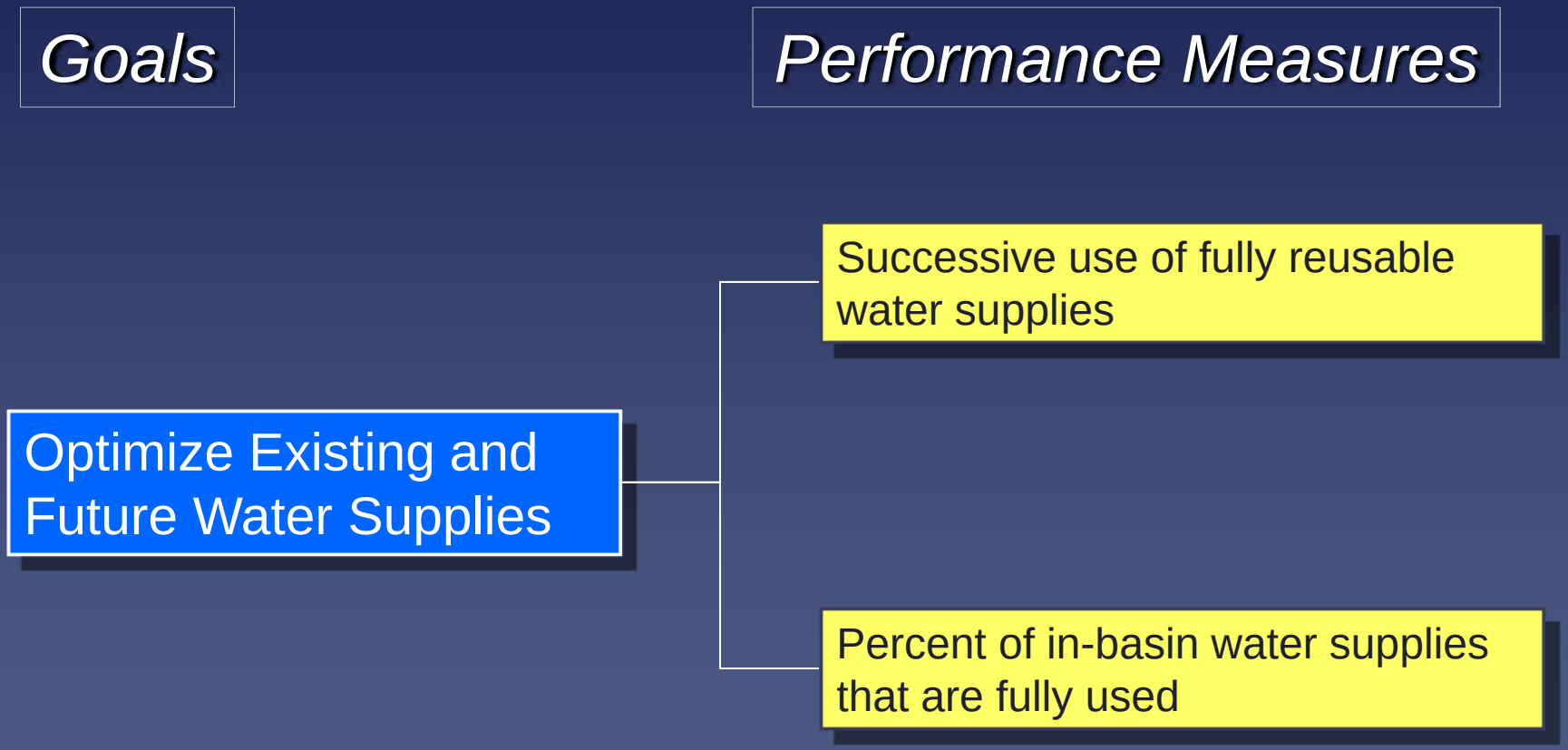


Performance Measures Indicate How Well Goals are Being Achieved in 2050



Performance Measures Indicate How Well Goals are Being Achieved in 2050

Goals

Performance Measures

Status Quo Portfolio

Status Quo Portfolio

- IPP - Success rate varied by basin
- Conservation – 5% (Passive Conservation) and assumes savings since 2000 can be made permanent
- New Supply – Future development of Colorado River water beyond IPPs will occur for uses on the West Slope
- Ag Transfer – Remaining East Slope M&I Demands will be met through ag transfers
- Reuse – 50% of reusable supplies

Mid-Demand/Mid-Supply Working Portfolio

Mid-Demand/Mid-Supply Working Portfolio from March 2010 Meeting

- IPP – Increased from status quo
- Conservation – 15% from 2008 baseline on new demand
- New Supply – 350 KAF developed between west slope and east slope
- Ag Transfer – Remaining East Slope M&I Demands will be met through ag transfers
- Reuse – 70% of reusable supplies

Lunch

- *Water Supply Reserve Account Criteria and Guidelines*
- *Update on CWCB Water Conservation Technical Advisory Group*

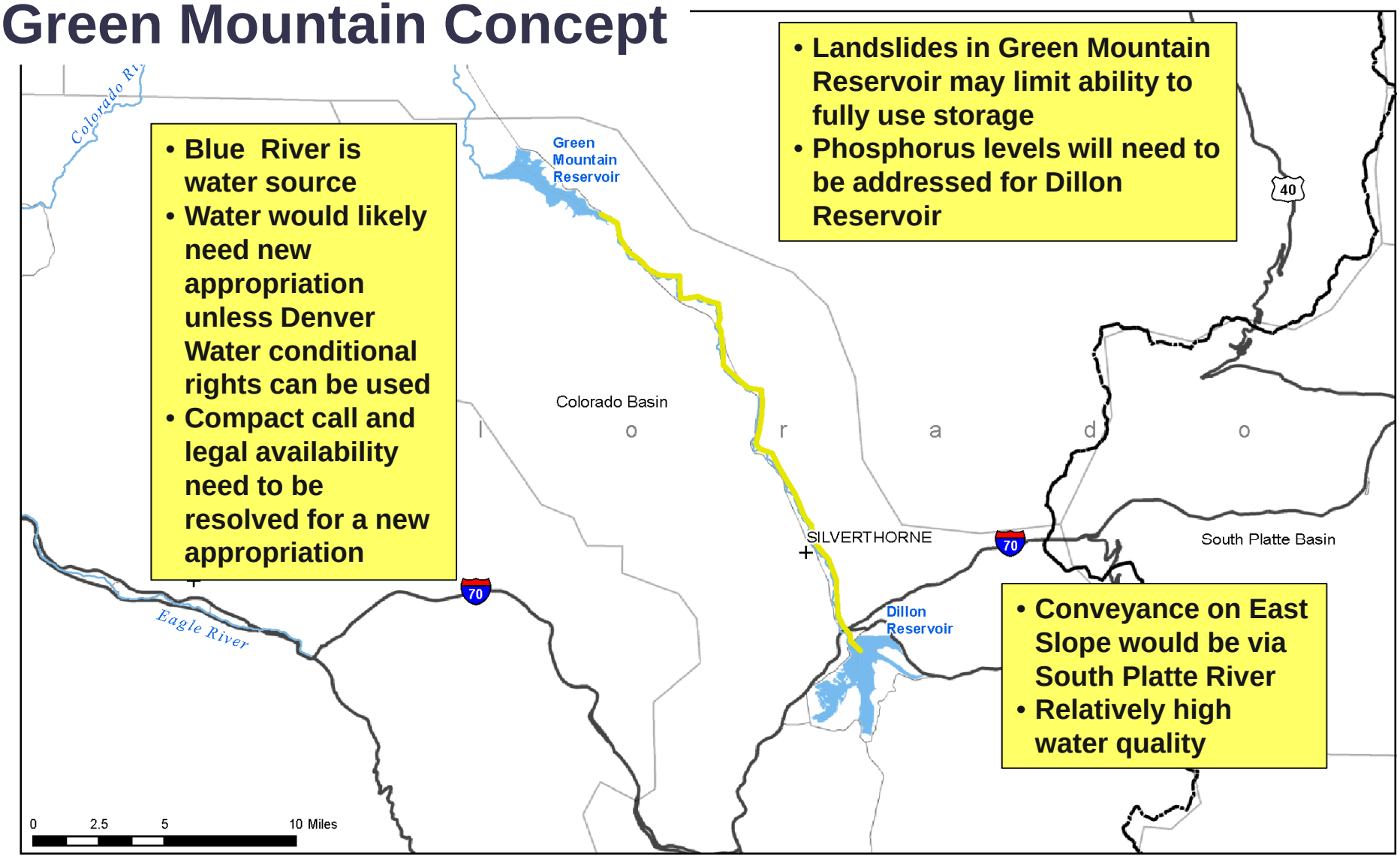
Breakout Groups

New Supply Development Breakout Group

New Water Supply Concepts

- 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
- Blue Mesa Concept 100,000 to 250,000 acre-ft

Green Mountain Concept



Legend

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

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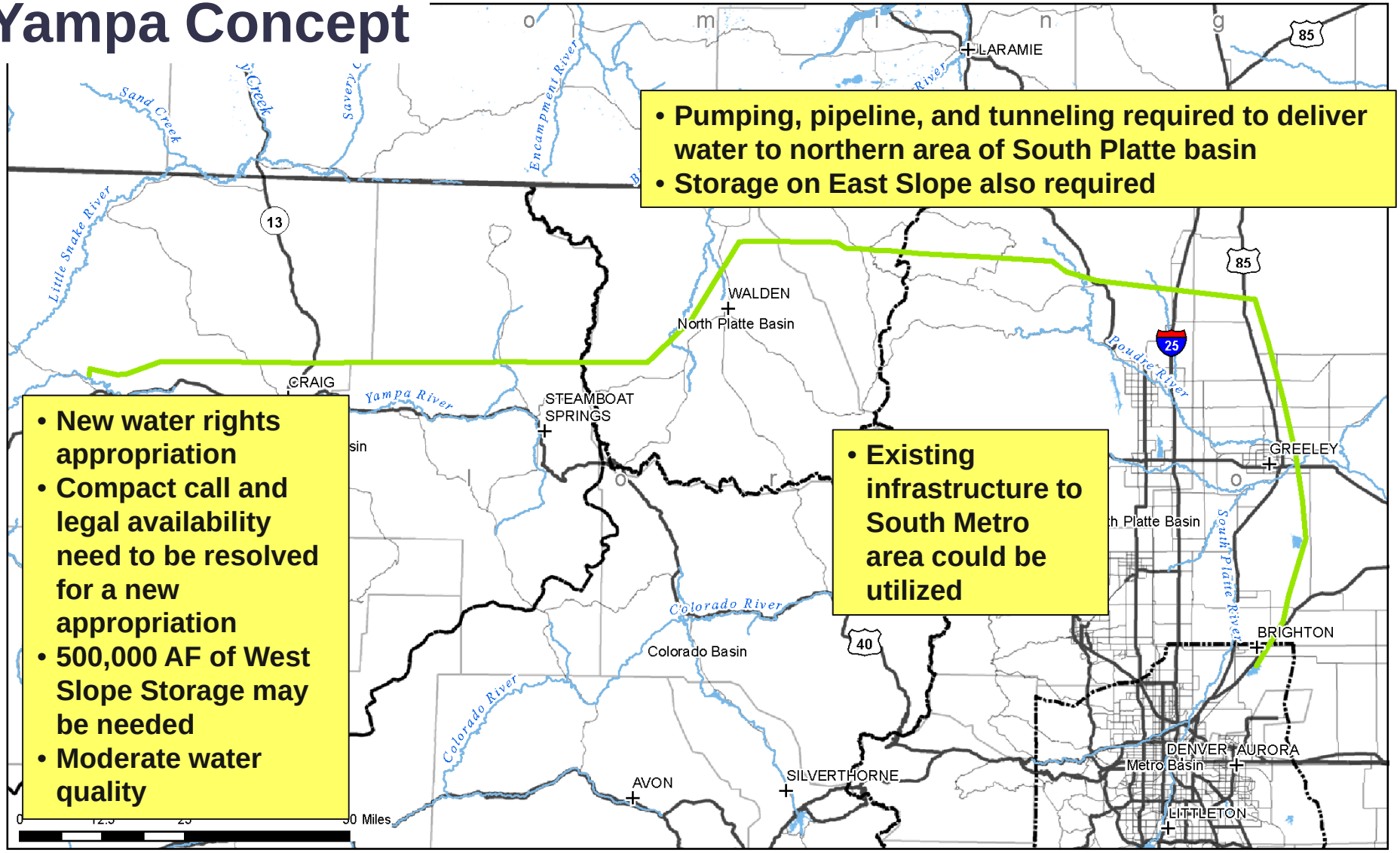
Yampa Concept



Legend

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

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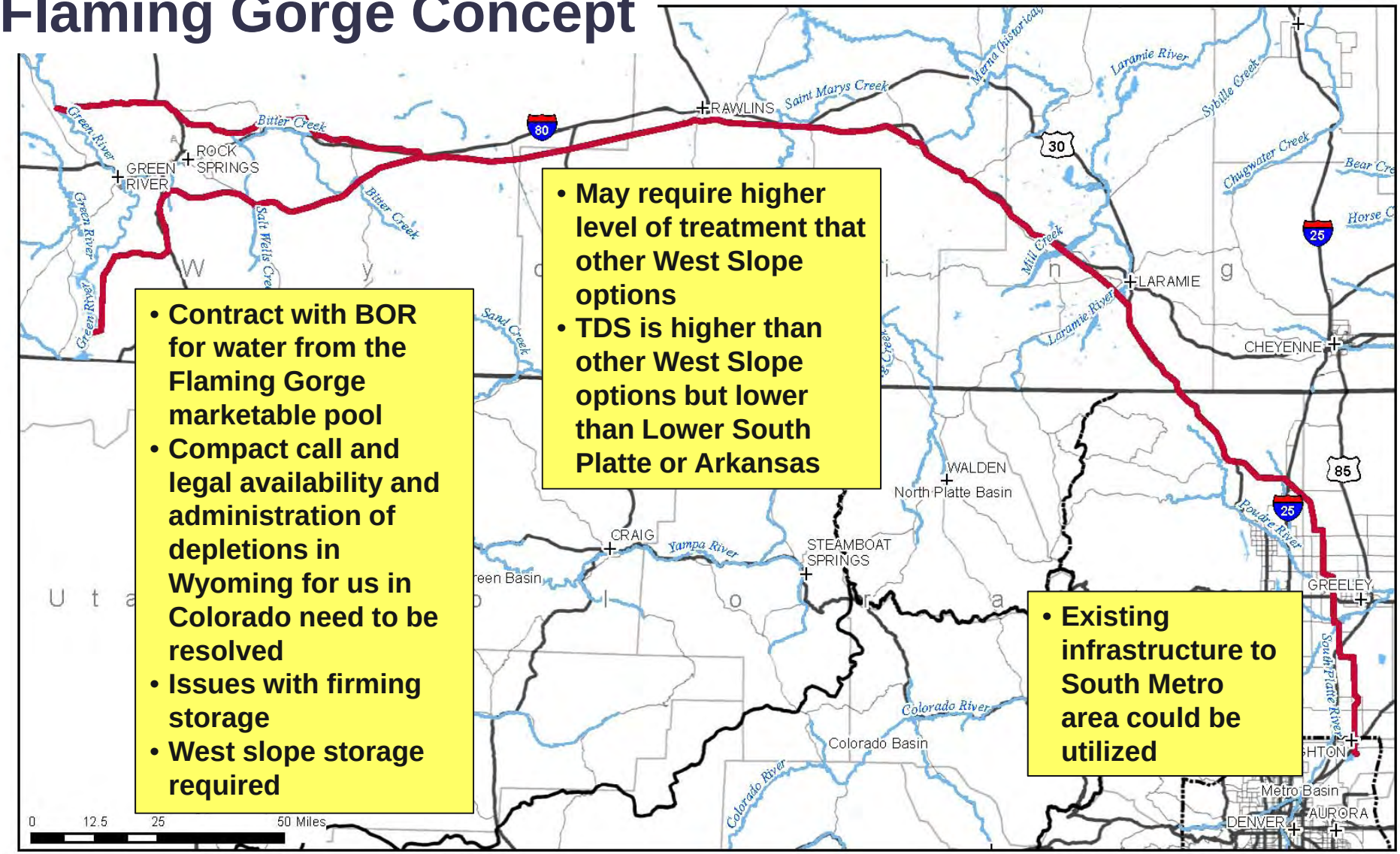
Flaming Gorge Concept



