STATE OF COLORADO

Colorado Water Conservation Board
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TO: Colorado Water Conservation Board Members

FROM: Eric Hecox
Intrastate Water Management & Development

DATE: September 15, 2009

SUBJECT: **Agenda Item 10, September 15-16, 2009 Board Meeting**
Colorado Water Supply Future Draft Reports

Staff Recommendation
This is an *information* item and Board action is not required.

Background
One of CWCB's roles in the Interbasin Compact Process is to support the on-going implementation of the Water for the 21st Century Act. In this capacity the CWCB Staff was asked to work with the Board, the Interbasin Compact Committee (IBCC), and the Basin Roundtables on several technical analyses.

Staff completed the following draft reports:

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

During this agenda item, staff will present the result and major findings of these draft reports. These draft reports are being circulated to the IBCC Members, Basin Roundtables members and other interested stakeholders. CWCB will be taking comments, input, and feedback for several months. The purpose of this presentation is to ensure each Director has the information necessary to help them solicit feedback from their basin.

Colorado's Water Supply Future

CWCB Board Meeting

Steamboat, CO

September 15, 2009

1

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/

2

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.

3

Objective Moving Forward – Build Portfolios

- Identify different mixes or "portfolios" of Conservation, Ag Transfer, and New Supply Development to meet water supply needs
- Parts of these portfolios will serve as inputs to the Colorado River Water Availability Study (CRWAS) Phase II
- Results of CRWAS Phase I will inform the portfolios

4

M&I Demands to 2050

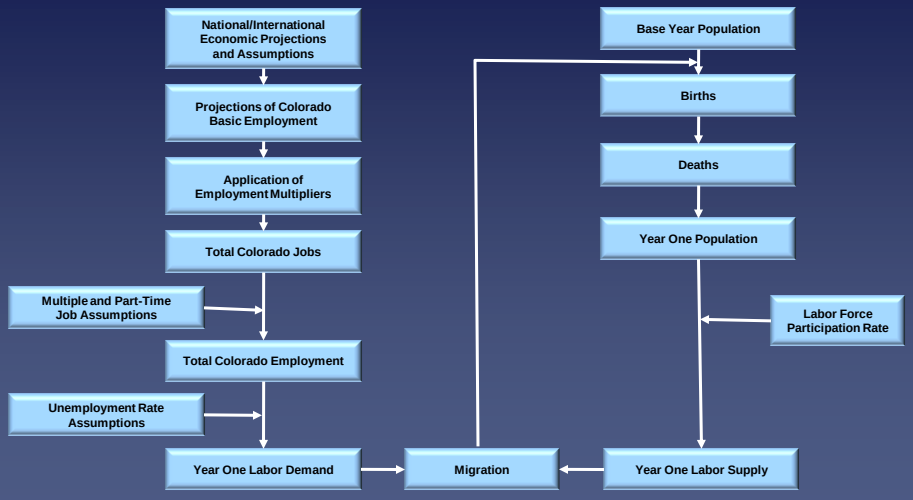
5

Overview – M&I Water Demands to 2050

- Population
  - 2035 population projection from Colorado State Demographer's Office (SDO)
  - 2050 population project using SDO's methodology
- Demands
  - Updating Statewide Water Supply Initiative (SWSI) gallon per capita per day (gpcd) values
  - Projecting water demands at 2035 and 2050

6

Population Projection Methodology – Center for Business and Economic Forecasting (CBEF) and SDO's Model



Note: CBEF uses employment commuting pattern assumptions and historical growth capture rates to allocate job growth from the state to regions and counties.

7

Colorado's Basic Employment Sectors

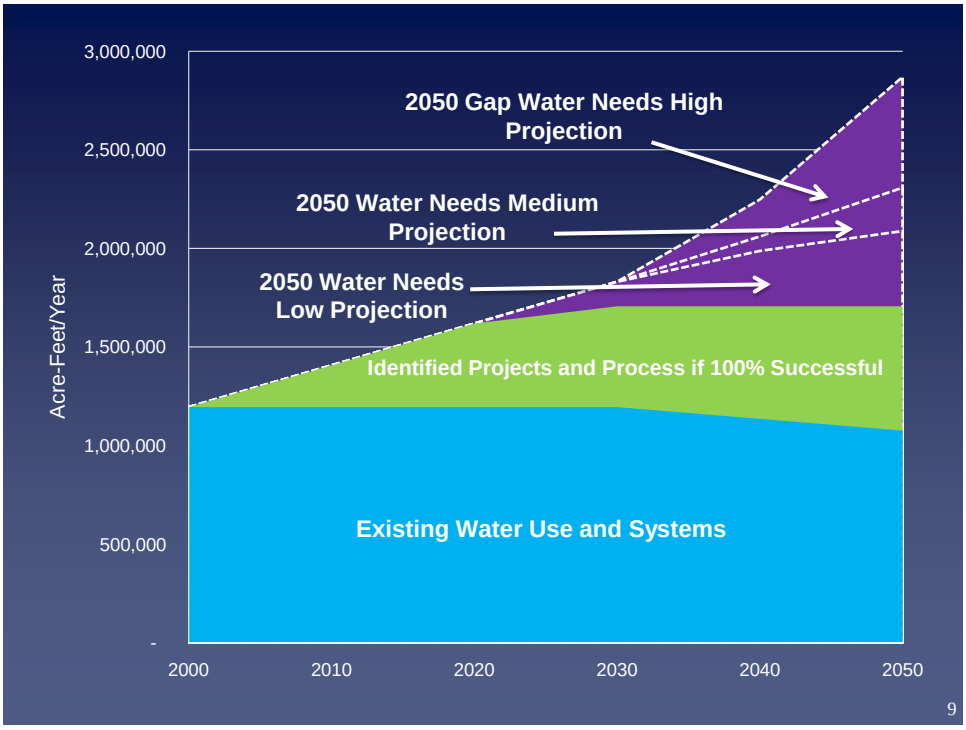
Traditional Basic Sectors

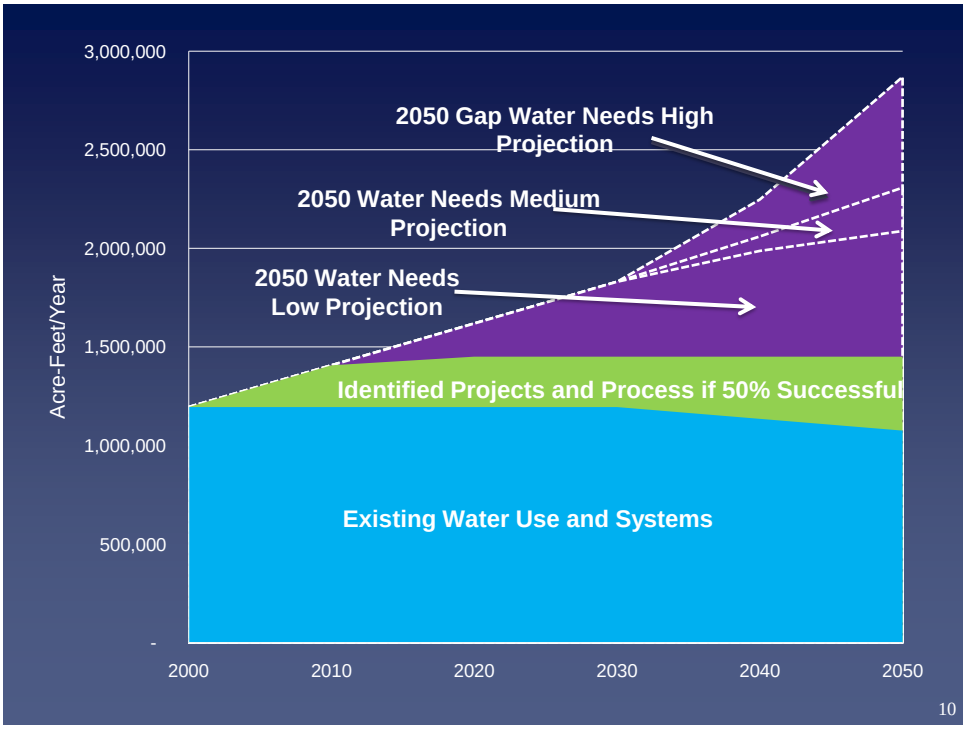
- Agriculture
- Government
- Mining
- Manufacturing
- Regional and National Services
- Tourism

