

THE STATEWIDE WATER SUPPLY INITIATIVE

The Technical Update to the

COLORADO

WATER PLAN

IBCF





AGENDA

- Background
- Data Analysis
- SWSI Rollout
- Future Planning

CYCLICAL PLANNING IN THE COLORADO WATER PLAN

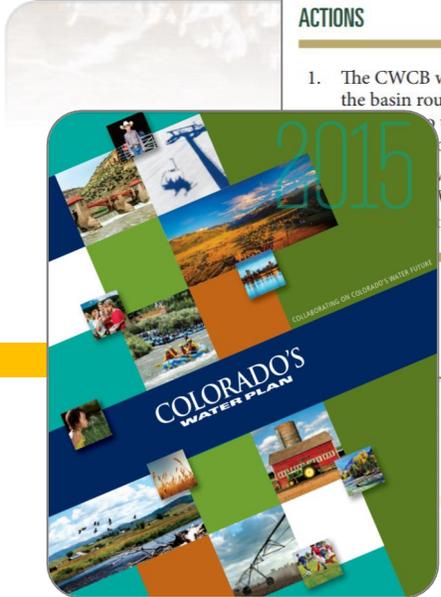
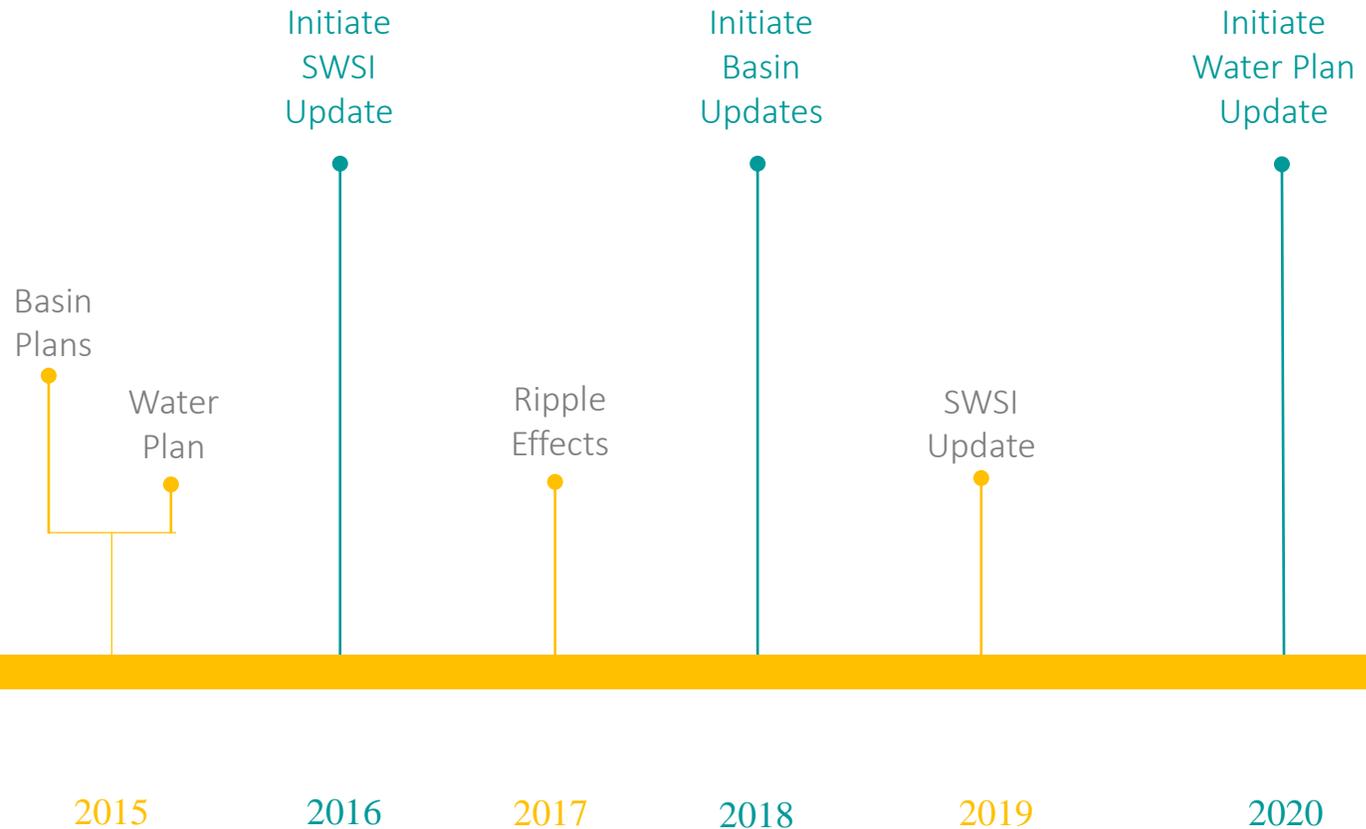


TABLE 11-1 CYCLICAL PLANNING PROCESS PROPOSED BY THE CWCB

Product	Year Initiated
Basin Implementation Plans	2013
Colorado's Water Plan	2013
Statewide Water Supply Initiative	2016
Basin Implementation Plans	2018
Colorado's Water Plan	2020
Statewide Water Supply Initiative	2022

ACTIONS

1. The CWCB will work with other state agencies, the basin roundtables, and the people of Colorado to update Colorado's Water Plan, to be completed no later than 2020. The CWCB will develop guidelines for Basin Implementation Plans (BIPs) and will use WWSRA grants to help facilitate the implementation of the BIPs.