- 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

- 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

- 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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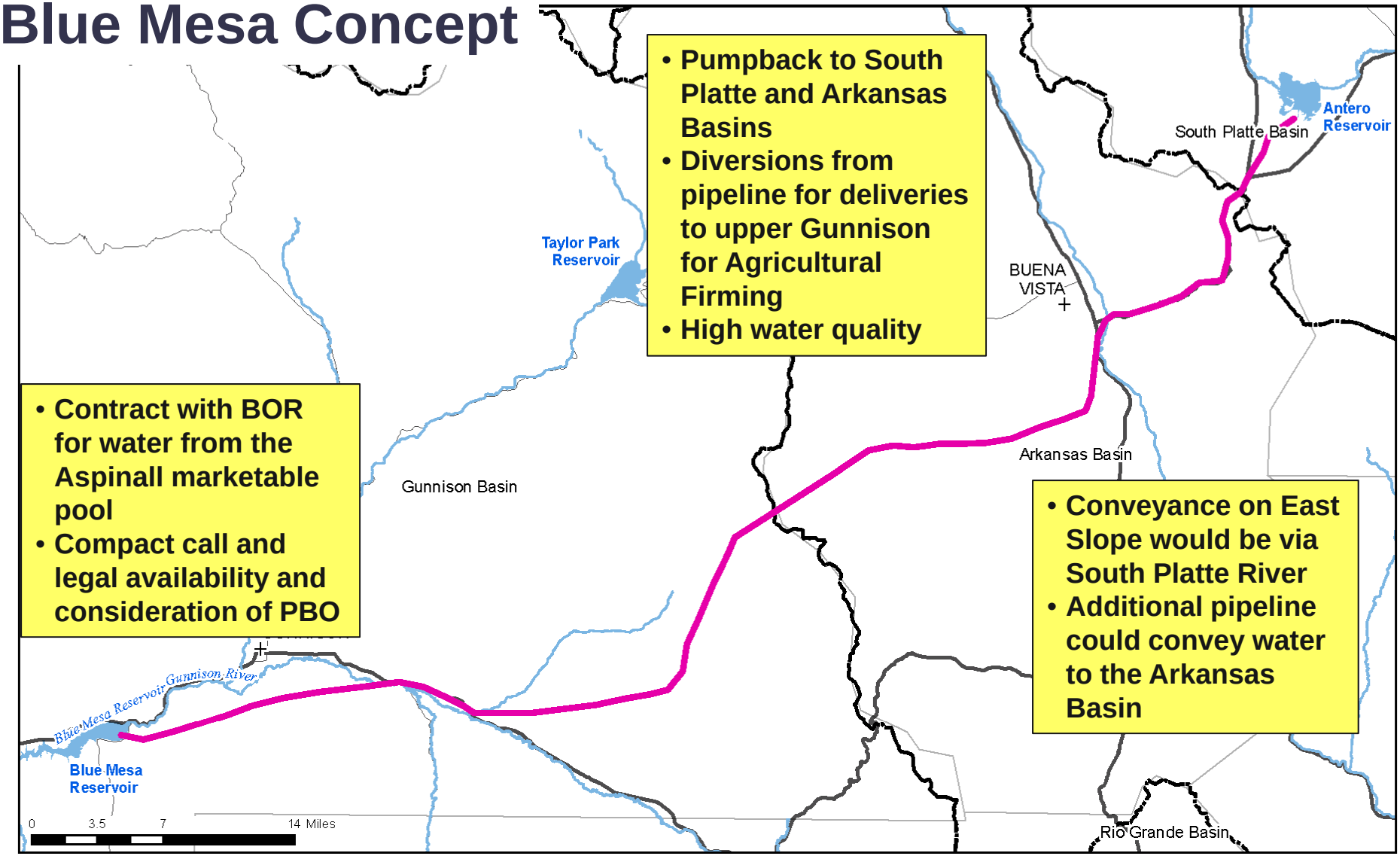
Blue Mesa Concept



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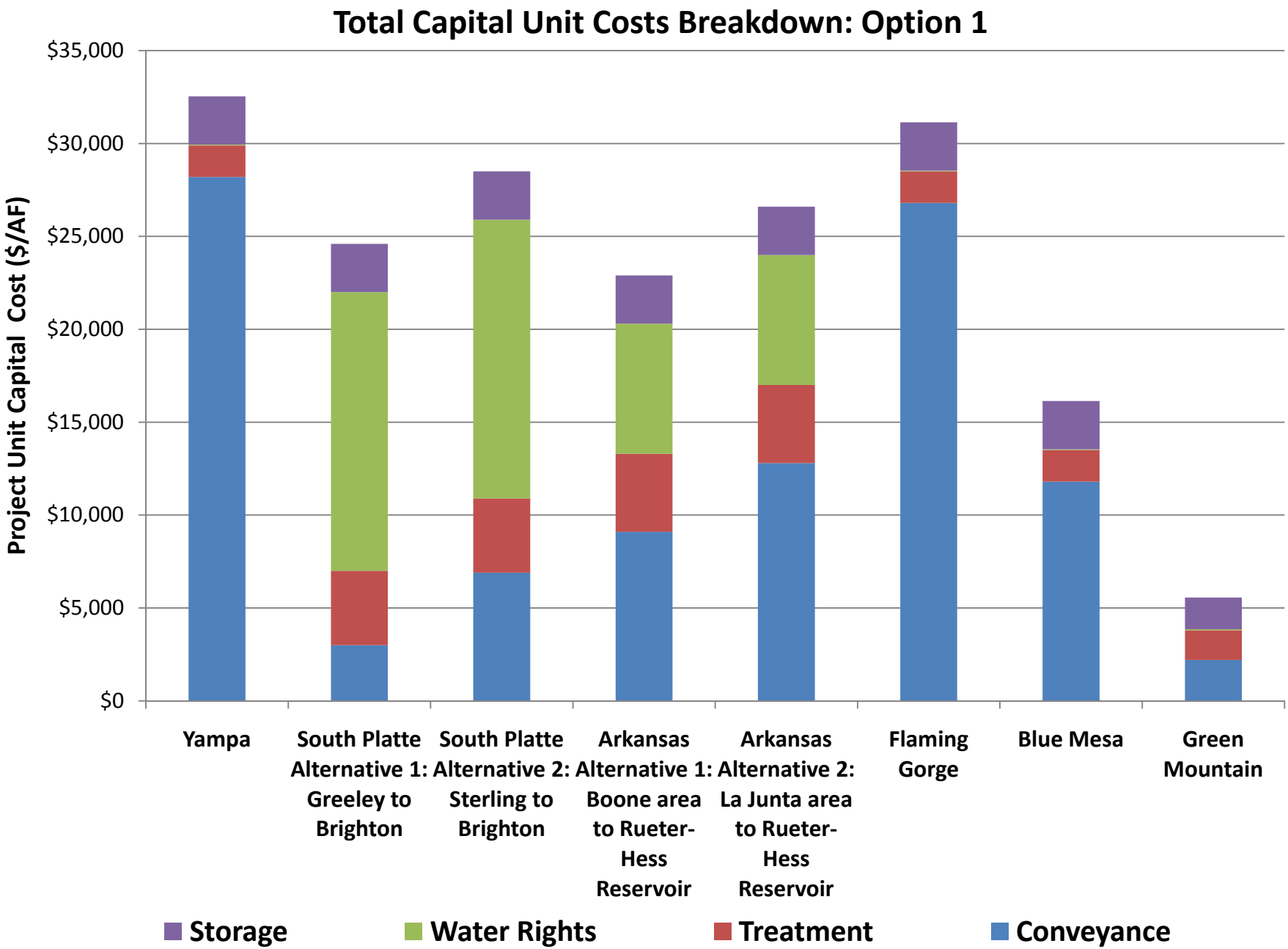
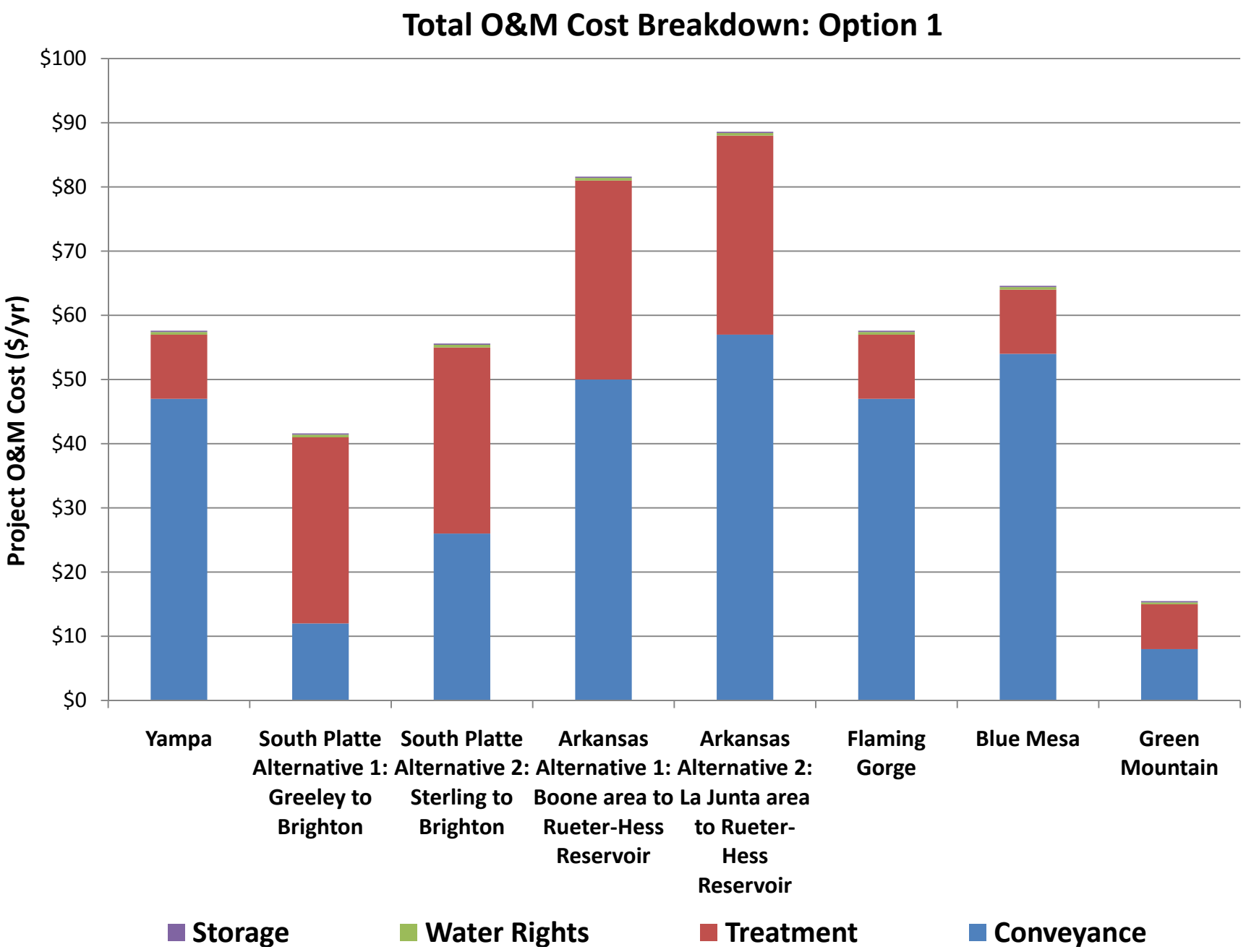
Cost Elements

- Water Rights
- Firming Storage
- Transmission Facilities
- Water Treatment
- Reuse


Total Capital Unit Costs Breakdown: Option 1
Project Unit Capital Cost ($/AF)
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Yampa
South Platte Alternative 1: Greeley to Brighton
South Platte Alternative 2: Sterling to Brighton
Arkansas Alternative 1: Boone area to Rueter-Hess Reservoir
Arkansas Alternative 2: La Junta area to Rueter-Hess Reservoir
Flaming Gorge
Blue Mesa
Green Mountain
Storage
Water Rights
Treatment
Conveyance