Household Basic Sectors

- Retirees
- Wealth & Income
- Public Assistance
- Commuting/Employment

8


3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
-
Acre-Feet/Year
2050 Gap Water Needs High Projection
2050 Water Needs Medium Projection
2050 Water Needs Low Projection
Identified Projects and Process if 100% Successful
Existing Water Use and Systems
2000
2010
2020
2030
2040
2050
9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Acre-Feet/Year
2050 Gap Water Needs High Projection
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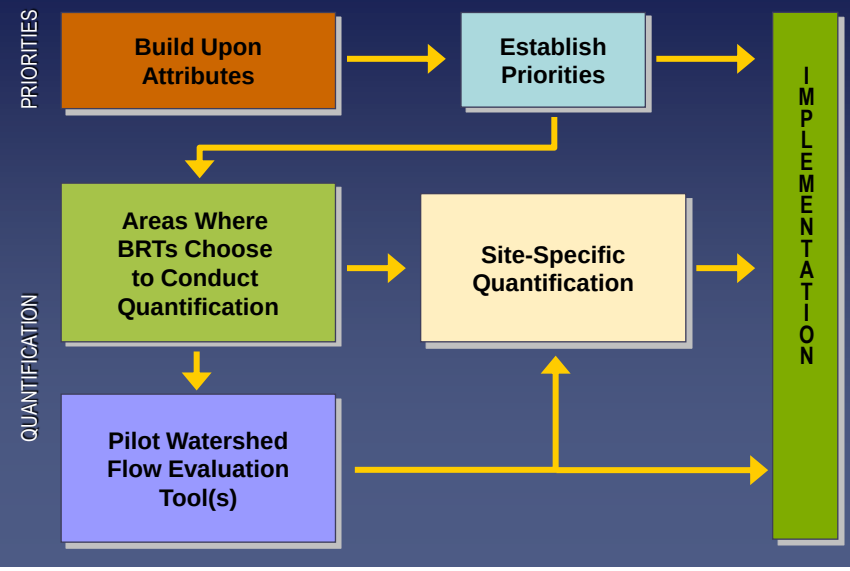
2050 Water Needs Low Projection
Identified Projects and Process if 50% Successful
Existing Water Use and Systems
2000
2010
2020
2030
2040
2050
10

Nonconsumptive Needs Assessment Overview

11

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

13

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.

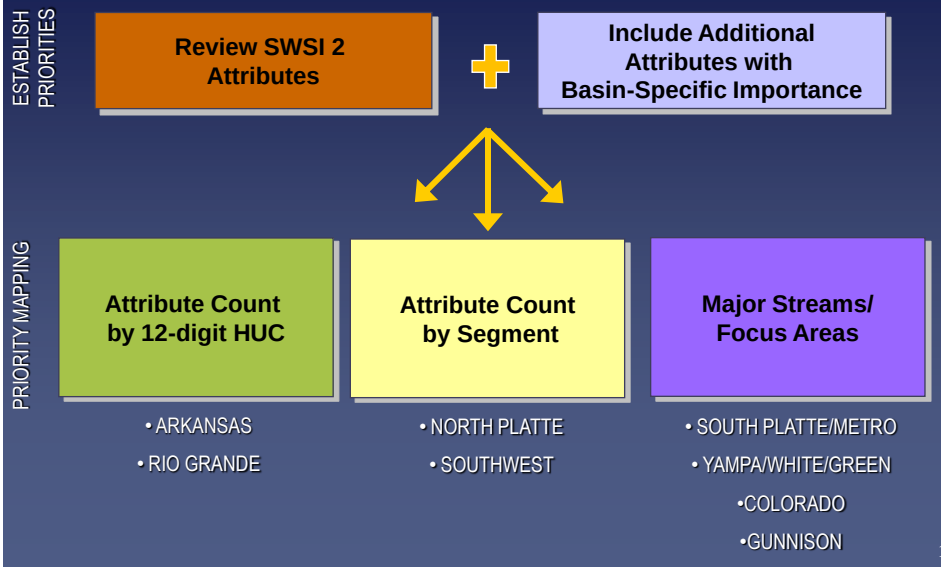
14

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:** Approved, WSRA projects
- **Southwest Basin:** Approved
- **Yampa/White Basin:** Approved, WSRA quantification

15

Priorities Mapping Methodology –



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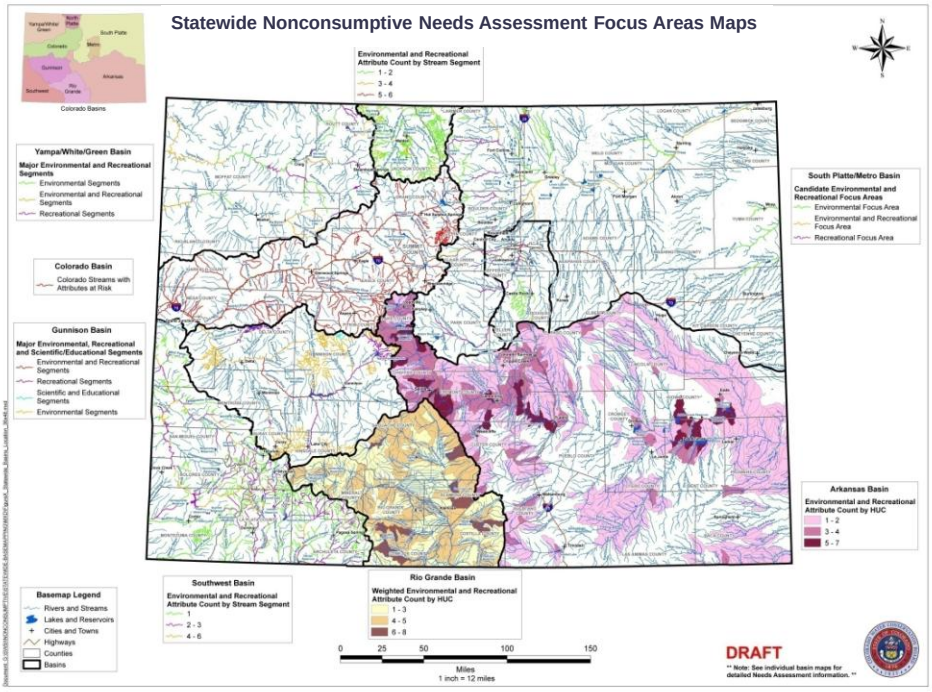


Results/Conclusions

- 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

18

Where Do We Go From Here?