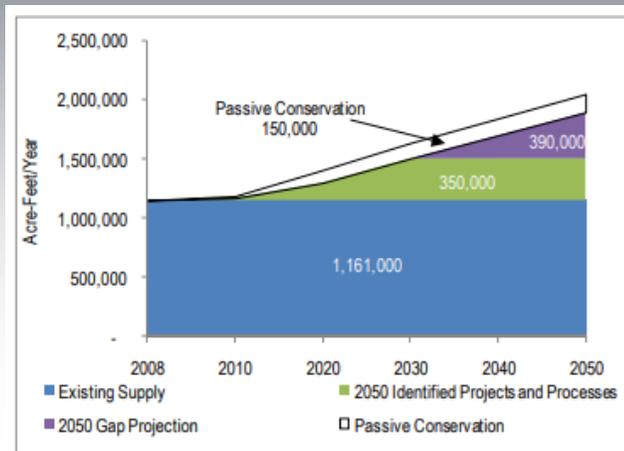


New Stakeholder-Driven Methodologies

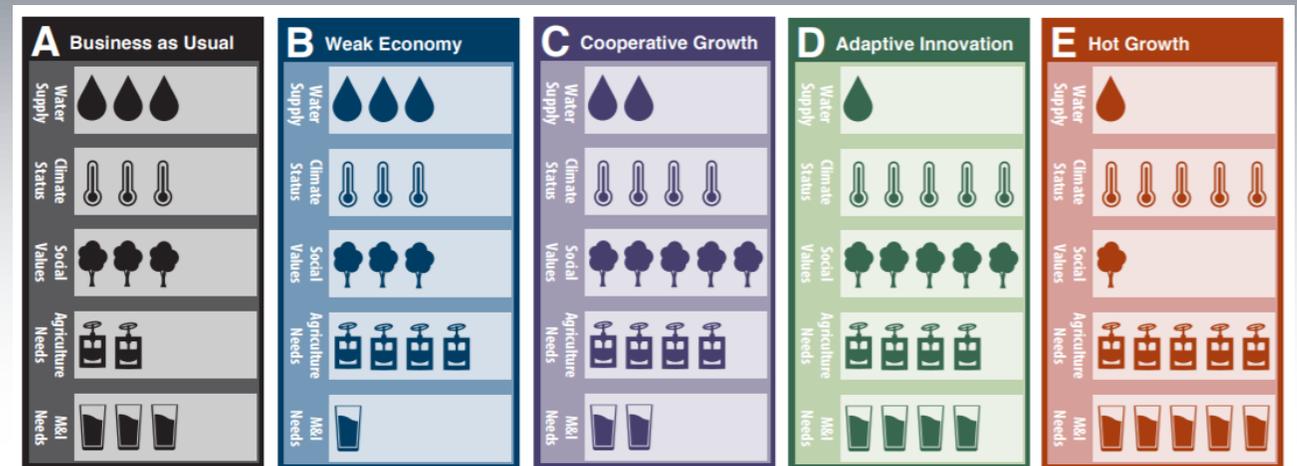
2050 Demand Projections

- IPPs

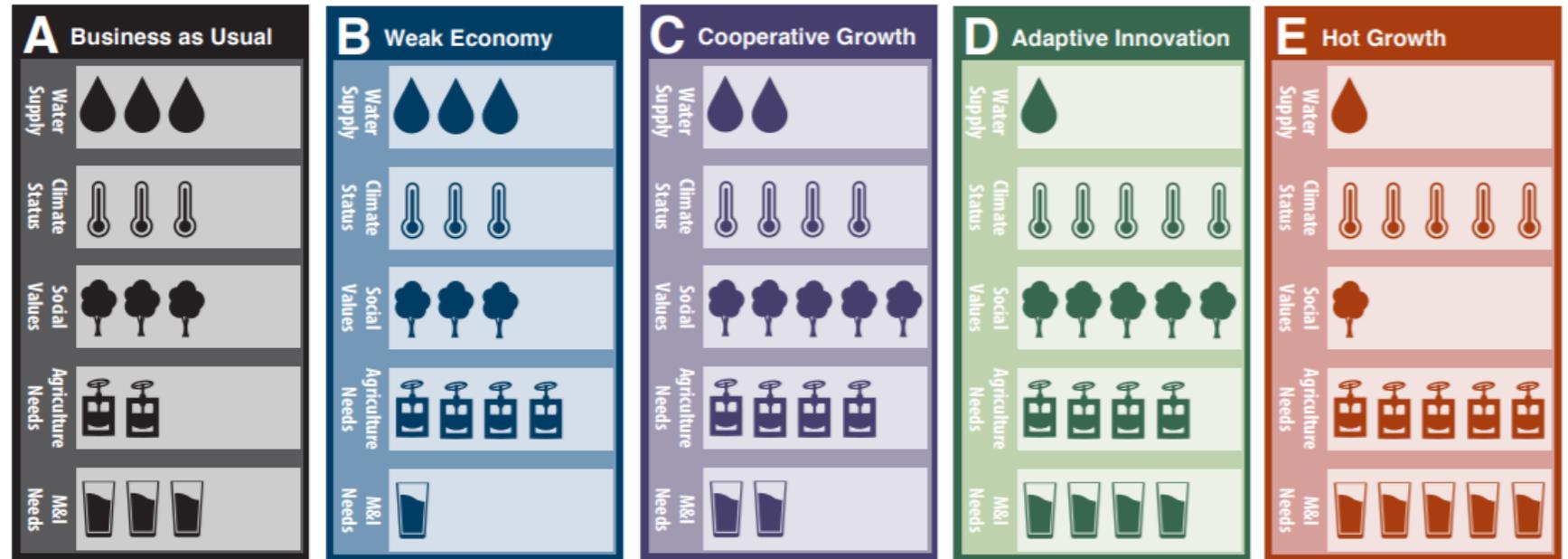
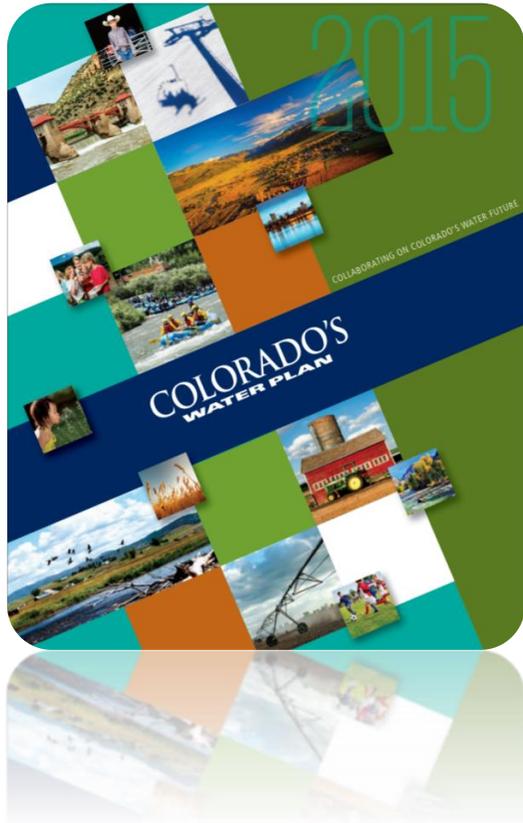
= 2050 M&I Gap



- Hydrologic Modeling
- Municipal Modeling
- Agricultural Modeling
- Environmental Modeling
- Scenario Planning Across Major Drivers