Total O&M Cost Breakdown: Option 1
Project O&M Cost ($/yr)
$100
$90
$80
$70
$60
$50
$40
$30
$20
$10
$0
Yampa
South Platte Alternative 1: Greeley to Brighton
South Platte Alternative 2: Sterling to Brighton
Arkansas Alternative 1: Boone area to Rueter-Hess Reservoir
Arkansas Alternative 2: La Junta area to Rueter-Hess Reservoir
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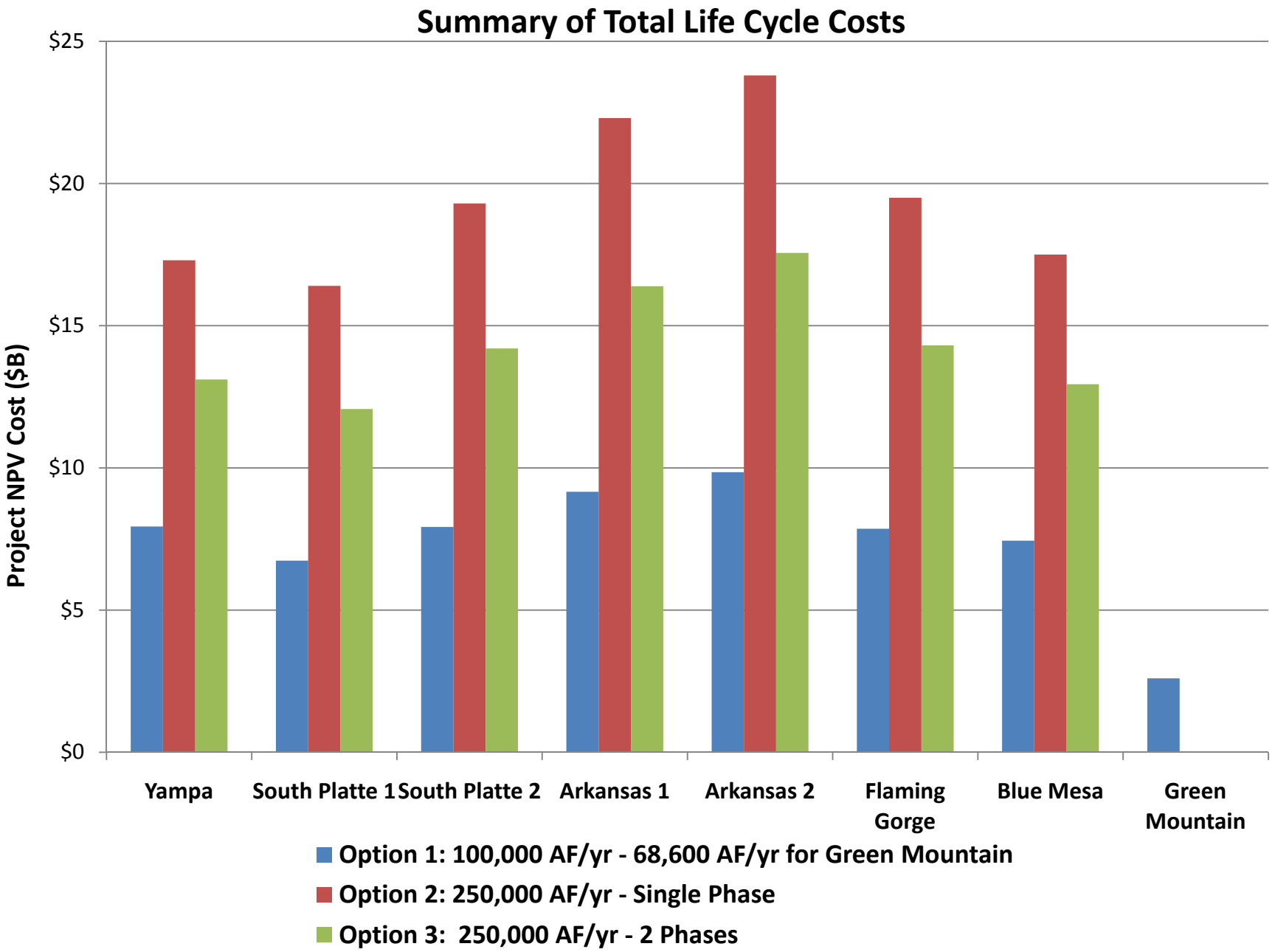
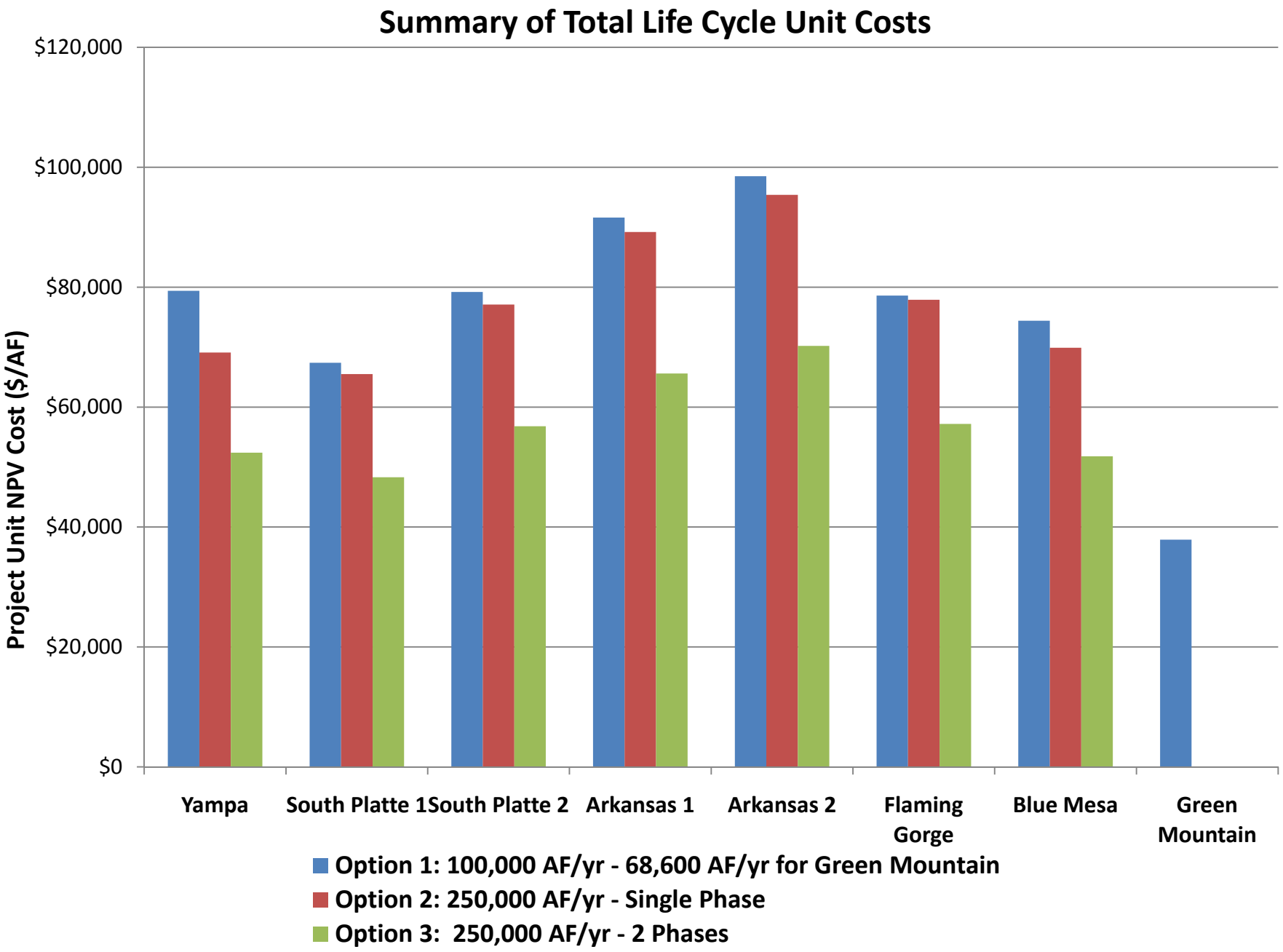

Summary of Total Life Cycle Costs
Project NPV Cost ($B)
$25
$20
$15
$10
$5
$0
Yampa
South Platte 1
South Platte 2
Arkansas 1
Arkansas 2
Flaming Gorge
Blue Mesa
Green Mountain
Option 1: 100,000 AF/yr - 68,600 AF/yr for Green Mountain
Option 2: 250,000 AF/yr - Single Phase
Option 3: 250,000 AF/yr - 2 Phases


Summary of Total Life Cycle Unit Costs
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Project Unit NPV Cost ($/AF)
Yampa
South Platte 1
South Platte 2
Arkansas 1
Arkansas 2
Flaming Gorge
Blue Mesa
Green Mountain
Option 1: 100,000 AF/yr - 68,600 AF/yr for Green Mountain
Option 2: 250,000 AF/yr - Single Phase
Option 3: 250,000 AF/yr - 2 Phases

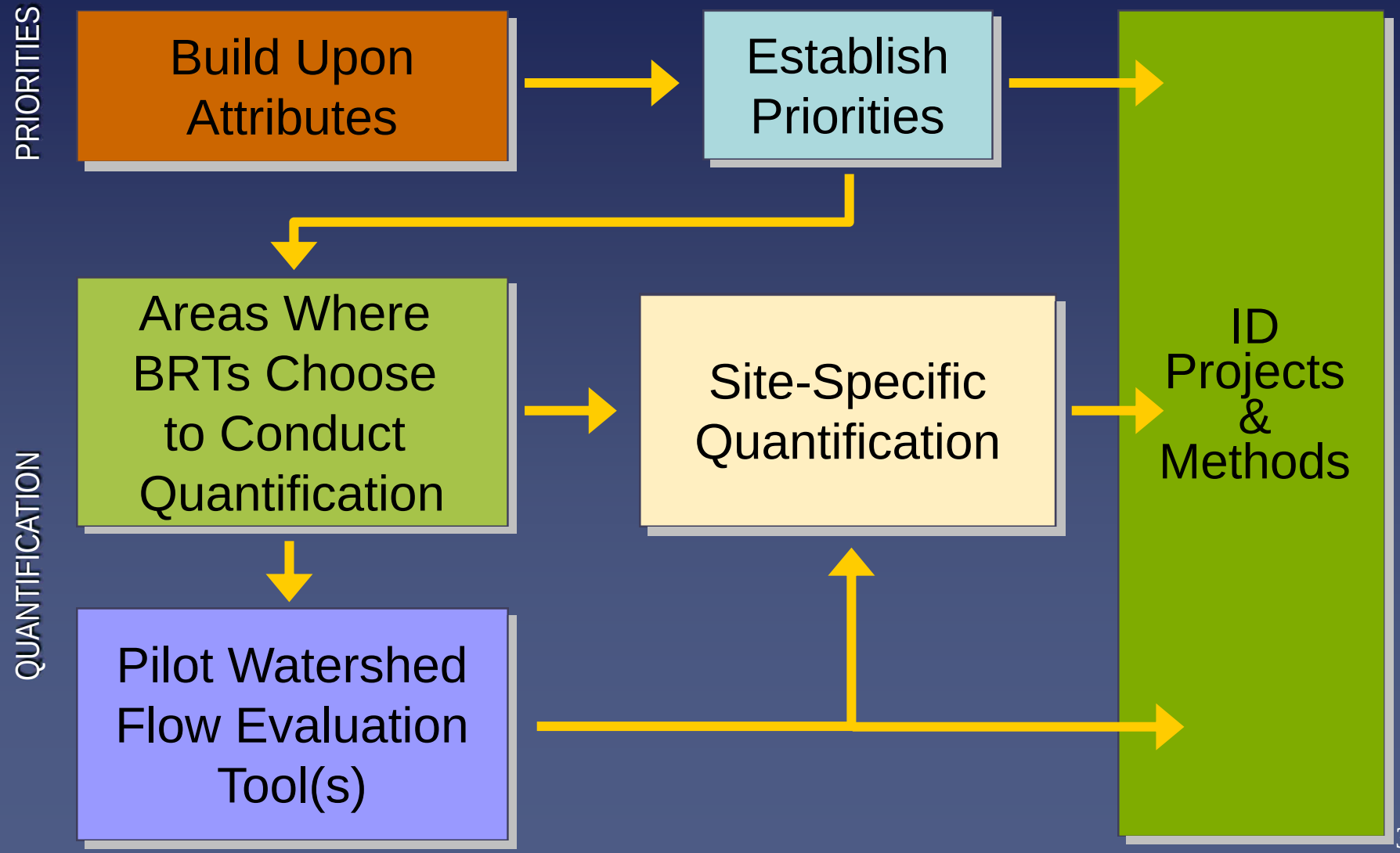
Nonconsumptive Needs Breakout Group

Why are we here…

PLAN Upfront

- Provide valuable information to the roundtables so that they can determine sufficiency of protection and next steps
- Determine where CWCB should look at funding and supporting nonconsumptive projects
- Avoid long National Environmental Policy Act (NEPA) and litigation processes (be a useful guide for water supply planning up front),
- Avoiding Endangered Species Act “train wrecks” (help plan to prevent species of special concern from becoming federally listed),
- Inform Wild & Scenic Process
- Point to win/win opportunities for future multi-objective projects, and
- Help identify where future conflicts may occur

Nonconsumptive Needs Assessment Methodology



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.

What Phase I of the NCNA was…

- 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

Phase I: Example Attributes, mapped & considered by the roundtables

- CWCB Instream Flow Rights
- CWCB Natural Lake Levels
- CWCB water rights where water availability had a role in appropriation
- Audubon important bird areas
- CDPHE WQCD 303(d) listed segments
- Rare Riparian Wetland Vascular Plants
- Significant Riparian/Wetland Communities
- Boreal Toad Critical Habitat
- Arkansas Darter
- Greenback Cutthroat Trout
- Colorado Pikeminnow
- Bonytail Chub
- Flannelmouth Sucker
- Colorado River Cutthroat Trout
- Razorback Sucker
- Humpback Chub
- Greenback Cutthroat Trout
- Bluehead Sucker
- Rio Grande Cutthroat Trout
- Rio Grande Sucker
- Roundtail Chub
- Gold Medal Trout Streams
- Gold Medal Trout Lakes
- Recreational In-Channel Diversions
- Rafting and Kayak reaches
- Eligible/Suitable Wild & Scenic Reaches

Statewide Nonconsumptive Needs Assessment Focus Areas Maps

Colorado Basins

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

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

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

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

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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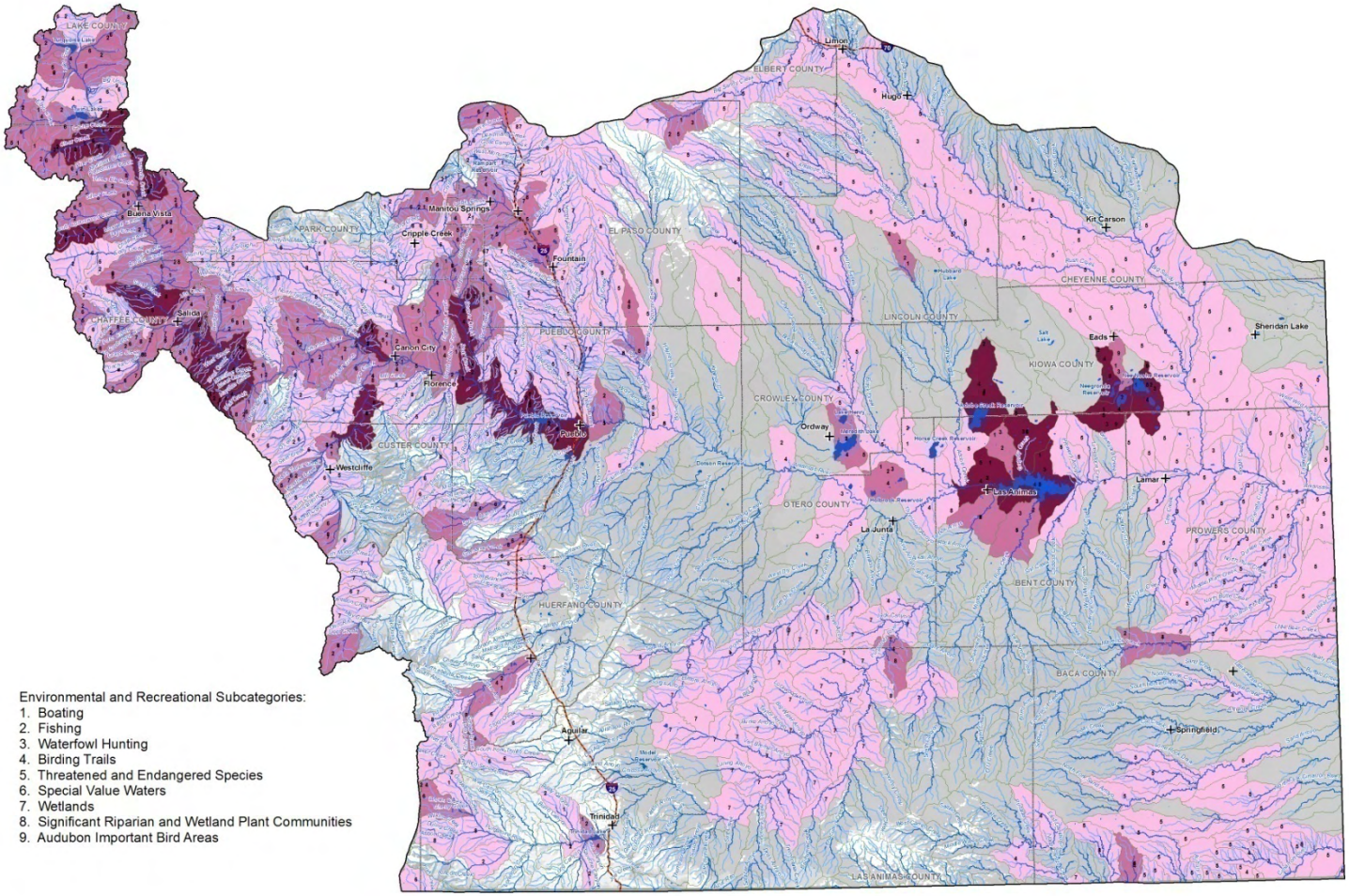

Environmental and Recreational Subcategories:
1. Boating
2. Fishing
3. Waterfowl Hunting
4. Birding Trails
5. Threatened and Endangered Species
6. Special Value Waters
7. Wetlands
8. Significant Riparian and Wetland Plant Communities
9. Audubon Important Bird Areas

Legend

Environmental and Recreational Subcategory Count by HUC

- 1 - 2
- 3 - 4
- 5 - 7
- Arkansas Basin HUC 12
- Highways
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary

N
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0 7 14 28 42
Miles

1 inch = 7 miles

Figure 3-3
Arkansas Basin
Nonconsumptive Needs Assessment
Environmental and Recreational Subcategories by 12-Digit HUC

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Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