- 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

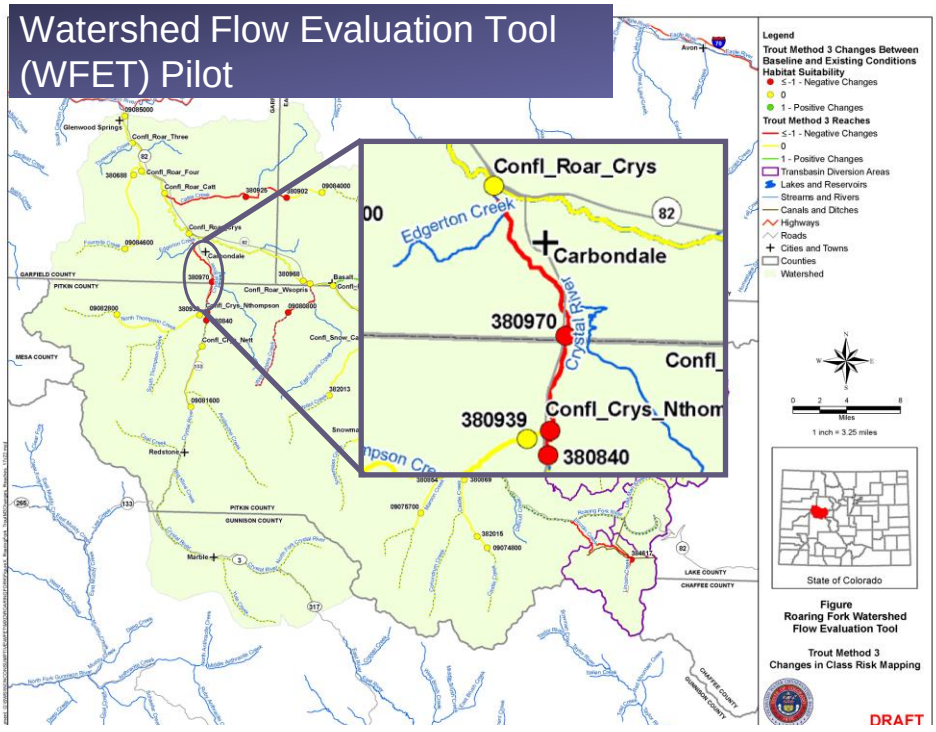
19

Nonconsumptive Projects and Methods

- CWCB will conduct literature search:
  - Existing studies and plans by "ISF recommending entities"
  - Watershed restoration plans and flood DSS for identified restoration projects
  - Other relevant restoration and quantification studies, plans and processes
  - Other WSRA funded studies or Basin Roundtable Studies
- Information will be summarized by focus area
- Results will be included in statewide update of consumptive and nonconsumptive needs

20

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

22

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

23

Water Supply Strategies

24

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

25

Conservation Strategy

26

Conservation Strategy

- Conservation Section's Efforts
- Linking land use planning and water supply planning
  - WSWC Symposium September 28-30, 2009

27

Overview of Agricultural Transfer Strategy and New Supply Development Strategy

28

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

29

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

30

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

31

Water Supply Concepts

- Two Lower South Platte concepts 100,000 to 250,000 acre-ft
- Two Lower Arkansas concepts 100,000 to 250,000 acre-ft
- 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

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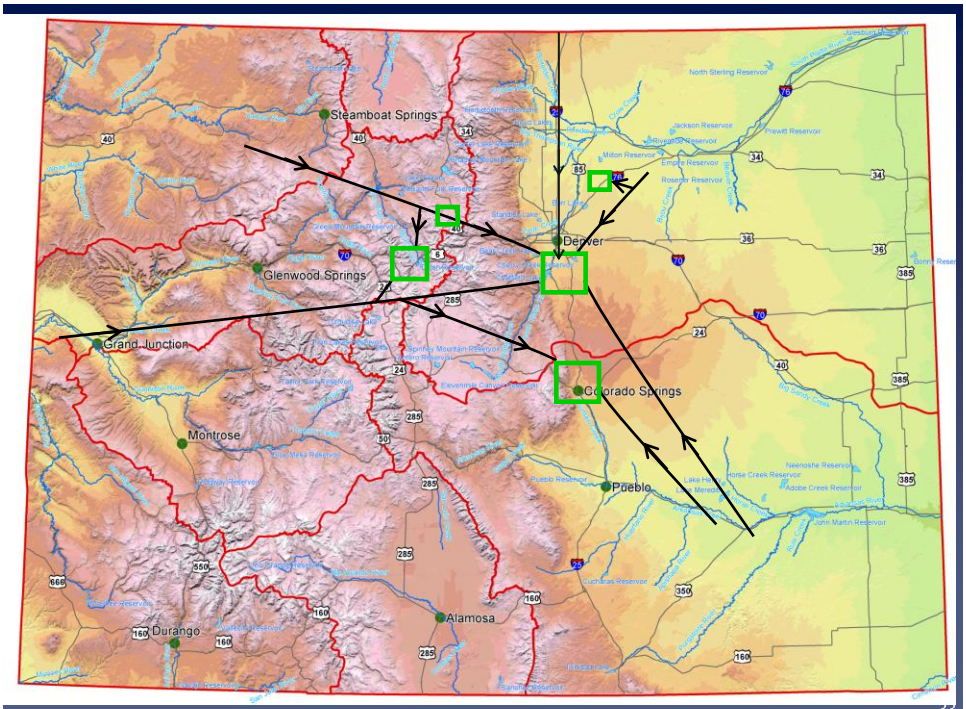

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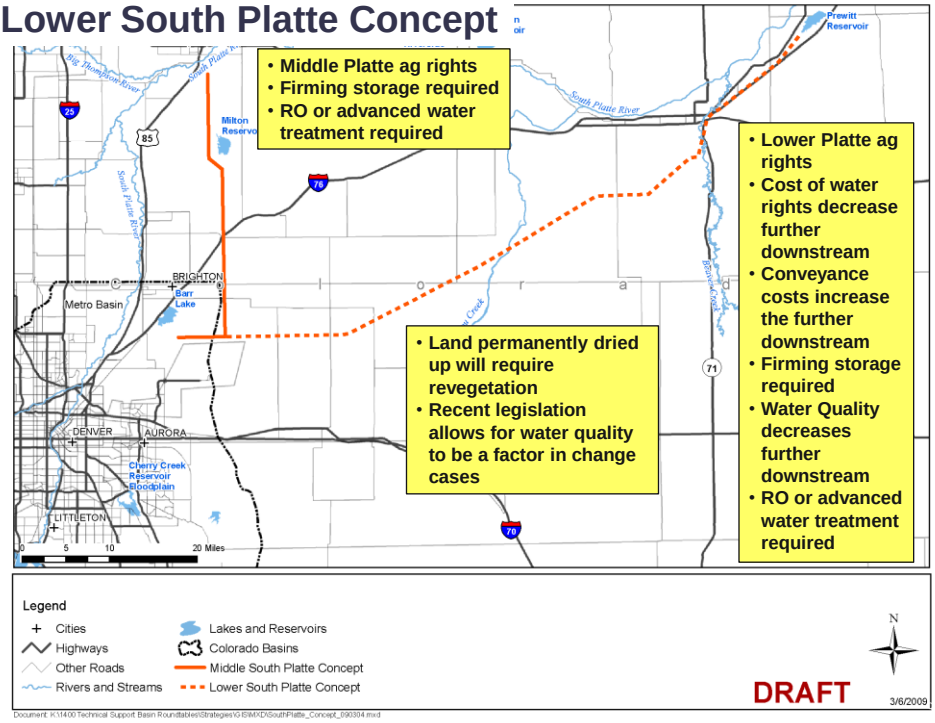
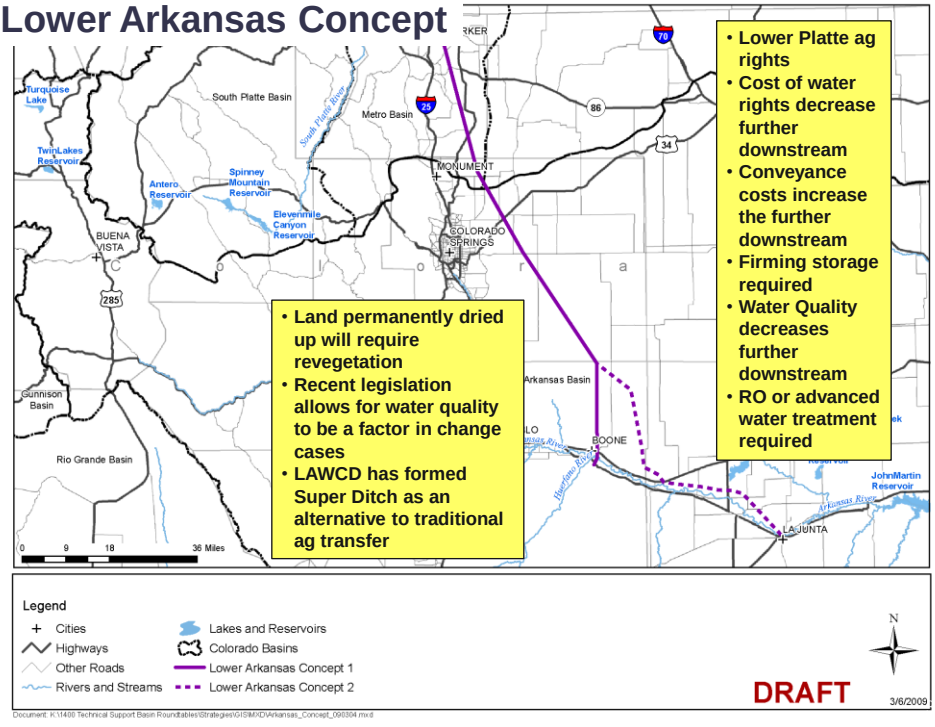
Agricultural Transfer Strategy