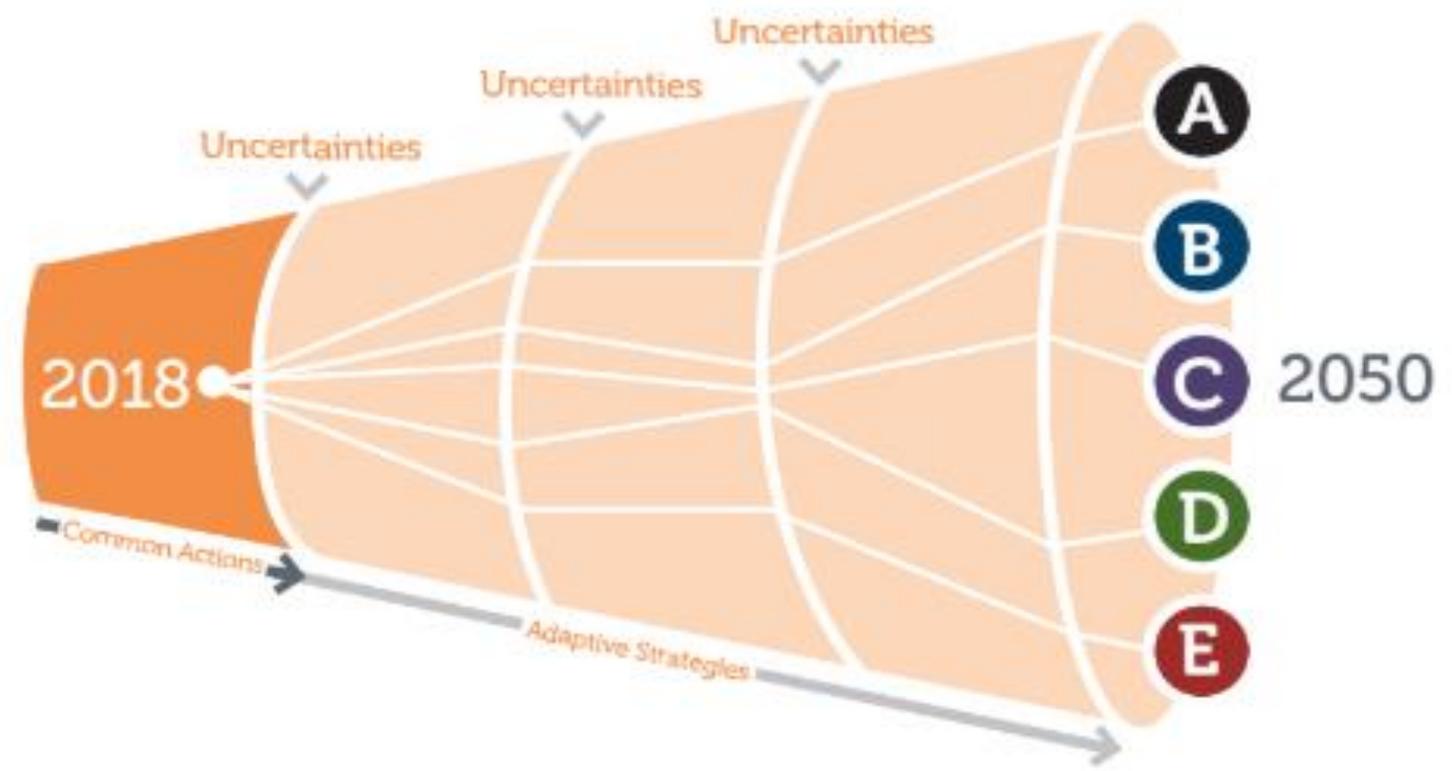
WATER PLAN SCENARIOS



NOTE:

- Scenarios in the Water Plan were named and developed with the IBCC.
- These represent equally plausible futures.

- A** Business as Usual
- B** Weak Economy
- C** Cooperative Growth
- D** Adaptive Innovation
- E** Hot Growth



FACT SHEET Agricultural Diversion Demand

This fact sheet summarizes the methodologies used to estimate agricultural diversion demands in the SWIS Update.

Previous Methodology

Water demands and savings for irrigated crops at the field level were estimated in SWIS 2010. Irrigation water requirements, water supply limited conservative use, and crop water shortages were estimated and aggregated at a basin level.

Updated Methodology

In the SWIS Update, crop water demands will again be estimated. In addition, the water diversion or pumping necessary to meet crop water demands will also be estimated. Total agricultural water demand will account for conservative needs at the field level plus the conveyance losses or pumping inefficiencies. As a result, agricultural demands (and gaps) will be higher than in SWIS 2010.

Why did we make this change?

- Allows us to use planning models to analyze planning scenarios from Colorado's Water Plan.
- Provides information and tools for basin roundtable use in analyzing "what if" scenarios and for evaluating effectiveness of future projects.
- Provides consistency with estimates of municipal and industrial demands.

Calculation Process for Current Agricultural Water Demands

JANUARY 2018 | AGRICULTURAL DIVERSION DEMAND METHODOLOGY FACT SHEET

FACT SHEET Municipal and Self-Supplied Industrial Demand Methodology

This fact sheet summarizes methodologies used to estimate municipal and self-supplied industrial demands in the SWIS Update.

Overview of Municipal Demand Methodology

Municipal demands for the SWIS Update will be calculated using methodologies similar to SWIS 2010 but will utilize Planning Scenarios and will use enhanced input data. Enhanced input data from 1051 reporting entities, Water Efficiency Plans, and Basin Implementation Plans, and Basin Information Data. The basic equation for estimating municipal demand considers population and per-capita water use (expressed as gallons per capita per day or gpcd).

Demand = Population * gpcd

For the SWIS Update, five scenario-specific, county-level population estimates for 2050 will be developed along with scenario-specific per-capita water use rates.

Municipal Demand Adjustments Under Planning Scenarios

Baseline estimates of 2000 population will be based on Colorado's State Demography Office modeling. Additional adjustments accounting for statistical and geographic variability will be made for scenario-specific considerations.

Projected Population Growth Through 2050

Future per-capita water use rates will be adjusted to reflect conditions described in each scenario and will consider economic conditions, climate, regulations and technology, and social values. Initial adjustments to future gpcd rates are shown in the table below.

Rate Adjustment Driver	Business as Usual	Weak Economy	Cooperative Growth	Adaptive Innovation	Hot Growth
Population	500	Low	500, adjusted	High	High
Climate Conditions	Current	Current	In-between	Hot and dry	Hot and dry

Initial adjustments to future gpcd rates based on drivers such as water efficiency adoption rates, future residential indoor gpcd, outdoor use, non-residential indoor use, and non-revenue water.

Summary of municipal demand calculation process for each Planning Scenario

JANUARY 2018 | MUNICIPAL AND SELF-SUPPLIED INDUSTRIAL DEMAND METHODOLOGY FACT SHEET

FACT SHEET Scenario Planning & Gap Analysis

This fact sheet summarizes new approaches and planning concepts that are being adopted for the SWIS Update. Information describing proposed methodologies for specific areas of study (for example, quantification of municipal or agricultural water demands) can be found in other fact sheets in this section.