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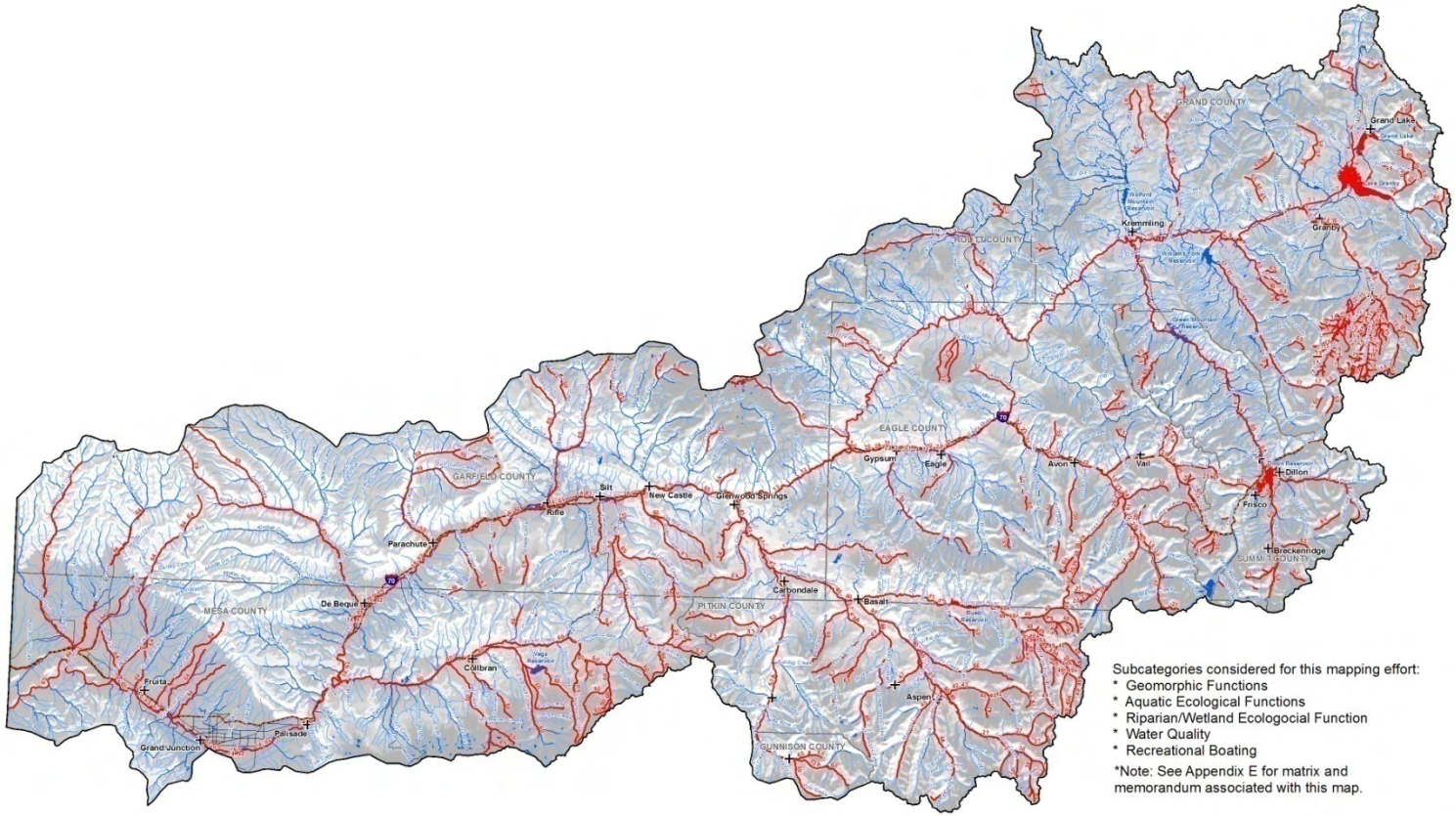

Subcategories considered for this mapping effort:
* Geomorphic Functions
* Aquatic Ecological Functions
* Riparian/Wetland Ecologocial Function
* Water Quality
* Recreational Boating

*Note: See Appendix E for matrix and memorandum associated with this map.

Legend
- Environmental and Recreational Features at Risk
- Highways
- Roads
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary

N
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S

0 5 10 20 30
Miles

1 inch = 5 miles

Figure 3-11
Colorado Basin
Nonconsumptive Needs Assessment
Environmental and Recreational Features at Risk

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Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

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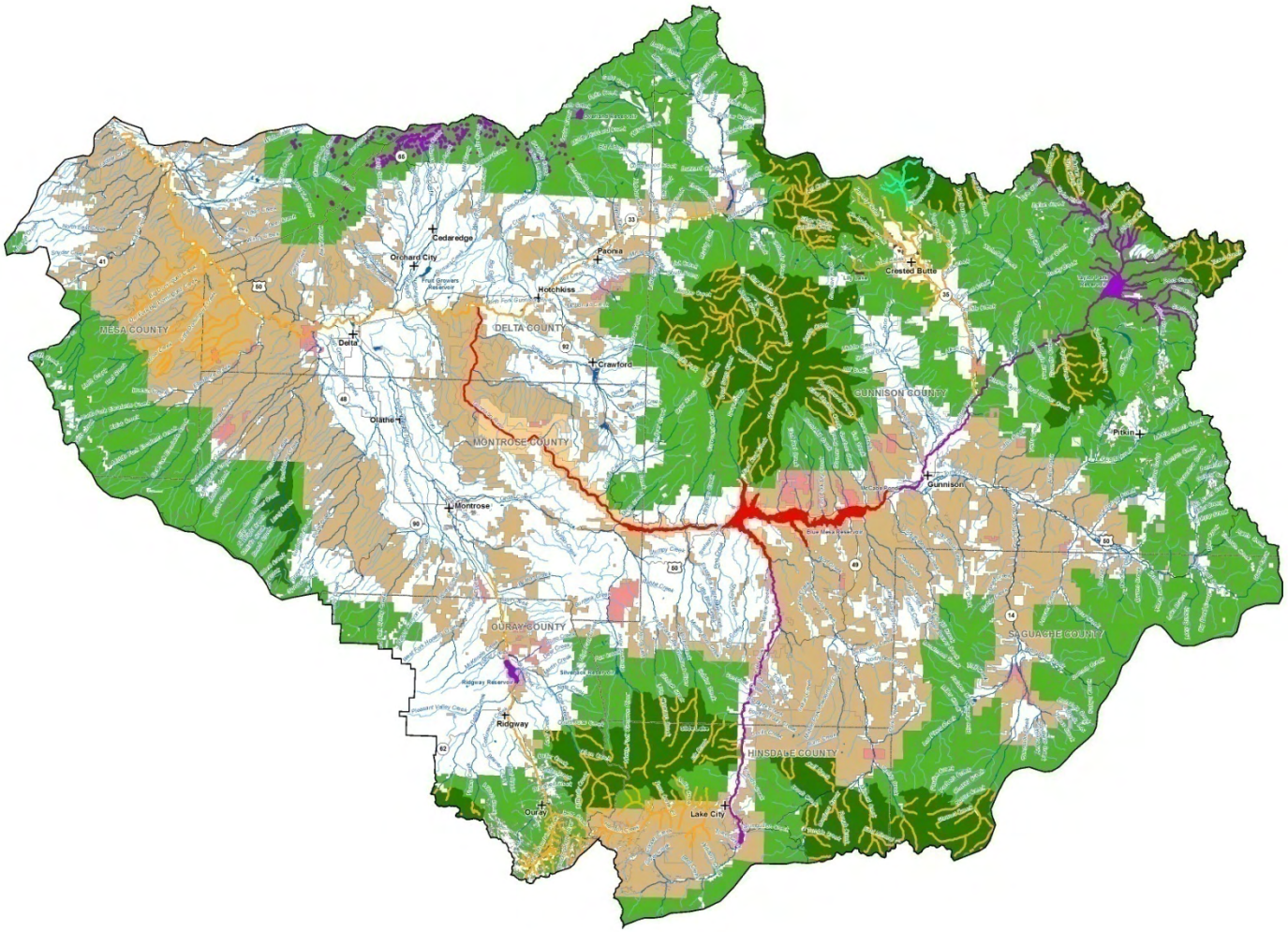

Legend

Major Environmental, Recreational and Scientific/Educational Segments

- Environmental and Recreational Segments
- Recreational Segments
- Scientific and Educational Segments
- Environmental Segments
- Roads
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary
- Wilderness Areas

Land Management

- BLM
- BOR
- CDOW
- CITY
- COUNTY
- FWS
- LAND TRUST
- NPS
- PRIVATE
- SCHOOL DISTRICT
- SLB
- STATE
- STPARKS
- USFS

N
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S

0 4 8 16 24
Miles

1 inch = 4 miles

Figure 3-7
Gunnison Basin
Nonconsumptive Needs Assessment
Major Stream and Lake Segments

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Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

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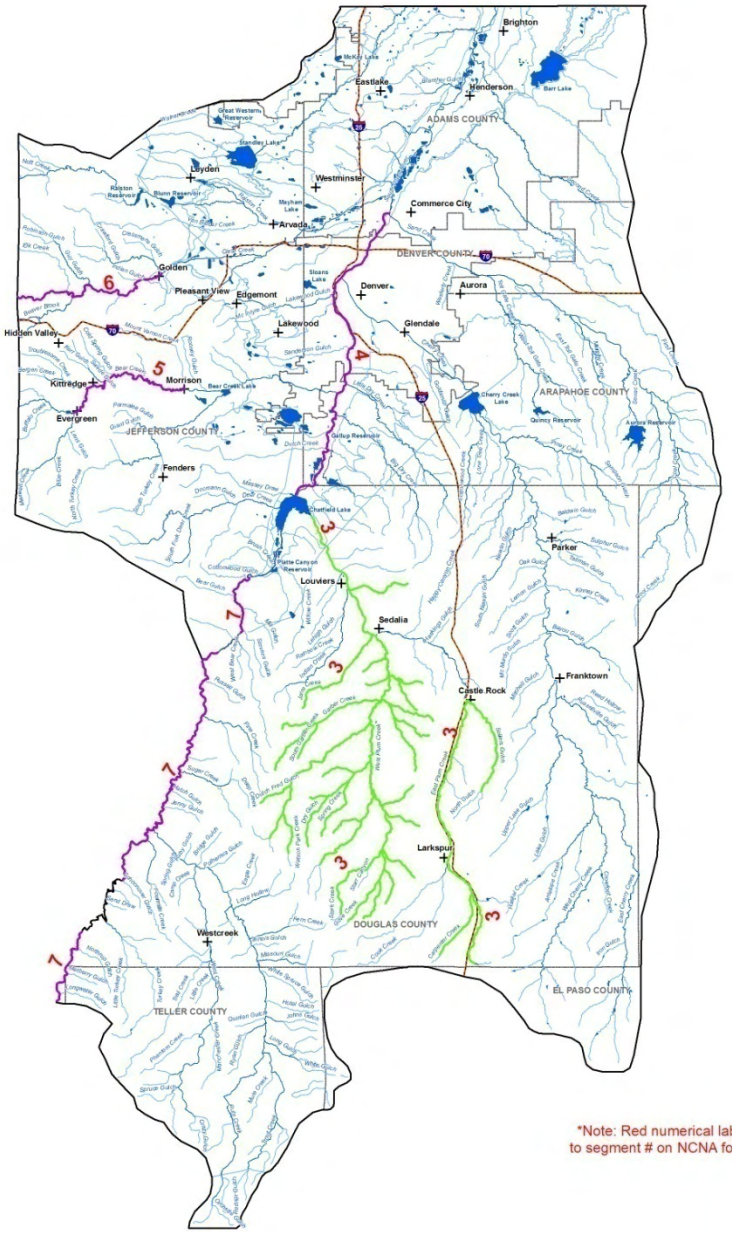

*Note: Red numerical labels correspond to segment # on NCNA focus area matrix.

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Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

Legend

Candidate Environmental and Recreational Focus Areas

- Environmental Focus Area
- Environmental and Recreational Focus Area
- Recreational Focus Area
- Highways
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary

N
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0 2.5 5 10 15

Miles

1 inch = 2.5 miles

Figure 3-9
Rio Grande Basin
Nonconsumptive Needs Assessment
Candidate Environmental and Recreational Focus Areas

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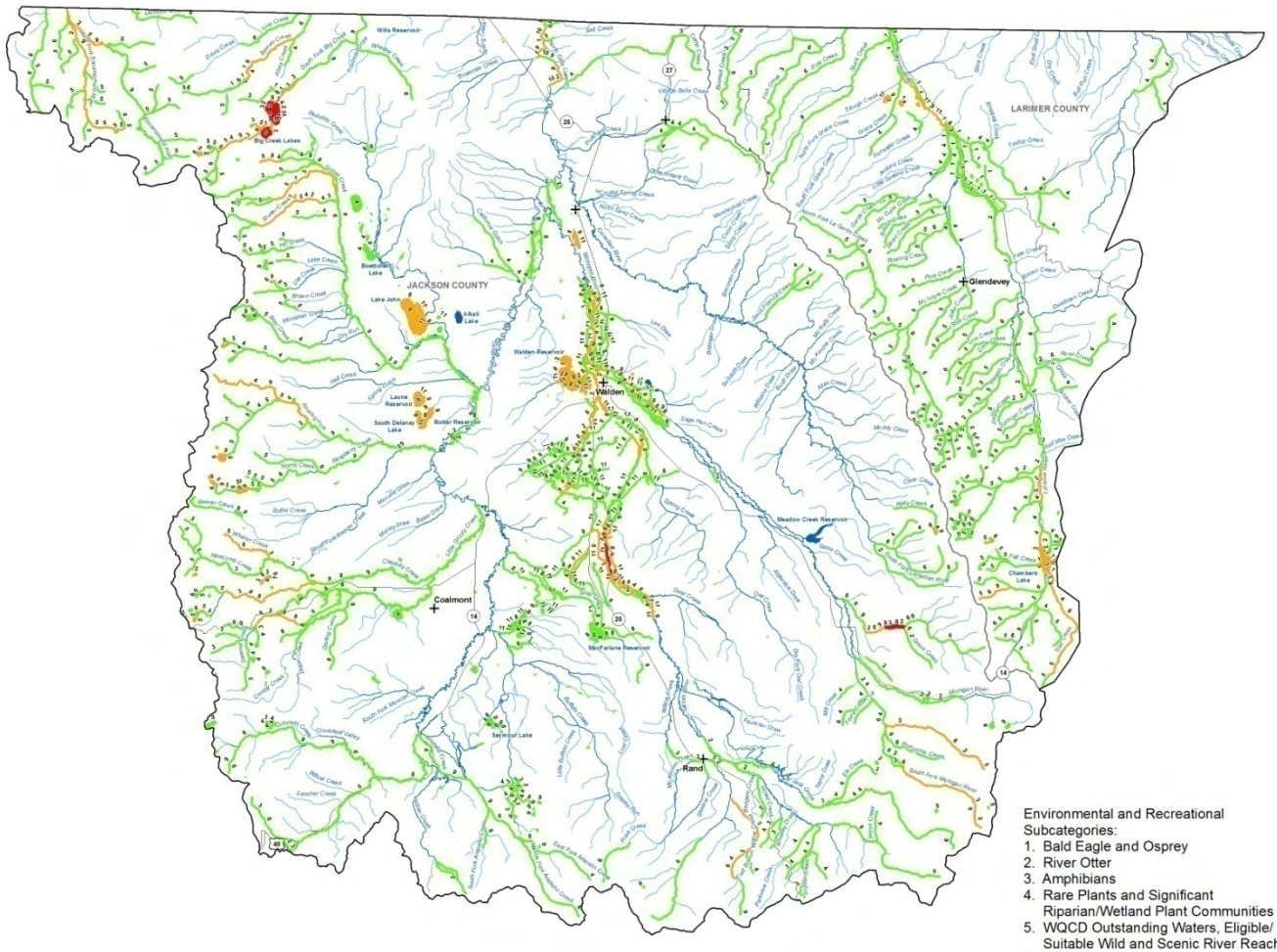

Environmental and Recreational Subcategories:

1. Bald Eagle and Osprey
2. River Otter
3. Amphibians
4. Rare Plants and Significant Riparian/Wetland Plant Communities
5. WQCD Outstanding Waters, Eligible/ Suitable Wild and Scenic River Reaches
6. CWCB Instream Flow Waters
7. Lake Chub
8. Important Waterfowl and Crane Habitat
9. Important Fishing
10. Whitewater and Floatwater Boating
11. Waterfowl Hunting and Riparian/ Wetland Wildlife Viewing

Legend

Environmental and Recreational Subcategory Count by Stream Segment

- 1 - 2
- 3 - 4
- 5; 6
- Roads
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary

N W E S

0 2 4 8 12

Miles

1 inch = 2 miles

Figure 3-5
North Platte Basin
Nonconsumptive Needs Assessment
Environmental and Recreational Subcategory Count per Stream Segment

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Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

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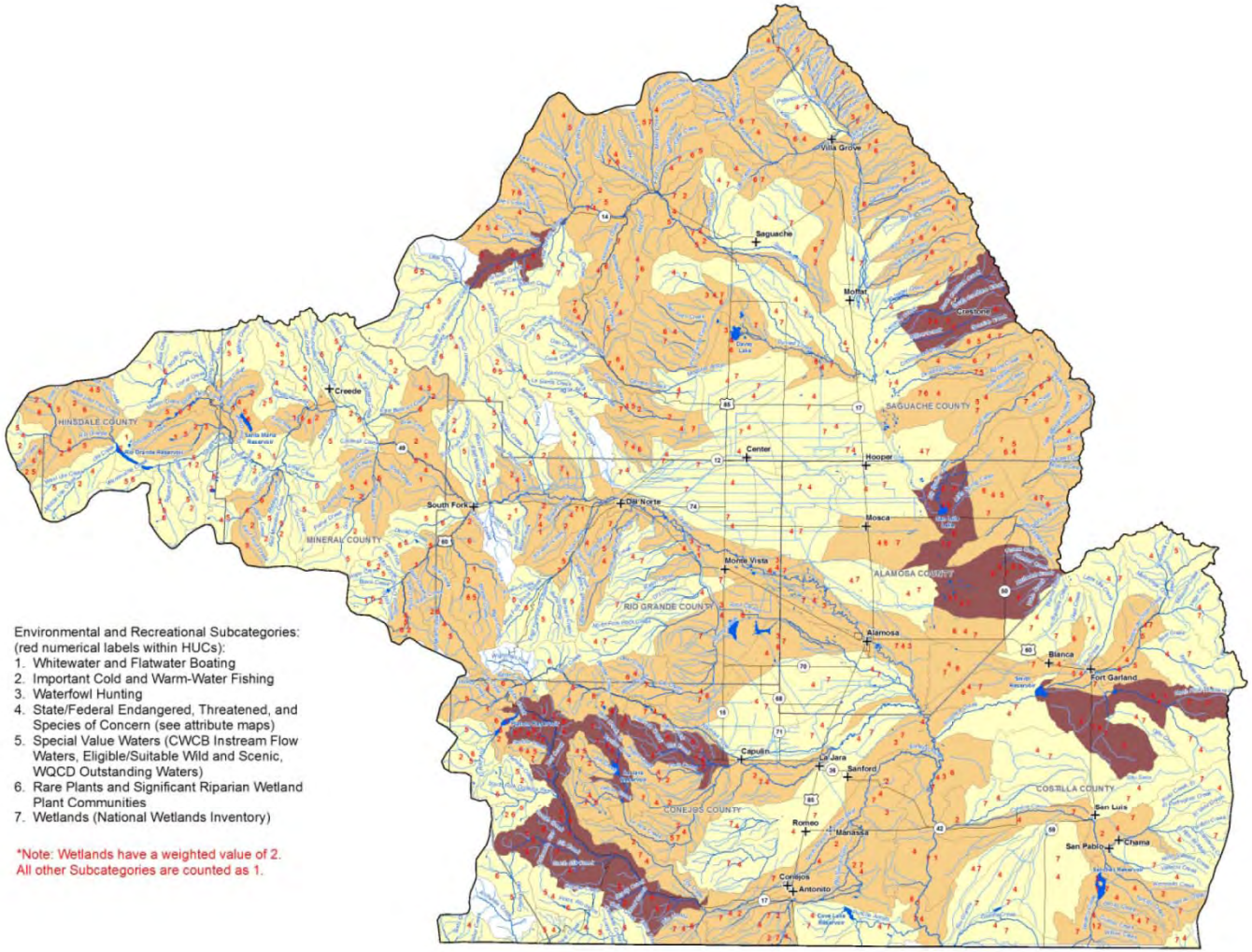

Environmental and Recreational Subcategories:
(red numerical labels within HUCs):

1. Whitewater and Flatwater Boating
2. Important Cold and Warm-Water Fishing
3. Waterfowl Hunting
4. State/Federal Endangered, Threatened, and Species of Concern (see attribute maps)
5. Special Value Waters (CWCB Instream Flow Waters, Eligible/Suitable Wild and Scenic, WQCD Outstanding Waters)
6. Rare Plants and Significant Riparian Wetland Plant Communities
7. Wetlands (National Wetlands Inventory)

*Note: Wetlands have a weighted value of 2.
All other Subcategories are counted as 1.

Legend

Weighted Environmental and Recreational Subcategory Count by HUC

- 1 - 3
- 4 - 5
- 6 - 8
- Roads
- Rivers and Streams
- Lakes and Reservoirs
- Cities and Towns
- County Boundary

N
W E
S

0 4 8 16 24
Miles

1 inch = 4 miles

Figure 3-4
Rio Grande Basin
Nonconsumptive Needs Assessment
Environmental and Recreational
Subcategory Count per 12-Digit HUC

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Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

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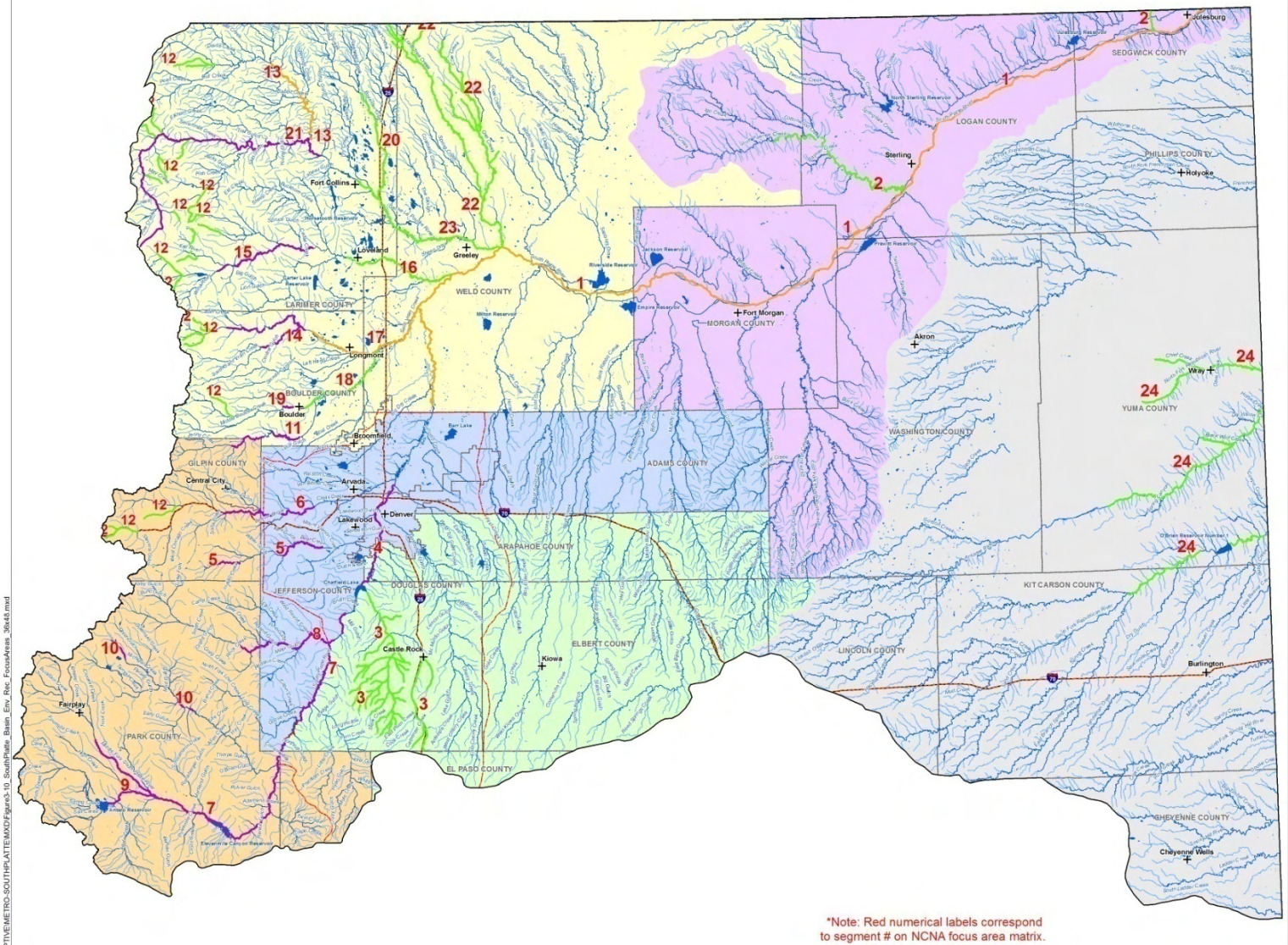

*Note: Red numerical labels correspond to segment # on NCNA focus area matrix.

Figure 3-10
South Platte Basin
Nonconsumptive Needs Assessment
Candidate Environmental and Recreational Focus Areas

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Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

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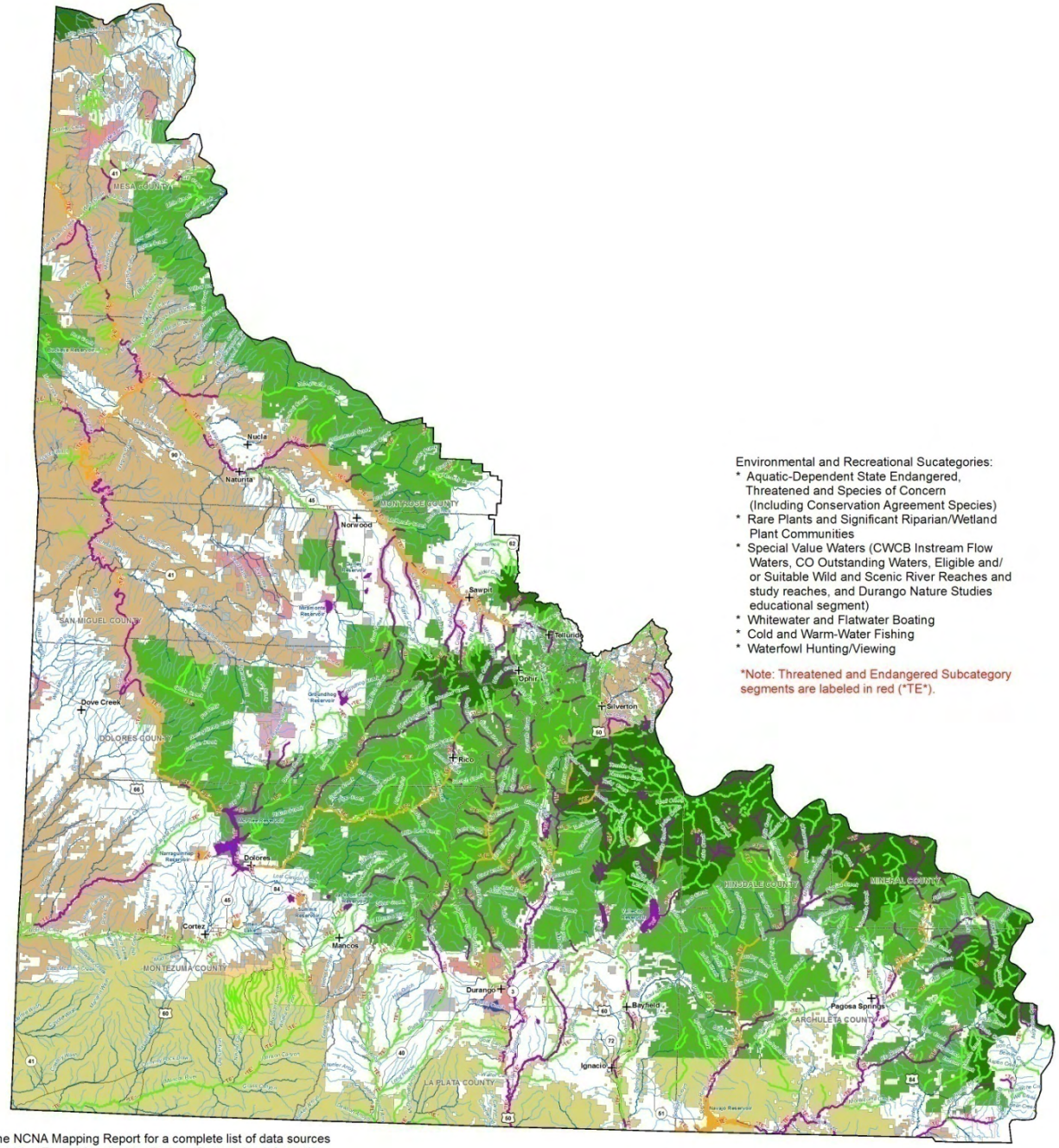


Environmental and Recreational Sucategories:

* Aquatic-Dependent State Endangered, Threatened and Species of Concern (Including Conservation Agreement Species)
* Rare Plants and Significant Riparian/Wetland Plant Communities
* Special Value Waters (CWCB Instream Flow Waters, CO Outstanding Waters, Eligible and/or Suitable Wild and Scenic River Reaches and study reaches, and Durango Nature Studies educational segment)
* Whitewater and Flatwater Boating
* Cold and Warm-Water Fishing
* Waterfowl Hunting/Viewing

*Note: Threatened and Endangered Subcategory segments are labeled in red (*TE*).