34

Lower South Platte Concept



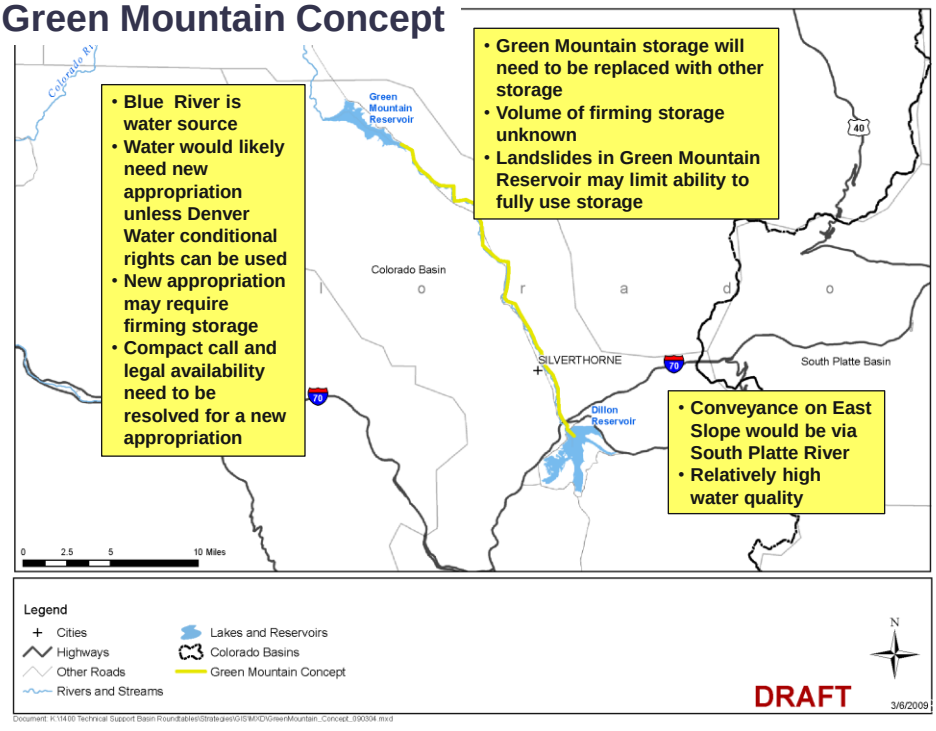
Lower Arkansas Concept



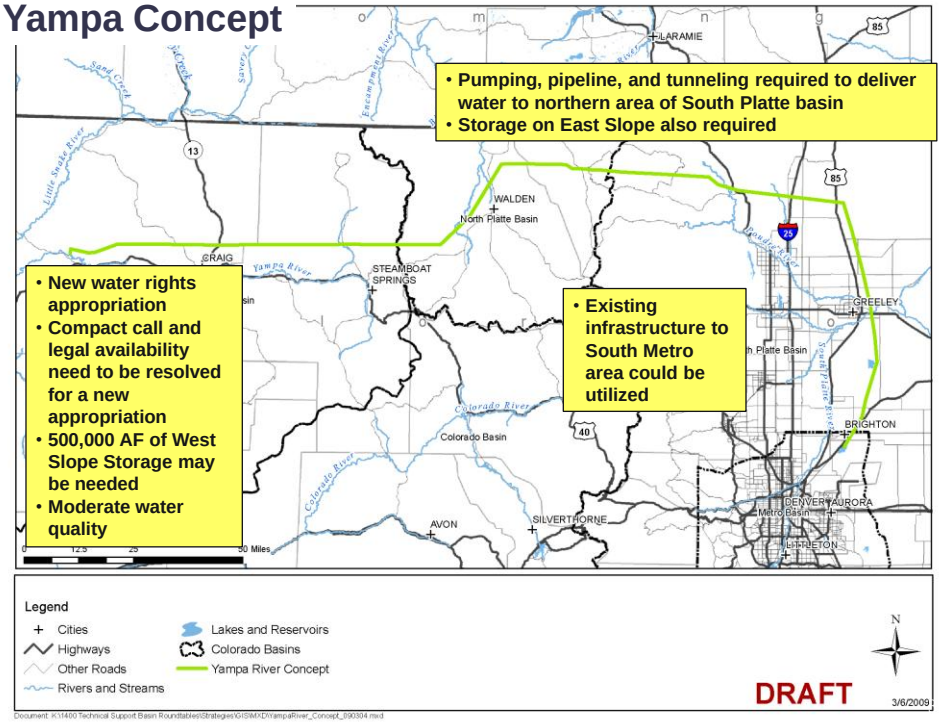
New Supply Development

37

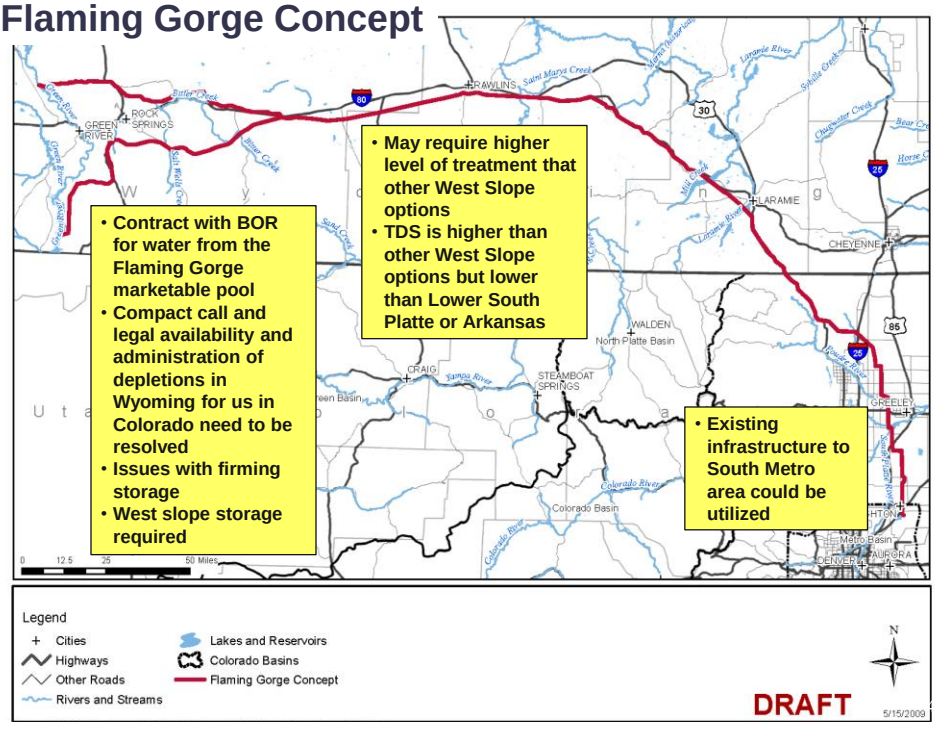
Green Mountain Concept



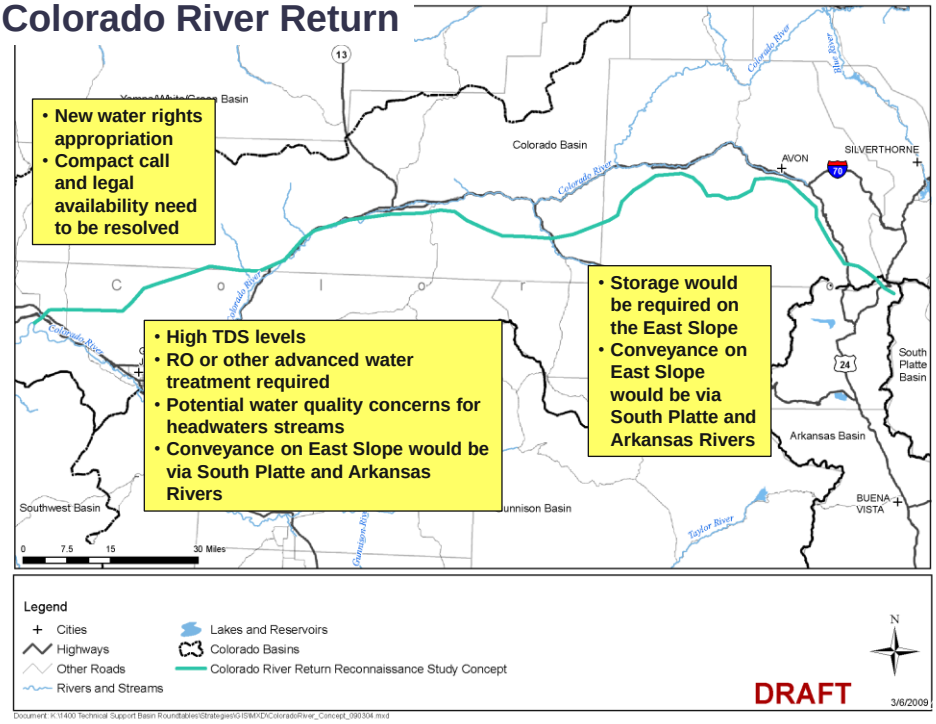
Yampa Concept



Flaming Gorge Concept



Colorado River Return



Updated Cost Information