Scenario Planning

Scenario planning relies on several planning forms to build multiple, plausible futures (or "scenarios"). In contrast, traditional "predict and react" approaches develop a single future.

Given the uncertainties of future water supply and demand, the SWIS Update will use scenario planning to explore the consequences of a range of planning options for the 2050 update. The approach assumes that the future is uncertain, and it provides flexibility to explore various future conditions. Rather than trying to predict the future by looking at the past, scenario planning allows the SWIS Update and stakeholders to identify and account for key drivers and uncertainties within the planning period. Common actions applicable to a future can be implemented, and adaptive strategies can be developed to meet future needs depending upon future conditions.

Gap Analysis

In this fact sheet, the gap analysis considered net new municipal and self-supplied industrial (MSIS) water needs and anticipated yield from identified projects and increases (PIs) in the year 2050. A range of 2050 MSIS gaps were calculated by using high and low baseline water demands combined with higher and lower assumptions regarding the access rate of PIs. Agricultural gaps were also calculated and were defined at the field level as the difference between the irrigation water requirement and water supply limited conservative use (in SWIS 2010, this difference was termed as a "shortage" rather than a "gap").

For the SWIS Update, the gap will be defined somewhat differently. For the purpose of the SWIS Update, a "gap" occurs when legally and physically available water supplies cannot meet diversion demands. The gap is the difference between diversion demand and water supply. The gap will be a hydrologic gap and will not consider identified projects and process that may be effective at meeting the agricultural or municipal gap. However, there may be evaluation in more detail during future updates of SWIS.

The updated gap evaluation methodology will utilize Colorado's Decision Support System (COSS) surface water allocation models where available and other analysis tools to evaluate hydrologic gaps. The models incorporate and consider water supply, existing infrastructure, diversion demands, water rights, river operations, and the effects of climate change (if applicable). The models then use this information to allocate water to meet demands based on their appropriateness. The output of the modeling and analysis will be a range of gaps for municipal and agricultural diversion demands under wet, normal, and dry conditions. The graphic below illustrates the gap analysis process:

FACT SHEET Environmental and Recreation Methodology

This fact sheet summarizes methodologies that will be implemented during the SWIS Update for the Environmental and Recreation component.

Environmental and Recreation Database Update

The Environmental and Recreation component of the SWIS Update will focus on the development of two tools:

1. Environmental and Recreation Database Update
2. Environmental and Recreation Flow Tool

Database Update

During the 2010 SWIS process, Basin Roundtables identified projects and methods required to meet the nonconsumptive needs identified as part of their Needs Assessment and focus area development process. In 2010, CWIC developed a number to collect information on existing or planned nonconsumptive projects, methods and studies. In addition, CWIC facilitated numerous meetings to gather additional data from stakeholders.

A database was developed in 2010, known as the "Nonconsumptive Needs Database" to help manage the nonconsumptive data received by Basin Roundtables and other stakeholders. The database included information related to nonconsumptive attributes, projects, and protections.

A significant focus of the SWIS Update will be enhancing the Nonconsumptive Needs Database (note that it is being renamed the "Environmental and Recreation Database" in the SWIS Update). The update of the Environmental and Recreation Database (ERDB) will include the following improvements:

Overall Goal	Action and Results
Enhanced Technical Foundation	Data loading processes will be consistent and streamlined to add efficiency and improve data quality. The Source Water Route Framework will be implemented as a common spatial unit to provide structure consistency.
Engaging and Meaningful User Experience	Excel-based templates for data entry will be developed, which will improve uniformity of data and add efficiency. Standard reports will be developed to enhance consistency of data retrieval. An on-line mapping tool will be developed to increase ease of use and enable visualization of database content. User feedback will be collected to identify improvements.
Enhanced Database Management	Database content will be managed and organized to include project identification, project descriptions, data, etc. making it more useful and meaningful for planning purposes.

The updated database will use the Source Water Route Framework as a common spatial unit for statewide consistency.

JANUARY 2018 | ENVIRONMENTAL AND RECREATION METHODOLOGY FACT SHEET

FACT SHEET Finance Methodology

This fact sheet summarizes project cost estimating tool that will be developed as a part of the SWIS Update.

As Colorado's Water Plan is implemented, it is critical that the overall cost of proposed projects and methods is understood and presented in a way that enables easy comparison (i.e., "apples to apples") between only 1% percent of the projects and methods listed in Basin Implementation Plans included cost estimates.

Previous iterations of SWIS have incorporated costing mechanisms developed for strategy and cost analysis and portfolio comparison. The goal of the Finance component of the SWIS Update is to build on previous SWIS cost estimation methodologies and develop an accessible and user-friendly tool for Basin Roundtables to use in developing high-level cost estimates of projects and methods.

The Environmental and Recreation component of the SWIS Update will focus on the development of a cost estimating tool with two modules:

1. Projects Module
2. Costing Module

The Projects Module

The Projects Module represents either an entire water project or a component of a large-scale, complex project. It includes an overview of the tool and allows the user to modify global inputs such as project location, project factors, cost indices, and life cycle and annual costs.

The types of projects proposed in Basin Implementation Plans will be pre-loaded into the Projects Module, and the user will be able to customize the parameters associated with their project to reflect specific design and physical characteristics. The output from the Projects Module becomes input to the Costing Module.

JANUARY 2018 | FINANCE METHODOLOGY FACT SHEET

FACT SHEET Water Supply Methodology

This fact sheet summarizes methodologies that will be implemented during the SWIS Update to estimate current and future water supplies under the various Planning Scenarios. In addition, modeling methodologies that will be used to quantify gaps under the Planning Scenario will be described.

Current and Future Water Supplies

Estimates of current water supply information are necessary to understand the amount of water that is physically and legally available to meet current demands, and any additional water supplies that may be available to meet future demands. Current water supply information consists primarily of estimates of "natural flow" at key locations as well as supplies available in reservoirs or conveyed across basins. "Natural flow" is the amount of surface water in the river at particular locations above the effect of man, and serves as the foundation of the Colorado Decision Support System (COSS) surface water allocation model used in the SWIS Update effort.

Colorado's Water Plan included "Water Supply" as a key driver in each of its planning scenarios. Future water supplies are projected to be impacted by climate change in the Cooperative Growth, Adaptive Innovation, and Hot Growth planning scenarios.