Legend

Environmental and Recreational Subcategory Count by Stream Segment

- 1
- 2 - 3
- 4 - 6
- Roads
- Rivers and Streams
- Cities and Towns
- County Boundary
- Wilderness Areas

Land Management

- BLM
- BOR
- CDOW
- CITY
- COUNTY
- FWS
- LAND TRUST
- NPS
- PRIVATE
- SCHOOL DISTRICT
- SLB
- STATE
- STPARKS
- TRIBE
- USFS

N
W E
S

0 4.5 9 18 27
Miles

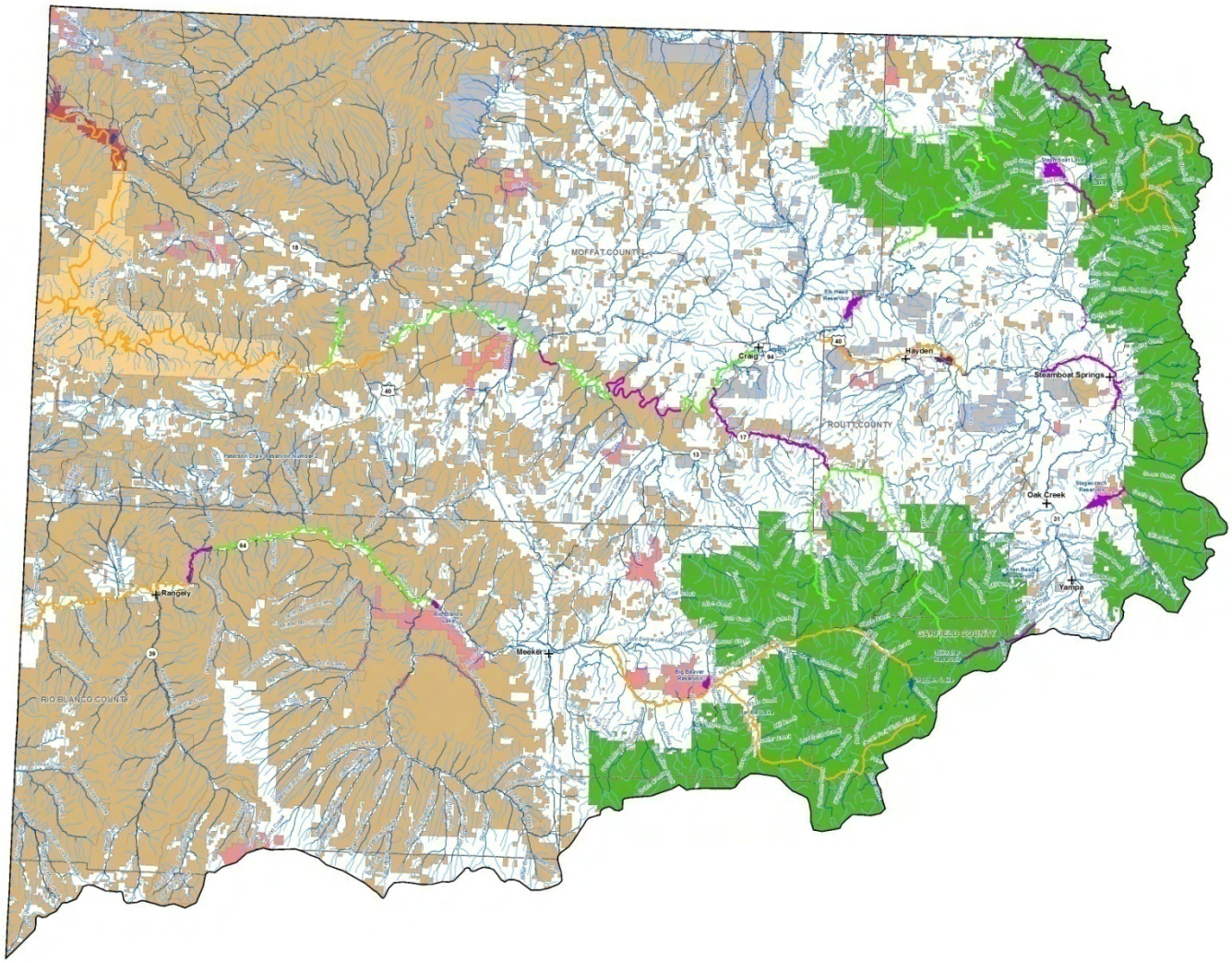
1 inch = 4.5 miles

Figure 3-6
Southwest Basin
Nonconsumptive Needs Assessment
Environmental and Recreational Subcategory Count per Stream Segment

DRAFT

Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

Document: G:\GIS\NONCONSUMPTIVE\SOUTHWEST\MXD\Figure3-6_Southwest_Basin_Env_Rec_byStreamSegment_36x46.mxd



Legend

Major Environmental and Recreational Segments

- Environmental Segments
- Environmental and Recreational Segments
- Recreational Segments
- Roads
- Rivers and Streams
- Lakes and Reservoirs
- County Boundary

Land Management

- BLM
- BOR
- CDOW
- CITY
- COUNTY
- FWS
- LAND TRUST
- NPS
- PRIVATE
- SCHOOL DISTRICT
- SLB
- STATE
- STPARKS
- USFS

N
W E
S

0 4 8 16 24
Miles

1 inch = 4 miles

Figure 3-8
Yampa/White Basin
Nonconsumptive Needs Assessment
Major Environmental and Recreational Segments

DRAFT

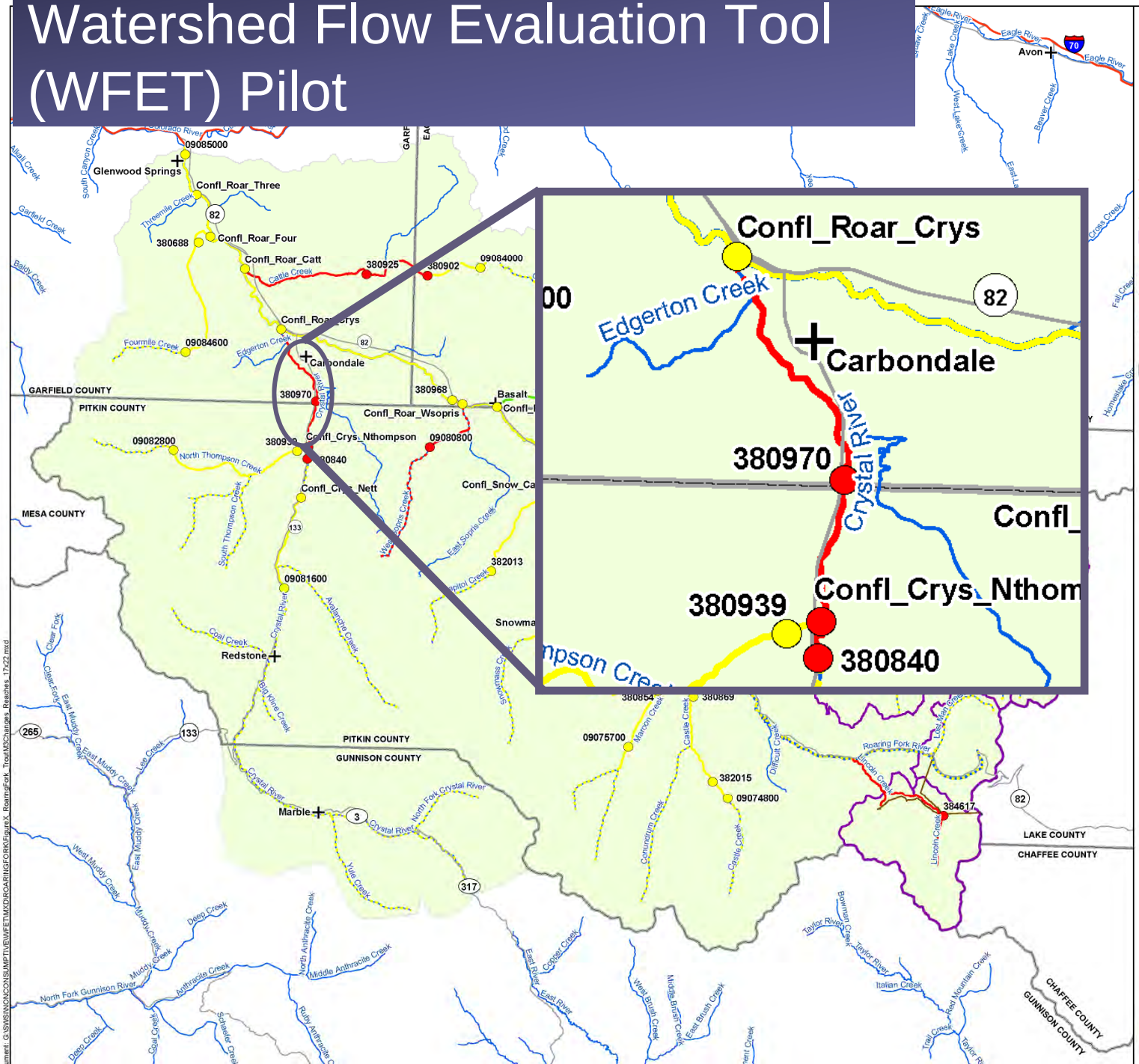
Refer to Appendix B of the NCNA Mapping Report for a complete list of data sources and Appendix D of the Mapping Report for other basin-specific mapping information.

Document: G:\GIS\NONCONSUMPTIVE\YAMPA-WHITE\MXD\Figure3-8_YampaWhite_Basin_Env_Rec_MajorSegments_36x48.mxd

Results/Conclusions

- Methodologies differed based on basin-specific needs
- Mapping provides framework for focus areas 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

Watershed Flow Evaluation Tool (WFET) Pilot



WFET Pilot Findings and Next Steps

- WFET provides a watershed scale, science-based perspective on ecological risks throughout drainage networks where site-specific studies are sparse or lacking
- Flow-ecology relationships derived for several key environmental and recreational attributes across the state
- 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 is best utilized in areas with detailed hydrologic data or models

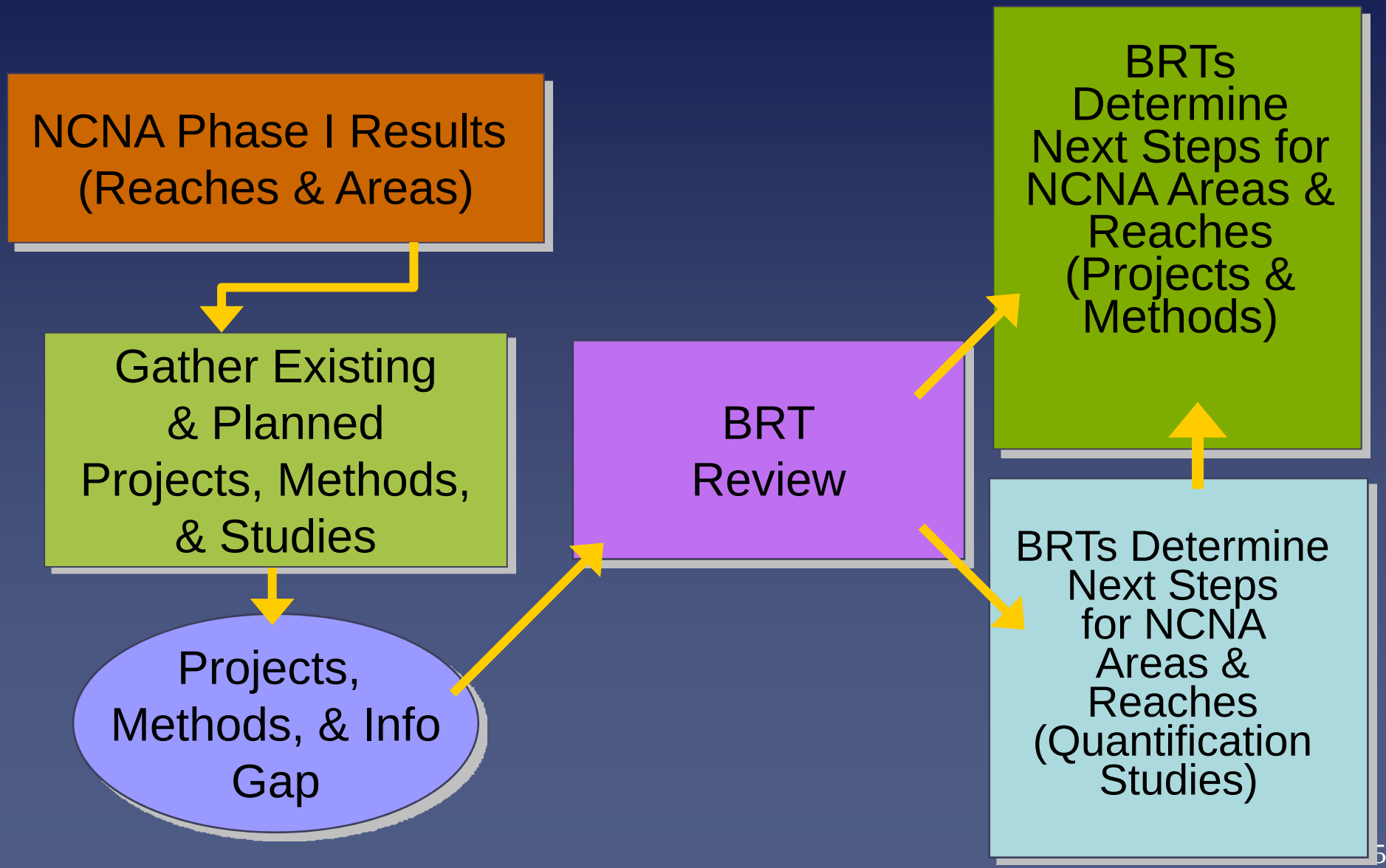
WFET Pilot Findings and Next Steps

- WFET not intended to set flow prescriptions or rules for flow needs to the level of that detailed that would be required for NEPA analysis
- WSRA Grants for Colorado and Yampa Basins
- Refinement of flow-ecology relationship for riparian areas
- Refinement of recreational relationships from pilot
- Further validation and calibration needed as part of future application

CWCB NCNA Next Steps

- 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 NCNA Methodology Detail



Report Out from Breakout Groups

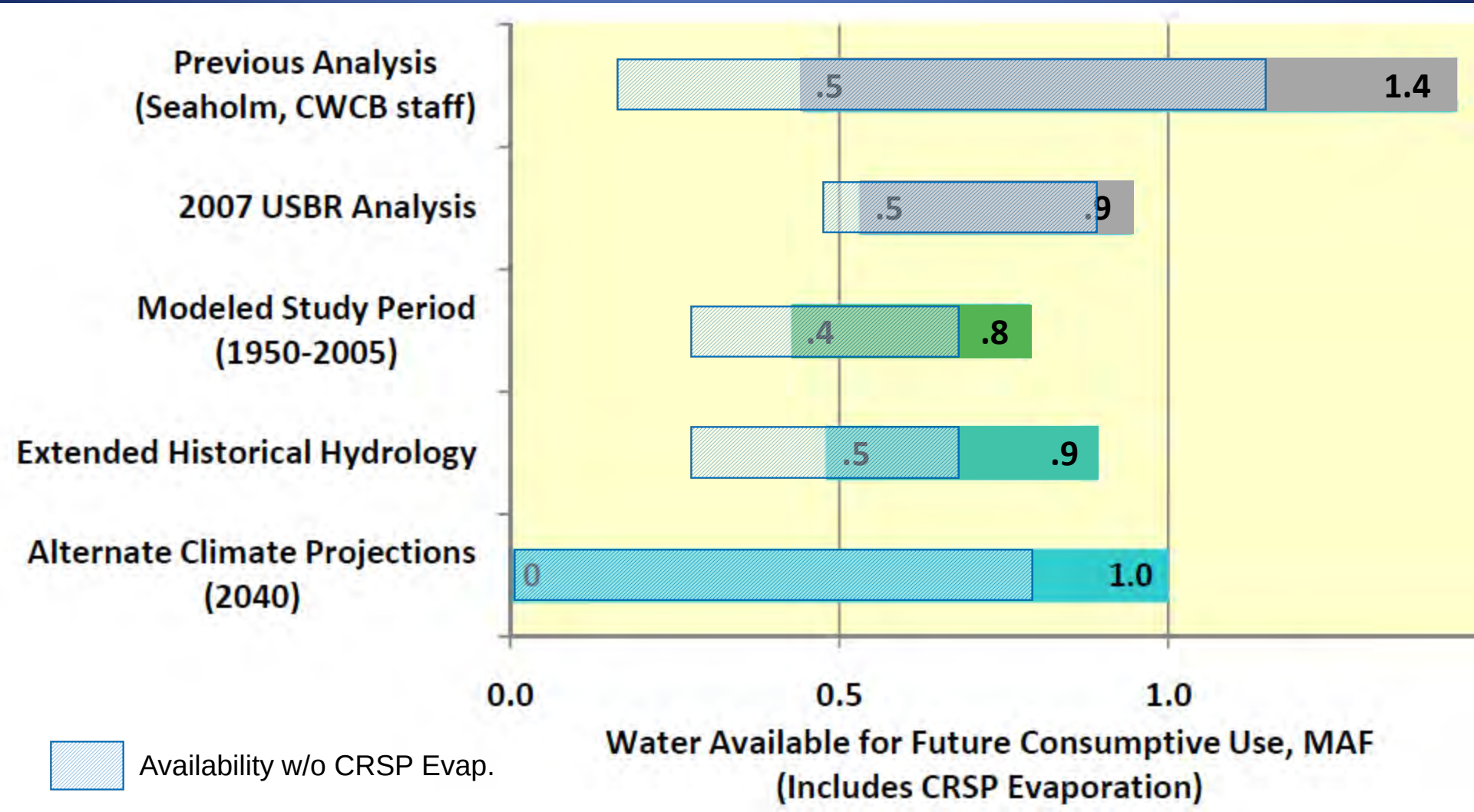
Portfolios for Mid-Demand/Low-Supply and Mid-Demand/High-Supply