42

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

43

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

44

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

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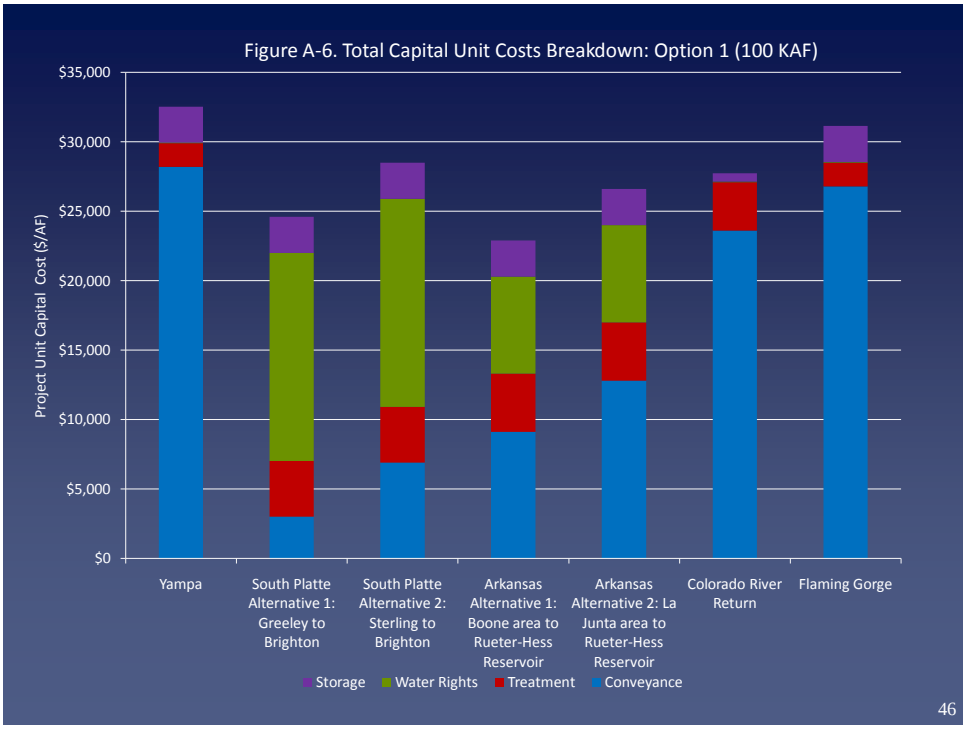

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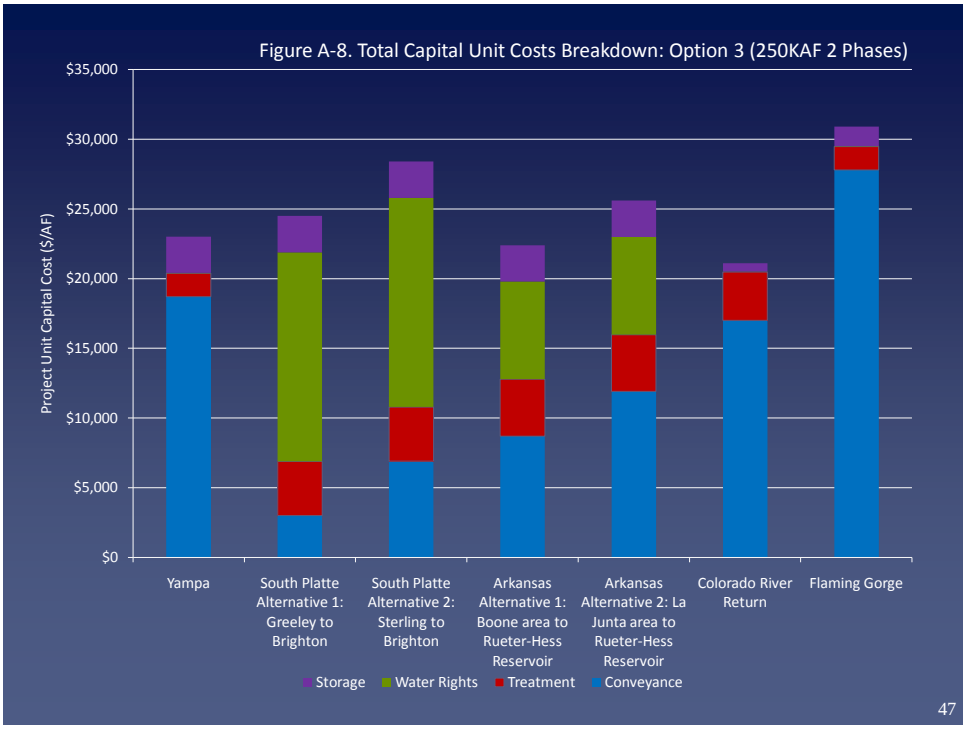