Impacts to Water Supplies from Climate Change

CWIC has undertaken several studies and investigations on the impact of climate projections on the future of water use in Colorado. Most notably was the development of the Colorado Climate Plan (CCP), which focuses on observed climate trends, climate modeling, and climate and hydrology projections to assist with the planning and management of water resources in Colorado. The CCP discusses the most recent global climate projections (GCMs) and recommends the integration of these results with the previous global climate projections (GCMs) to provide a representative range of potential future climate and hydrological conditions.

Colorado's Water Plan incorporates the impact of climate change and identifies two future potential climate projections for the planning scenarios. The projections reflect "Hot and Dry" conditions and conditions that are in between Current conditions and the Hot and Dry conditions ("in-between"). The climate projections are assigned to the planning scenarios as follows:

Scenario as Usual	Current
Weak Economy	Current
Cooperative Growth	In-between
Adaptive Innovation	Hot and Dry
Hot Growth	Hot and Dry

The effort associated with processing the projected climate data and downsizing the information for use at the Water District level was completed through the Colorado River Water Availability Study Phase II (CROWAS-II) project. This effort resulted in a new series of climate-adjusted "natural flow" hydrology at over 300 streamflow gage locations statewide for each climate projection. Natural flow hydrology for the In-Between and Hot and Dry conditions differed from current conditions in various degree depending on location. In general, peak runoff tended to occur earlier than Current in some locations, average annual natural flow tended to be lower than Current in most locations, and frequency/duration of droughts tended to increase.

JANUARY 2018 | WATER SUPPLY METHODOLOGY FACT SHEET

FACT SHEET Population Projection Methodology

This fact sheet summarizes methodologies that will be implemented during the SWIS Update to project population growth by the year 2050 for each Planning Scenario.

Population projections, by basin and for the state as a whole, are the primary driver in the municipal and industrial demand projections being developed for the SWIS Update. In the Update, population projections will be developed for each of the Planning Scenarios described in Colorado's Water Plan. The projections will then be used to estimate municipal and industrial demands for each Planning Scenario and will also influence agricultural water demands as the urban footprint is anticipated to expand onto lands currently used for agricultural purposes.

Projections of future population have been a key component of past SWIS iterations. Prior population projections conducted by the State Demography Office (SDO) covered the period 2005 to 2035. In past SWIS iterations, a complex process was used to extend the population projections to the year 2050. The process included developing economic forecasts for the state and each county, estimating future water demands, comparing future labor demands to future water supply, and estimating net migration to balance labor demands throughout the state. In addition, high and low growth scenarios were developed.

Statewide Population Projection

High and low rates of population growth will be projected using statistical methods that consider the SDO growth rate through 2030 and historical growth rates from 1965 to 2010. Thousands of simulations of future growth based on these parameters will be conducted. The estimate of high population growth will be based on the level at which only 10 percent of the simulations predict higher growth. Similarly, the low population growth will be based on the level at which only 10 percent of the simulations predict lower growth.

JANUARY 2018 | POPULATION PROJECTION METHODOLOGY FACT SHEET

FACT SHEET SWIS Update Overview

This fact sheet provides an overview of the context, process, and features of the current update to the Statewide Water Supply Initiative (SWSI).

Context

The current SWIS Update is the first iteration of SWIS to be conducted in the context of Colorado's Water Plan (CWP) and the Basin Implementation Plans (BIPs) that were developed in Colorado's eighth major river basin. Prior iterations of SWIS included components (such as portfolio of projects and methods to meet future gaps) that are now exclusive to the BIP or CWP process. As a result, the SWIS Update will be a technically-focused effort to new evaluation to the BIP or CWP process. The SWIS Update will be a technically-focused effort to new evaluation to the BIP or CWP process. The SWIS Update will provide more detailed geographic information to help guide basin roundtables as they update their BIPs, which in turn will serve as the backbone for the next update to CWP.

Features of the SWIS Update

The SWIS Update addresses a wide variety of new questions, processes, and tools.

New Questions	New Processes	New Tools
The SWIS Update will estimate future available water supplies and gaps under the five different planning scenarios described in CWP. Previous iterations of SWIS were conducted prior to CWP and therefore did not consider the scenarios. The planning scenarios incorporate water supply and demand drivers associated with the potential effects of climate change, population growth, and many other factors.	In their BIPs, the basin roundtables cataloged various projects and methods to mitigate future water supply gaps. The SWIS Update focuses on developing tools and more detailed datasets to help the basin roundtables update their portfolio and of projects and methods for meeting future water needs in a targeted manner with forthcoming updates to their BIPs.	New analysis tools and data sets have been developed since the last iteration of SWIS. Consumptive use and surface water allocation models are now available in most river basins. Municipal water demand and concentration data is available via 1051 reporting. The availability of these new tools and data sets allow for a more robust approach to assessing future water availability and gaps.