CRWAS Options for Statewide Planning

for discussion purposes

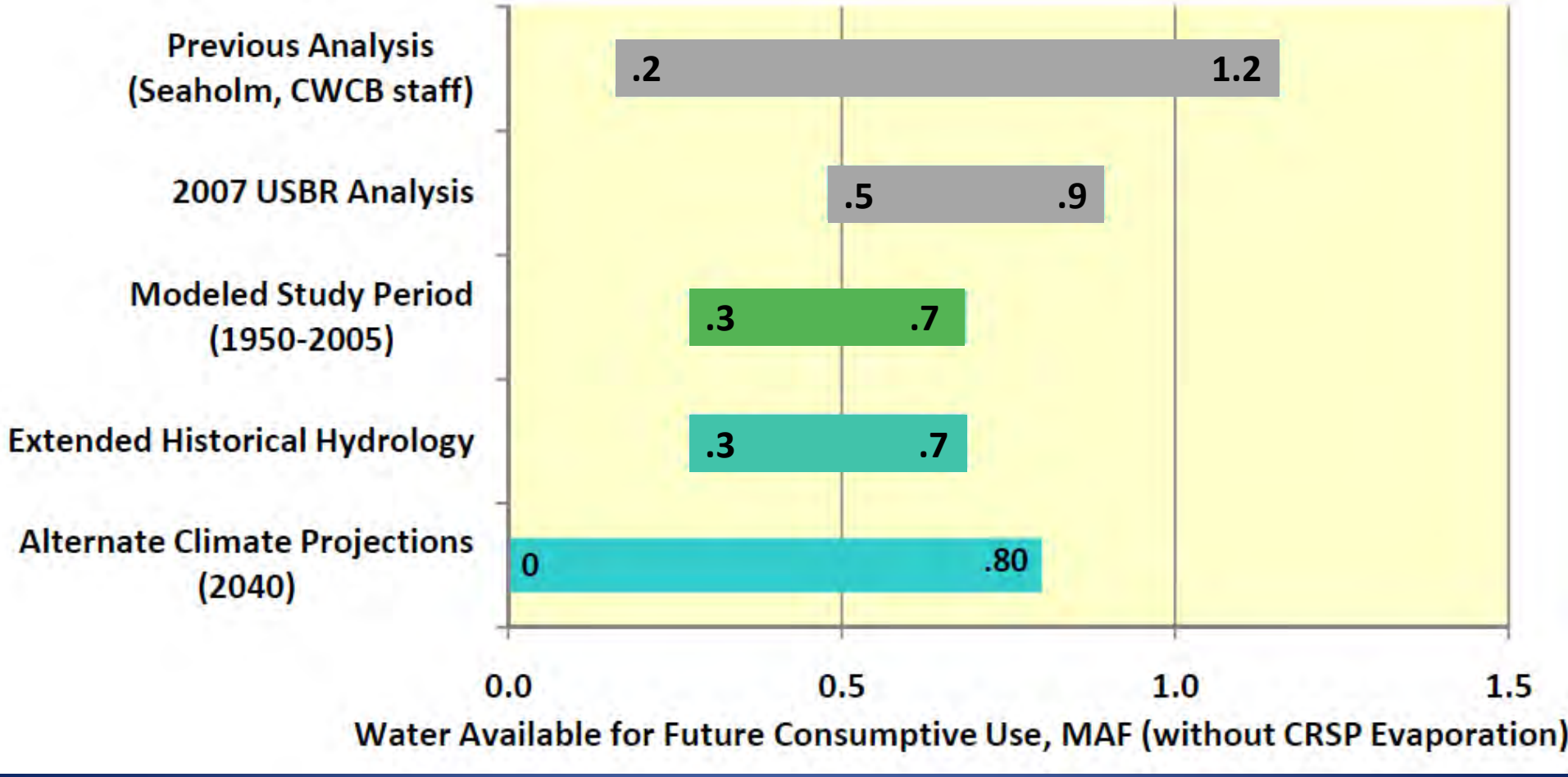
Colorado Water Availability for Future Consumptive Use

(with CRSP evaporation)

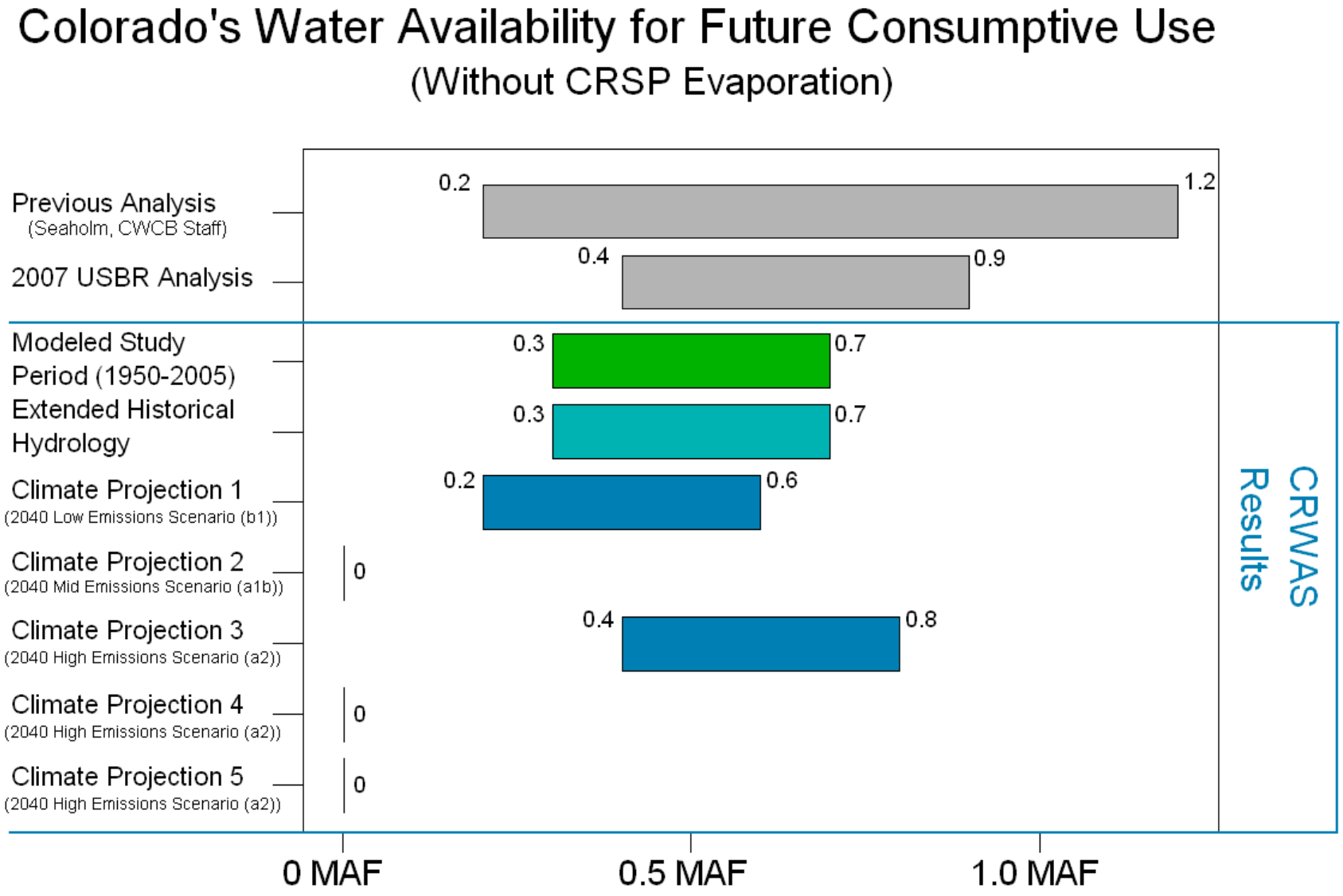


Colorado Water Availability for Future Consumptive Use

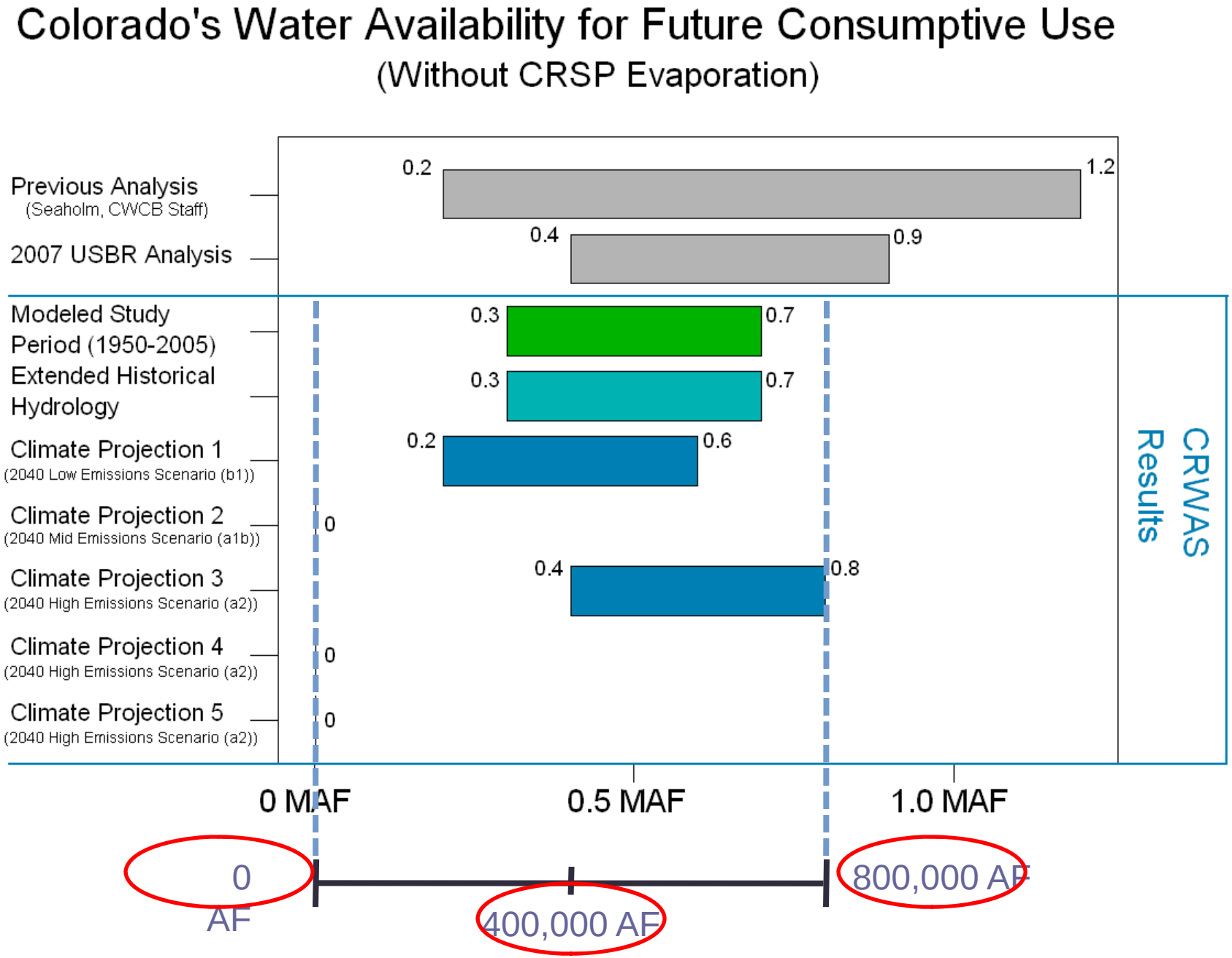
(without CRSP evaporation)