Figure A-8. Total Capital Unit Costs Breakdown: Option 3 (250KAF 2 Phases)
Project Unit Capital Cost ($/AF)
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Yampa
South Platte Alternative 1: Greeley to Brighton
South Platte Alternative 2: Sterling to Brighton
Arkansas Alternative 1: Boone area to Rueter-Hess Reservoir
Arkansas Alternative 2: La Junta area to Rueter-Hess Reservoir
Colorado River Return
Flaming Gorge
Storage
Water Rights
Treatment
Conveyance
47

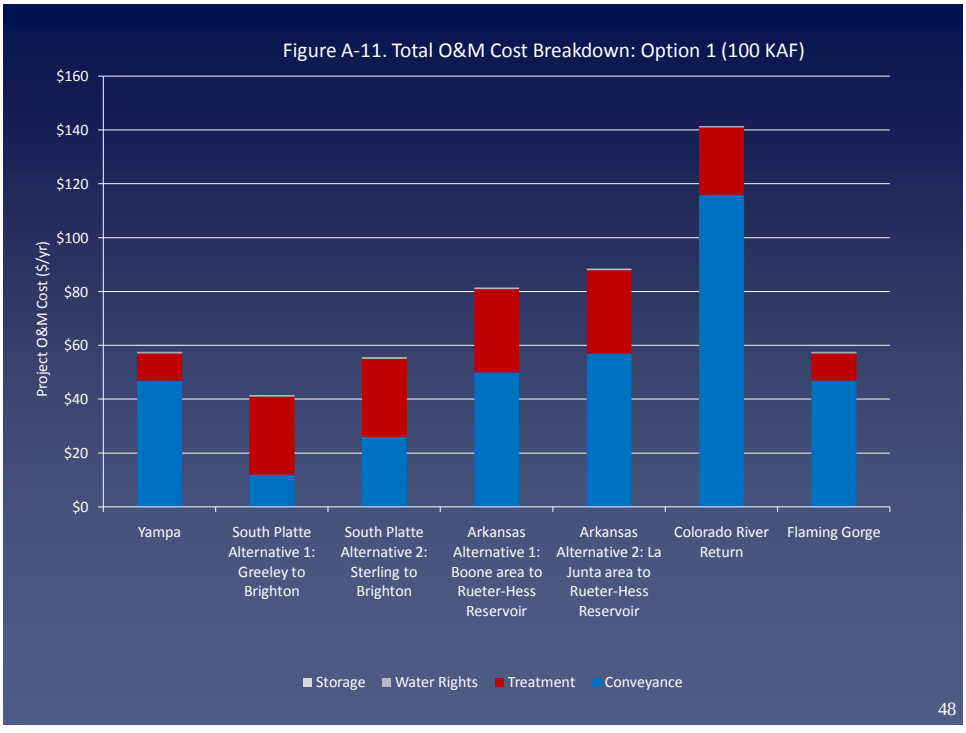


Figure A-11. Total O&M Cost Breakdown: Option 1 (100 KAF)
Project O&M Cost ($/yr)
$160
$140
$120
$100
$80
$60
$40
$20
$0
Yampa
South Platte Alternative 1: Greeley to Brighton
South Platte Alternative 2: Sterling to Brighton
Arkansas Alternative 1: Boone area to Rueter-Hess Reservoir
Arkansas Alternative 2: La Junta area to Rueter-Hess Reservoir
Colorado River Return
Flaming Gorge
Storage
Water Rights
Treatment
Conveyance
48

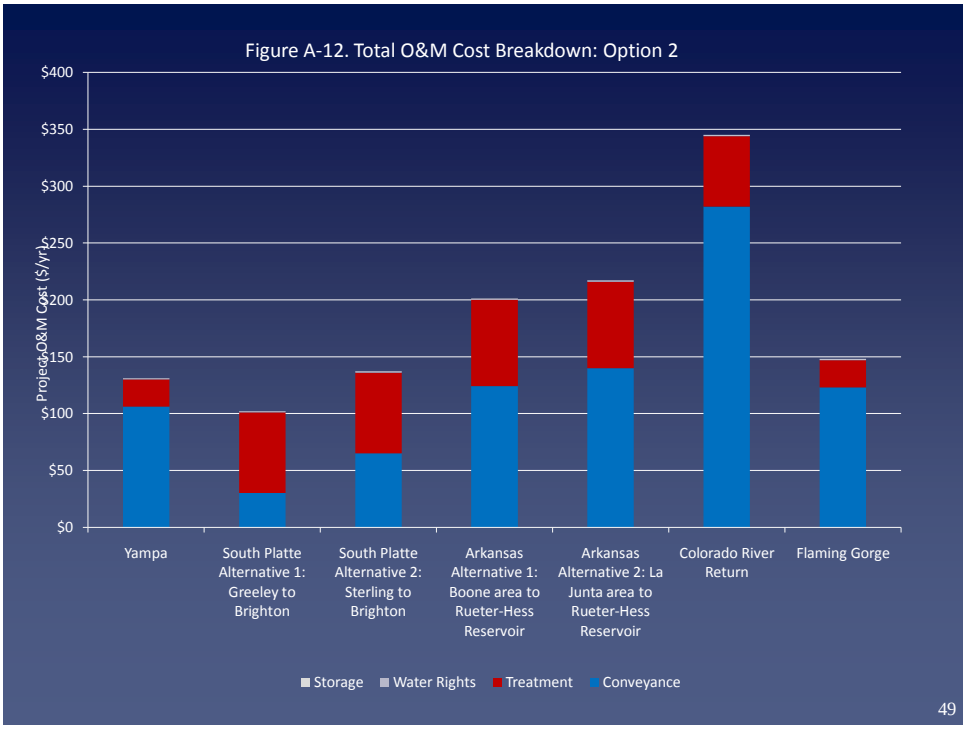


Figure A-12. Total O&M Cost Breakdown: Option 2
$400
$350
$300
$250
$200
$150
$100
$50
$0
Project O&M Cost ($/yr)
Yampa
South Platte Alternative 1: Greeley to Brighton
South Platte Alternative 2: Sterling to Brighton
Arkansas Alternative 1: Boone area to Rueter-Hess Reservoir
Arkansas Alternative 2: La Junta area to Rueter-Hess Reservoir
Colorado River Return
Flaming Gorge
Storage
Water Rights
Treatment
Conveyance
49