JANUARY 2018 | SWIS UPDATE OVERVIEW METHODOLOGY FACT SHEET

DRAFT Statewide Population Projections

FACT SHEET
Population Projection Methodology

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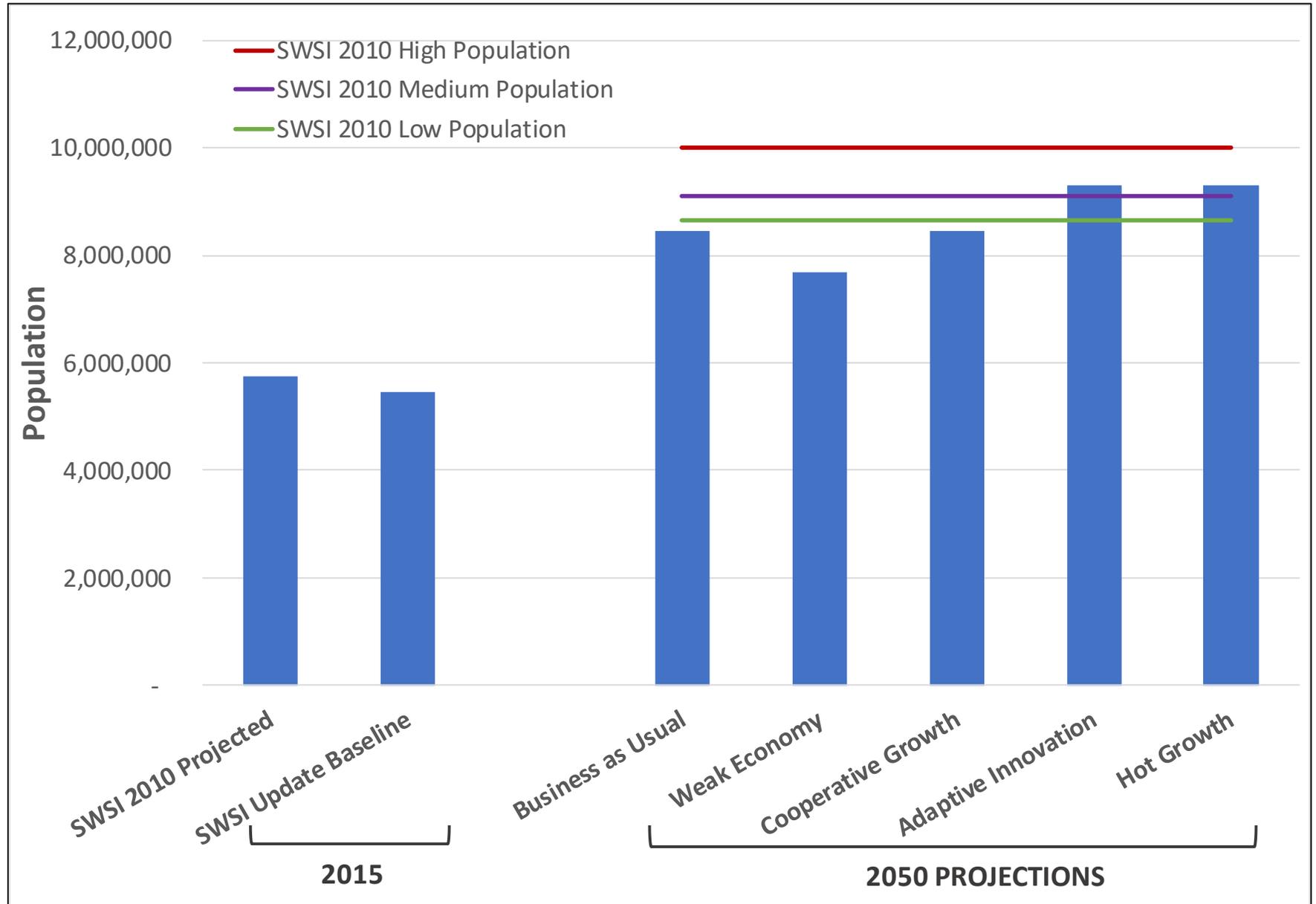
The SWSI update will include two primary enhancements to the population projection methodology:

1. Adoption of new SDO population projections, which are now available through 2050
2. Taking a simpler approach for developing high and low population projections for various Planning Scenarios

Statewide Population Projection

High and low rates of population growth will be projected using statistical methods that consider the SDO growth rate through 2050 and historical growth rates from 1990 to 2010. Thousands of simulations of future growth based on these parameters will be conducted. The estimate of high population growth will be based on the level at which only 10 percent of the simulations predict higher growth. Similarly, low population growth will be based on the level at which only 10 percent of the simulations predict lower growth.

JANUARY 2018 | POPULATION PROJECTION METHODOLOGY FACT SHEET



POPULATION

FACT SHEET
Finance Methodology

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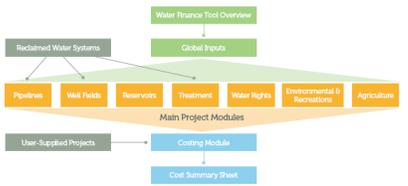
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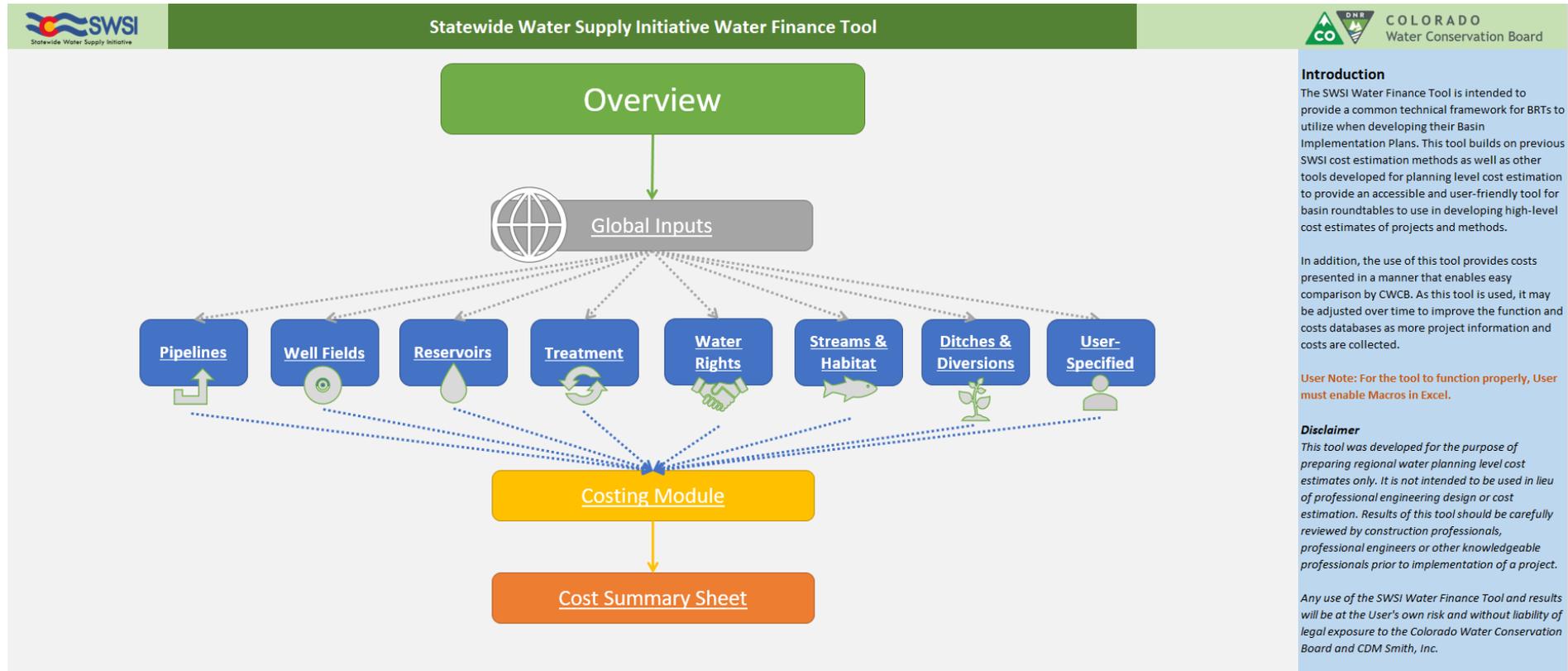
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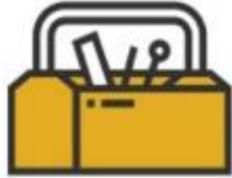