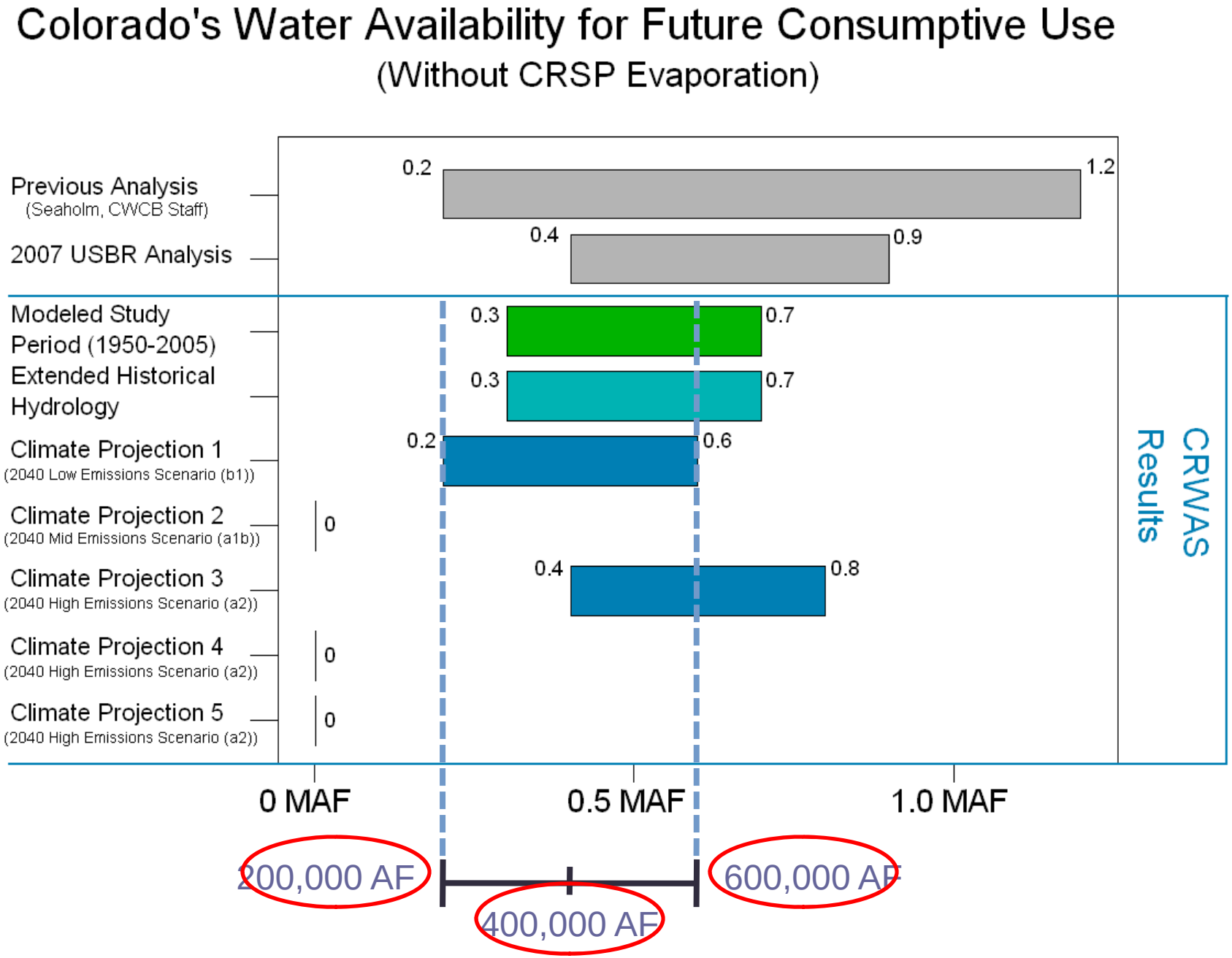
Results Summary



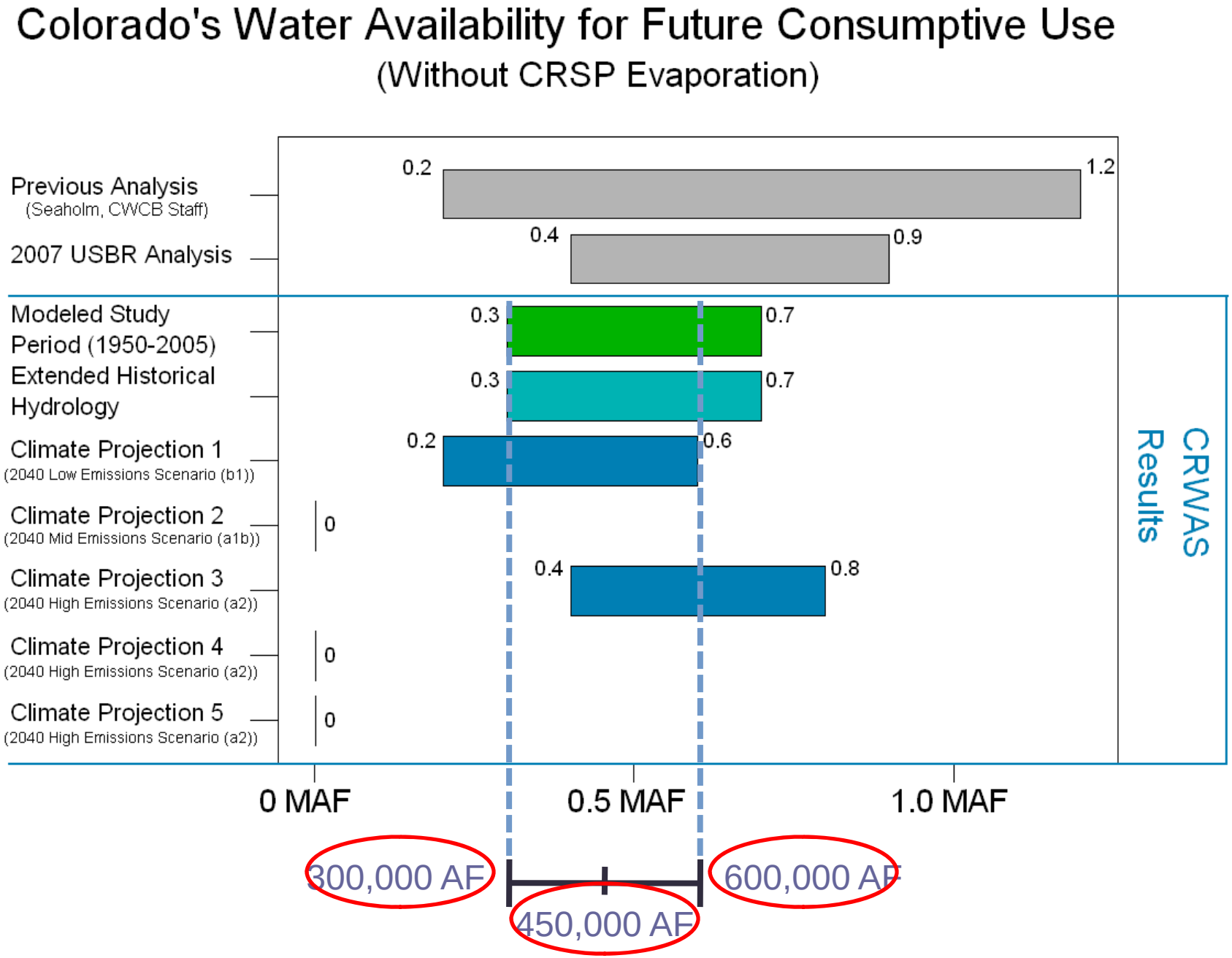
Option 1: Full Range Approach



Option 2: Midpoint / Average Approach



Option 3: Overlap Approach



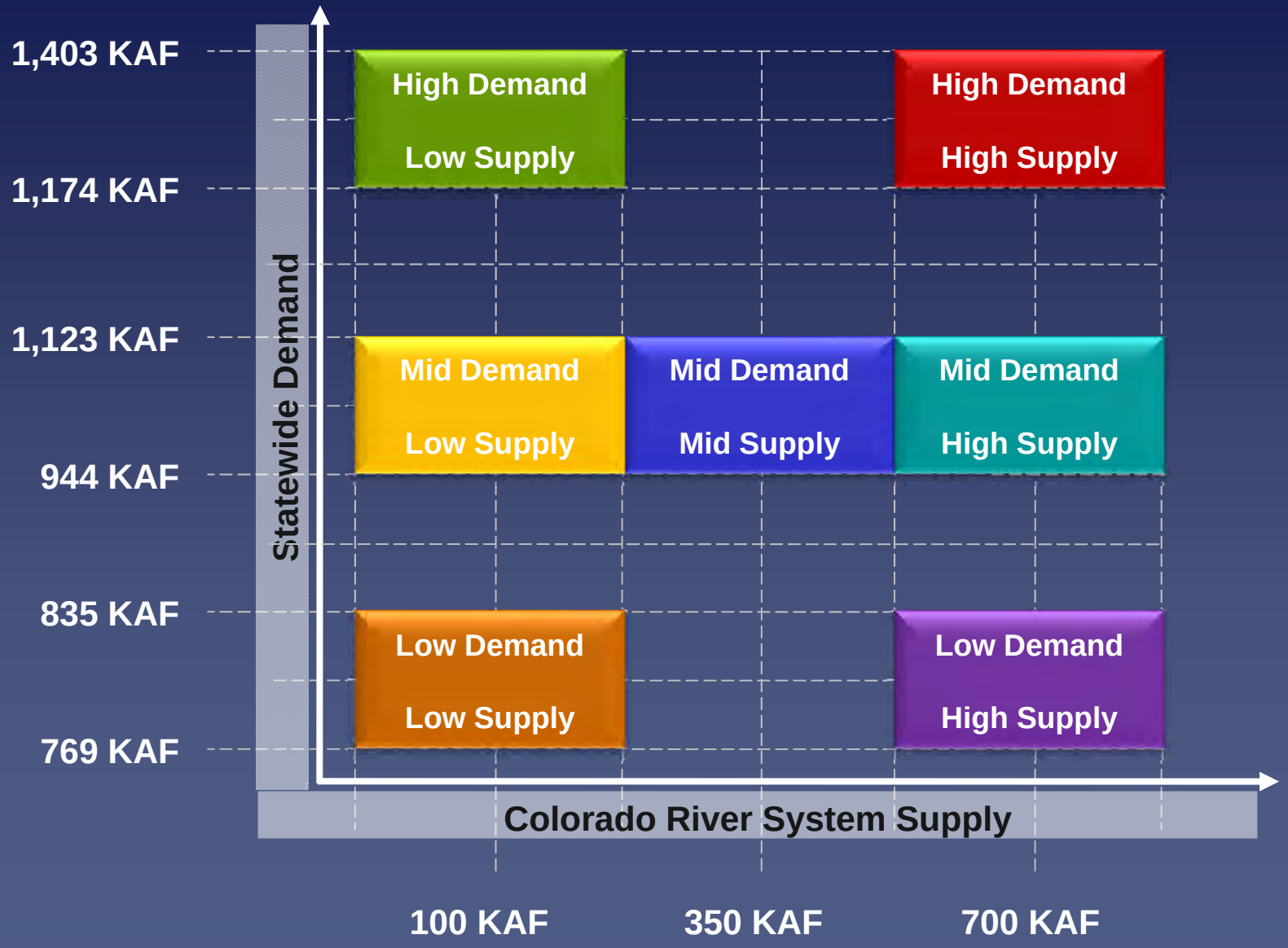
Combined Approach

- Define the mid-range as the overlap area.
- Define the low-range as anything below the mid-range and the high range as anything above the mid-range.
- Take the midpoints of each range as a starting point.
- Conduct a sensitivity analysis to determine how representative the midpoint is and the affect of the extremes of each range on the trade-offs.

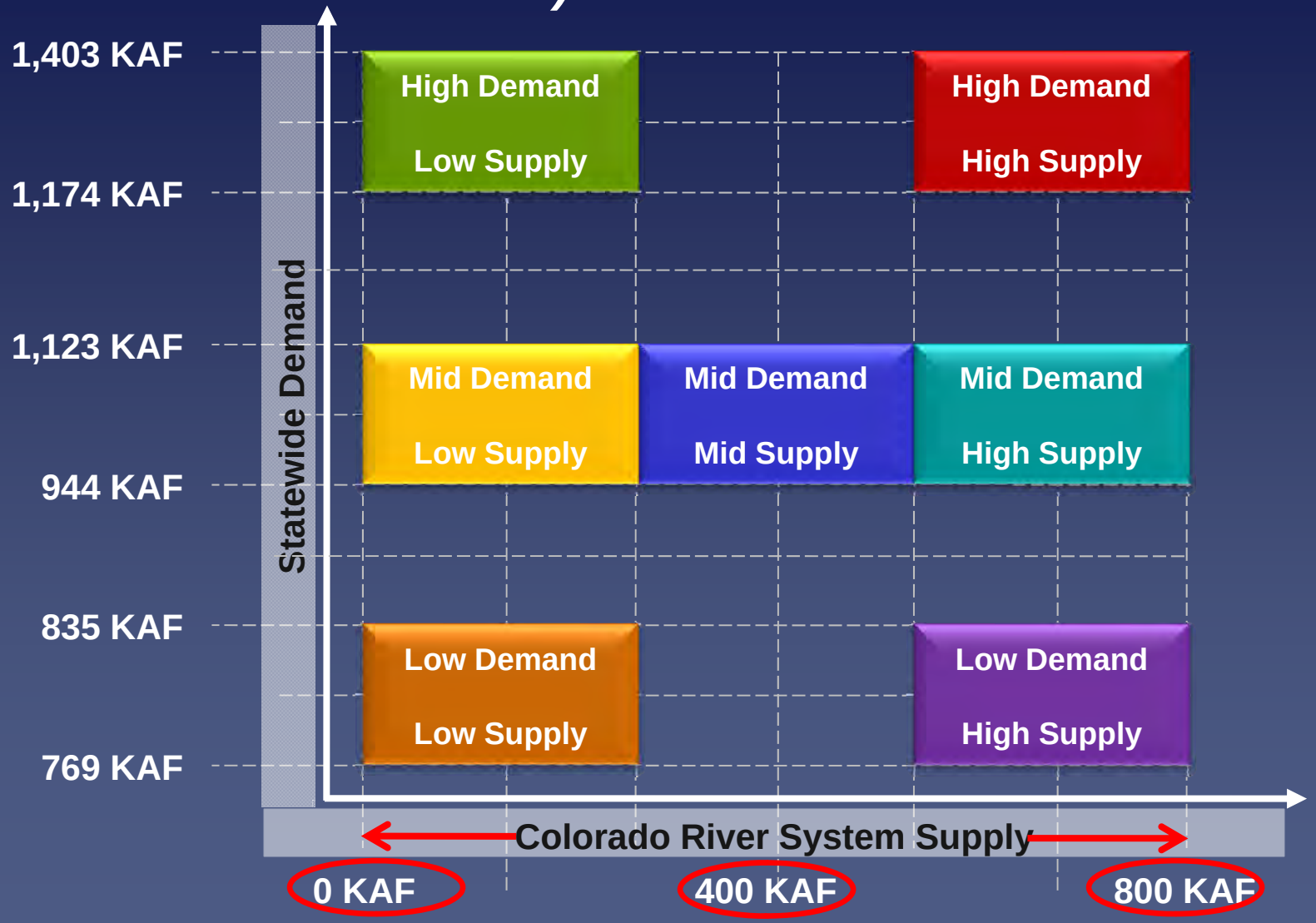
Assumptions

- IPP – same as mid-demand/mid-supply portfolio
- Conservation – same as mid-demand/mid-supply portfolio
- New Supply – varies from 0, 200, 400, 600 and 800 KAF/year
- Ag Transfer – Remaining East Slope M&I Demands will be met through ag transfers
- Reuse – same as mid-demand/mid-supply portfolio

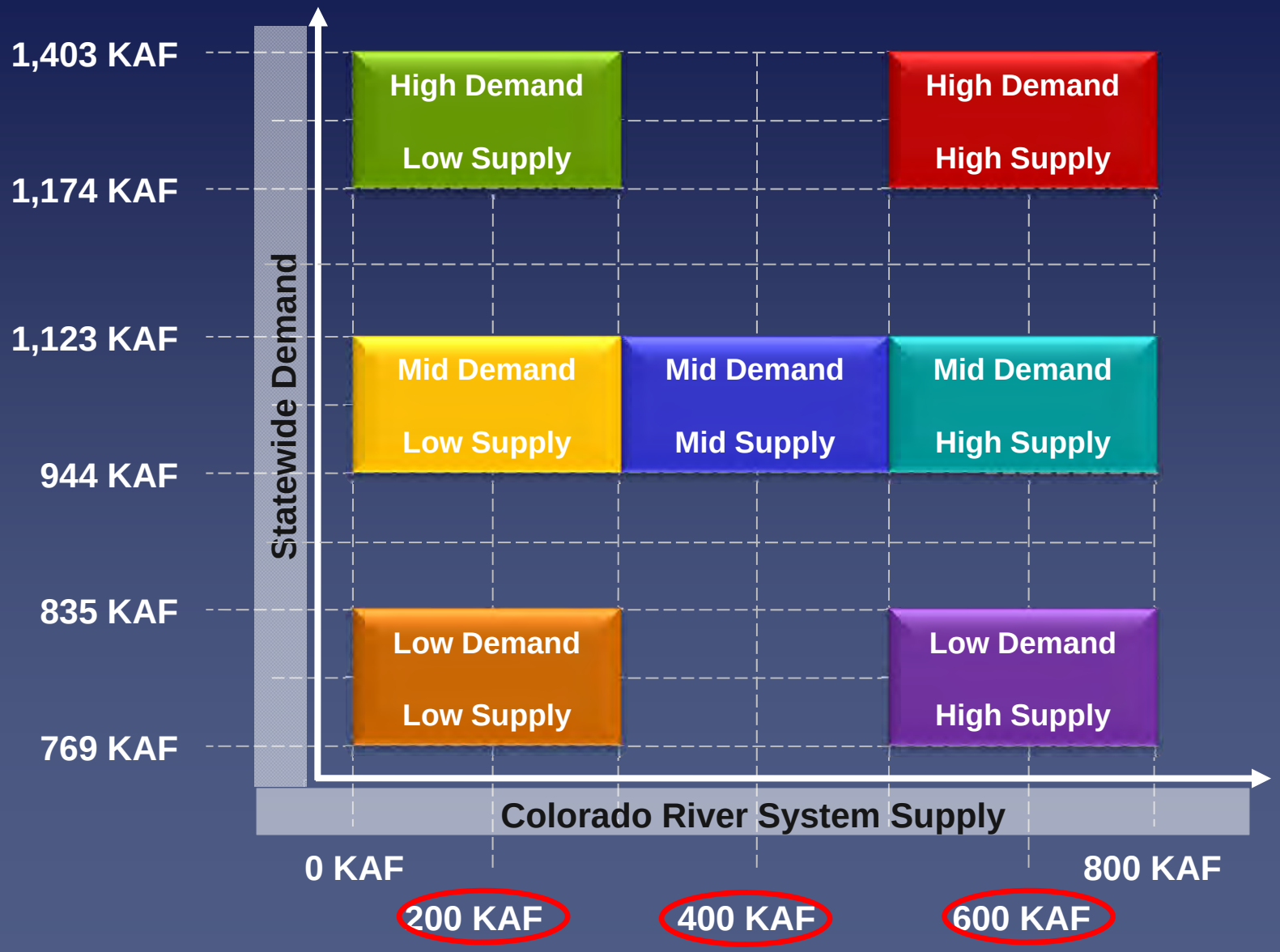
Current Planning Range (100 KAF to 700 KAF)



Option 1: Full Range Approach (0 KAF to 800 KAF)



Option 2: Average Approach (200 KAF to 600 KAF)



Option 3 Overlap Approach (300 KAF to 600 KAF)