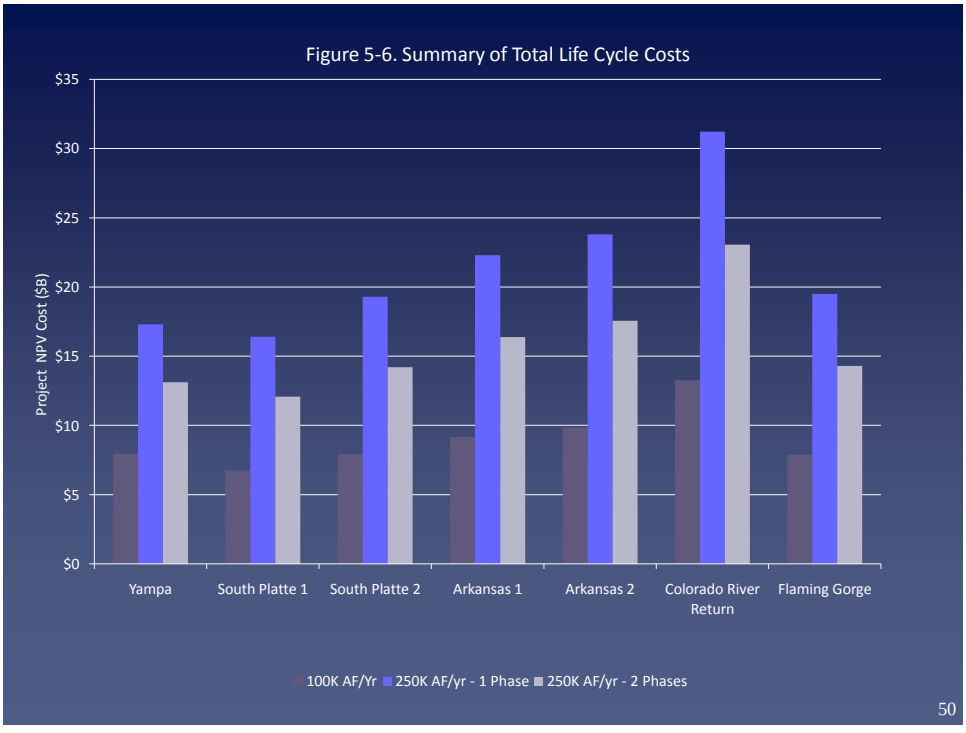
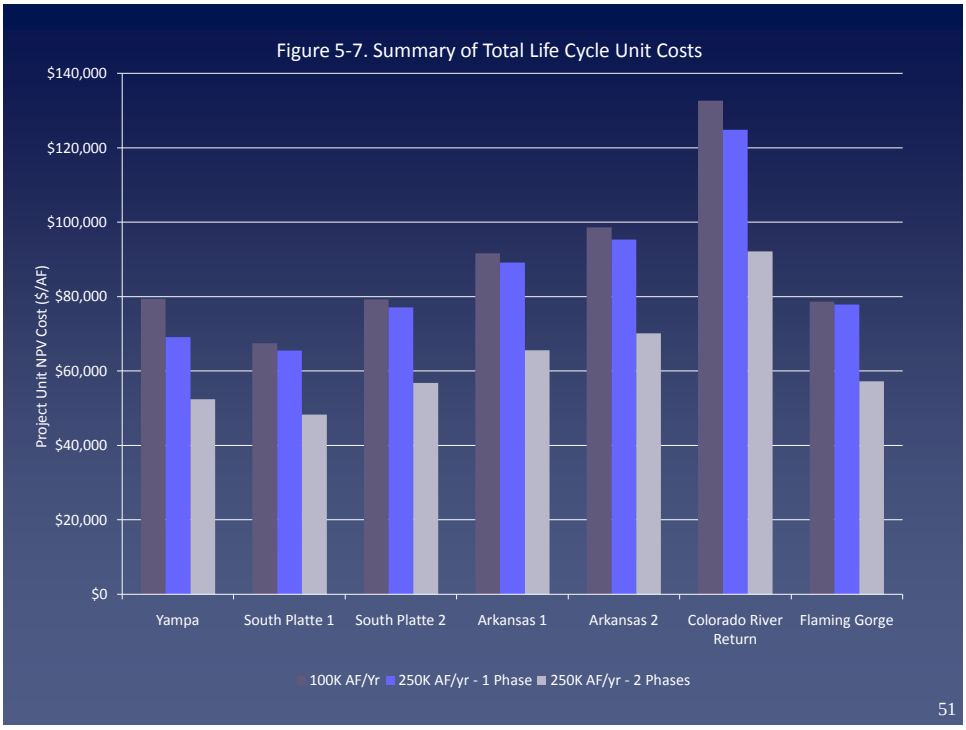


Figure 5-6. Summary of Total Life Cycle Costs
$35
$30
$25
$20
$15
$10
$5
$0
Project NPV Cost ($B)
Yampa
South Platte 1
South Platte 2
Arkansas 1
Arkansas 2
Colorado River Return
Flaming Gorge
100K AF/Yr
250K AF/yr - 1 Phase
250K AF/yr - 2 Phases
50



51

Next Steps

52

Next Steps

- Statewide Update of Nonconsumptive and Consumptive Needs
  - M&I Demands
  - Nonconsumptive Focus Areas Mapping
  - Nonconsumptive Projects and Methods
  - Agricultural shortages
  - Updated Gap Analysis
  - Report summarizing needs assessments (June, 2010)
- Development of Portfolios and Evaluation of Water Supply Strategies

53

M&I Demands

- CWCB Staff will be gathering comments on M&I Demands to 2050 report
- Feedback will be gathered through November 2009
- CWCB will respond to comments and revise report
- Report will be included as an appendix to statewide update of consumptive and nonconsumptive needs

54

Nonconsumptive Focus Areas Mapping

- CWCB Staff will be gathering comments on report mapping report
- Feedback will be gathered through November 2009
- CWCB will respond to comments and revise report
- Report will be included as a section in the statewide update of consumptive and nonconsumptive needs

55

Nonconsumptive Projects and Methods

- CWCB will examine past studies:
  - Existing studies and plans by "ISF recommending entities"
  - Watershed restoration plans and flood DSS for identified restoration projects
  - Other relevant restoration and quantification studies, plans and processes
  - Other WSRA funded studies or Basin Roundtable Studies
- Information will be summarized by focus area
- Results will be included in statewide update of consumptive and nonconsumptive needs

56

Agricultural shortages

- CWCB will update the agricultural shortages from SWSI 1
- CWCB will summarize results of Yampa and Gunnison Agricultural WSRA studies
- Information will be included in statewide update
- CWCB will review information with roundtables
- CWCB will also review the Alternative Agricultural Transfer Methods Grant Projects

57

Consumptive Gap Analysis

- CWCB will update M&I gap analysis from SWSI 1 using updated IPP database
- CWCB will update agricultural shortages statewide
- Information will be included in report updating consumptive and nonconsumptive needs statewide

58

Report summarizing needs assessments (June, 2010)

- CWCB will provide update of statewide consumptive and nonconsumptive needs based on recent reports and Basin Roundtable Needs Assessment efforts
- Target completion date of report is June 2010

59

Development of Portfolios and Evaluation of Water Supply Strategies

- During 2008, Colorado's water community embarked on a visioning process to address the following questions:
  - If we let Colorado's water supply continue to evolve the way it is now, what will our state look like in 50 years?
  - Is that what we want it to look like?
  - If not, what can and should we do about it?