JANUARY 2018 | FINANCE METHODOLOGY FACT SHEET

COSTING TOOL



TOP THREE THINGS WE HEARD



PROVIDE A TOOLBOX

for SWSI users that includes messaging, infographics and presentations



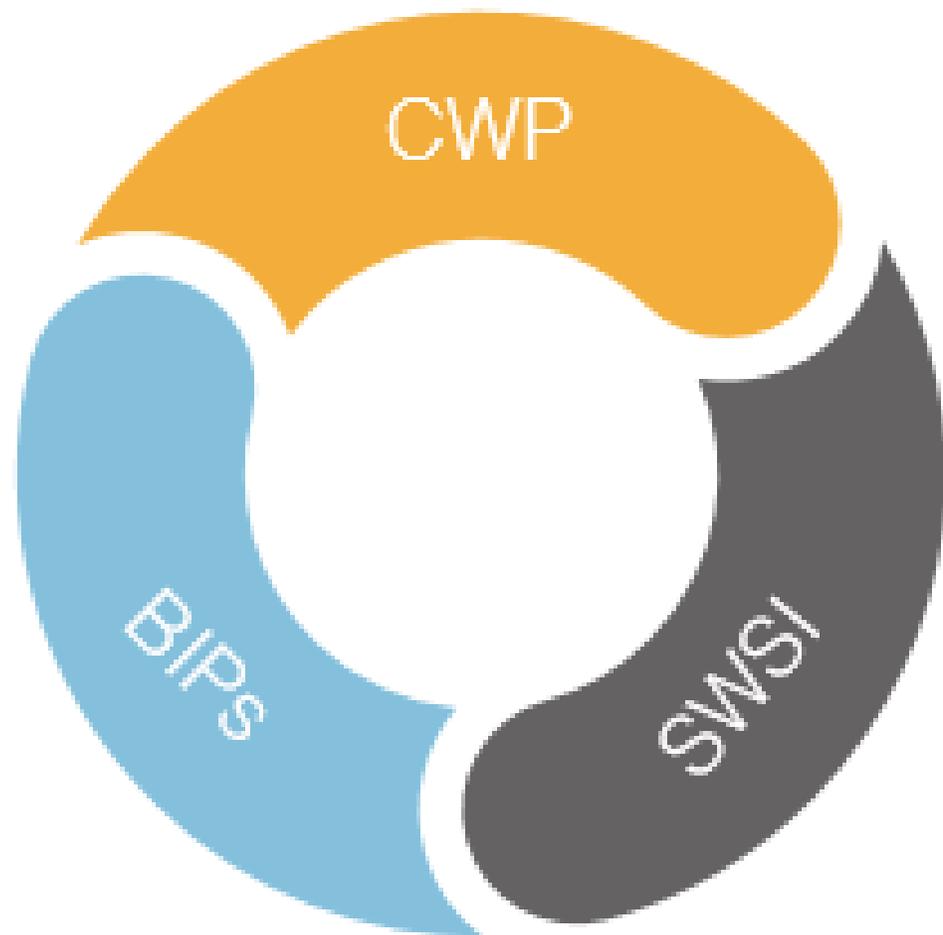
TELL THE SWSI STORY

about its evolution up to today to help users understand the limits of its data



UNIFY THE BRANDING

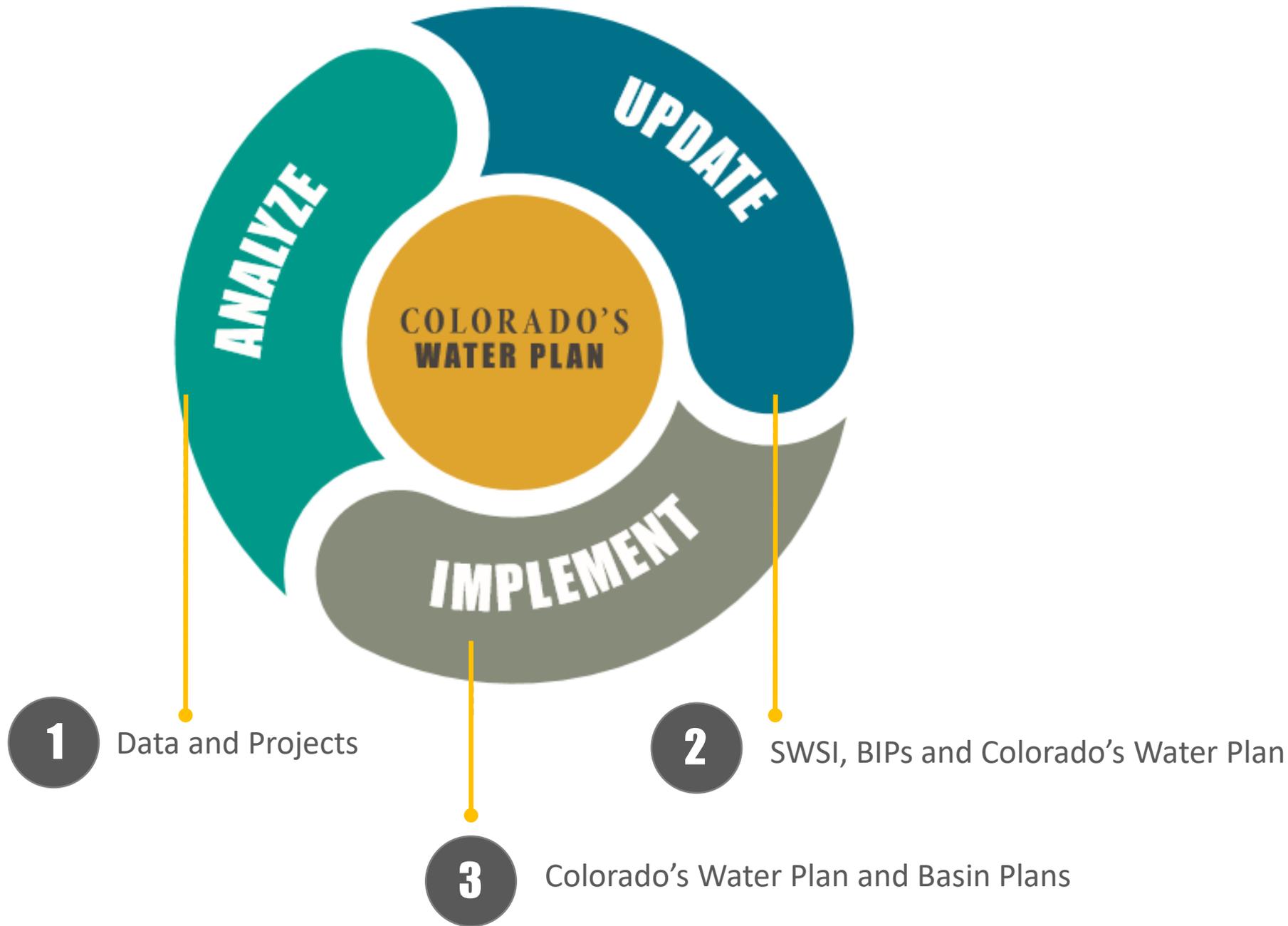
by rolling the SWSI Update into the larger story of Colorado's Water Plan it will show they are interrelated