60

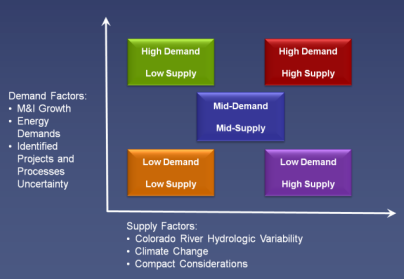
IBCC/CWCB Visioning Process
Basic Conclusions

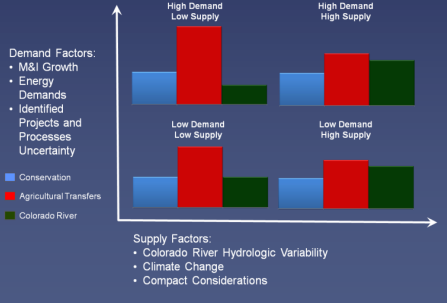
- The status quo approach to water supply will not lead to a desirable future for Colorado.
  - Example #6 of 7 – Representation of Status Quo
  - If not the Status Quo then what?
- Colorado will need of range of demand side and supply side strategies.
- We need to work together to examine the trade-offs, risks, and uncertainties associated with different strategies and combination of strategies.

61

Yesterday's IBCC Meeting Objective:

Begin building combinations of strategies or "portfolios" for meeting Colorado's future water needs.





62

Overview of Scenarios, Portfolios, and Strategies

- *Scenarios* – Different future conditions. Each scenario represents a different, but plausible, representation of circumstances that would result in differing statewide consumptive and nonconsumptive water demand and water supply. The IBCC is considering 5 different scenarios.
- *Portfolios* – Combinations of strategies which collectively meet statewide water demands. Portfolios can be developed for each future scenario.

63

Overview of Scenarios, Portfolios, and Strategies

- *Strategies* – Broad categories of solutions for meeting Colorado's consumptive and nonconsumptive water supply needs. Through its Visioning Process the IBCC identified a set of Demand Side Strategies and Supply Side Strategies and began developing conservation, agricultural transfers, and new water supply development strategies.

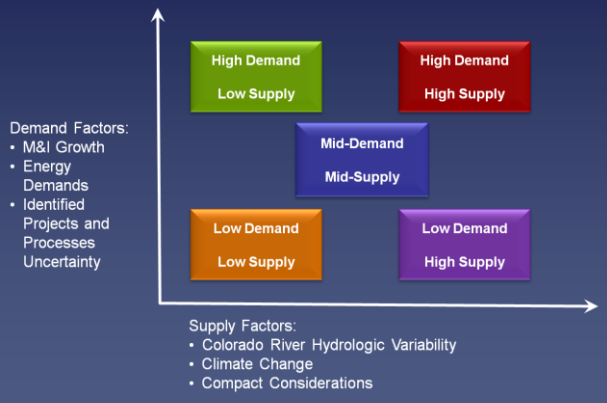
64

Overview of Scenarios, Portfolios, and Strategies

- *Projects and Methods* – Specific actions which help implement each strategy. For example a water project helps implement a new water supply development strategy, a rotational fallowing program helps implement an agricultural transfer strategy, and a block rate pricing program helps implement a conservation strategy. Each Basin Roundtable is responsible for proposing projects and methods to meet their consumptive and nonconsumptive needs.

65

Scenarios



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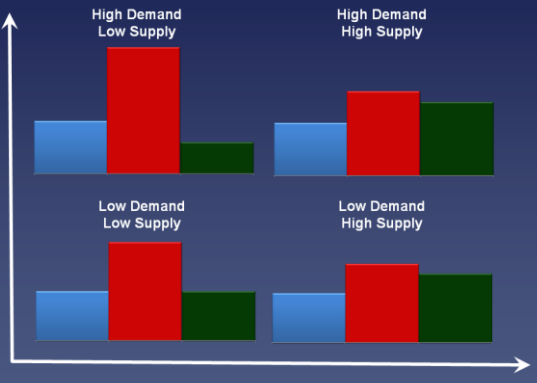
Portfolios

Demand Factors:
- M&I Growth
- Energy Demands
- Identified Projects and Processes Uncertainty

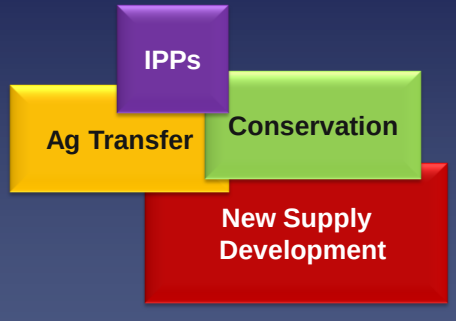
Conservation
Agricultural Transfers
Colorado River



Supply Factors:
- Colorado River Hydrologic Variability
- Climate Change
- Compact Considerations

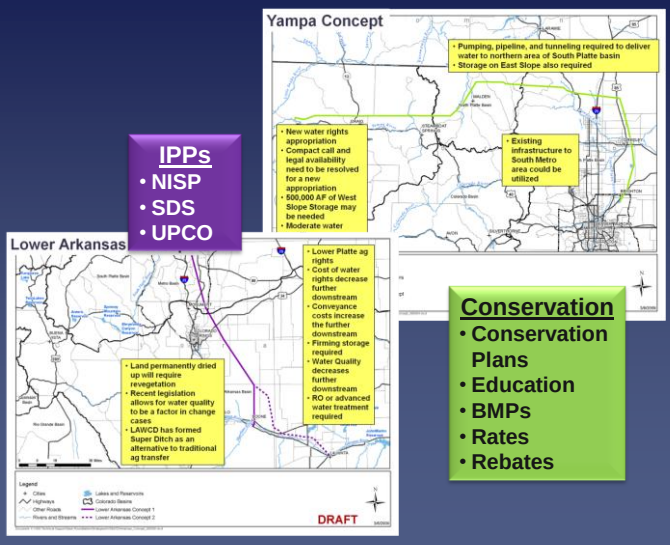
67

Strategies



68

Projects and Methods



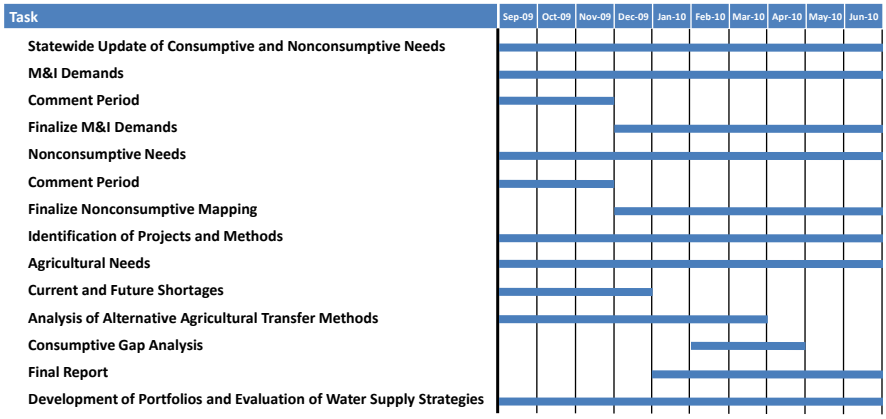
69

Roles

IBCC/CWCB: Support scenario, portfolio, and strategy development

Basin Roundtables: Work with stakeholders in their basin to propose project and methods to meet their basin's consumptive and nonconsumptive needs

70


Task
Sep-09
Oct-09
Nov-09
Dec-09
Jan-10
Feb-10
Mar-10
Apr-10
May-10
Jun-10
Statewide Update of Consumptive and Nonconsumptive Needs
M&I Demands
Comment Period
Finalize M&I Demands
Nonconsumptive Needs
Comment Period
Finalize Nonconsumptive Mapping
Identification of Projects and Methods
Agricultural Needs
Current and Future Shortages
Analysis of Alternative Agricultural Transfer Methods
Consumptive Gap Analysis
Final Report
Development of Portfolios and Evaluation of Water Supply Strategies