DEATH BY **ACRONYM**

A close-up photograph of a silver spoon resting in a bowl of alphabet pasta. The pasta is a vibrant orange-red color, likely from a tomato-based sauce. The spoon is positioned in the center-right of the frame, and the word "HELP" is clearly visible, formed by several pieces of pasta letters. The background is filled with more of the same pasta, creating a dense, textured field of orange and red. The lighting is bright, highlighting the glossy surface of the pasta and the metallic sheen of the spoon.

HELP



PHASE 1
NOW - DEC

- Modeling
- Roundtable Tour
- Data Visualization
- Initial Data Release

PHASE 2
JAN - JULY

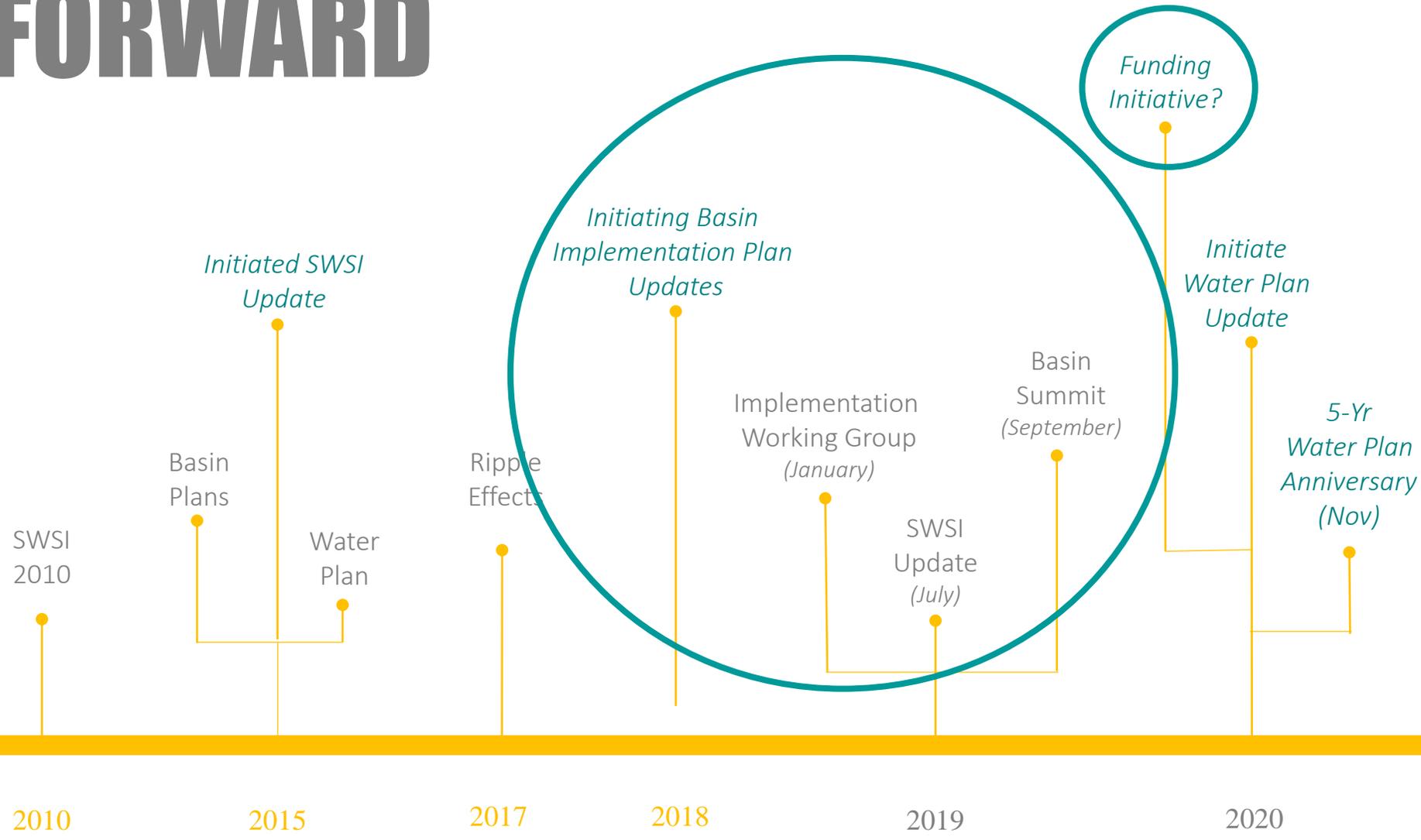
- Working Group
- Tech Webinars
- Report Release

PHASE 3
AUGUST - BEYOND

- Roundtable Summit
- BIP Updates

PHASED OUTREACH

RECENT HISTORY & THE PATH FORWARD



COLORADO WATER PLAN CHAP. 11

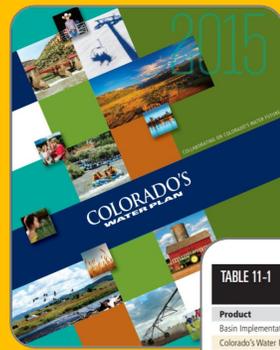


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ACTIONS

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CWCB will develop guidelines for Basin Implementation Plans to help facilitate the initiation of the BIPs.



Sets goals to initiate the updates to SWSI (2016), BIPs (2018) and CWP (2020)

8 THINGS WE HEARD:

- 1) Focus on Projects (Funding is Down)
- 2) Basin Updates Take Time
- 3) Better Project Metrics (61%)
- 4) Working Group (65%)
- 5) CWCB Support (88%)
- 6) Retain Basin Control
- 7) Roundtable Summit
- 8) Utilize SWSI Findings



SWSI Integration

- Standardization + Support
- IPP Database
- HB-1051 Updates

Basin Updates

- \$ to Roundtables (% avg BIP cost)?
- Central BIP + IPP Document
- Contractor/BIP Coordination + Standardization

Water Plan Update

- CWP Scoping, Update and Printing
- Statewide Survey
- Engagement and Innovation

IMPLEMENTATION WORKING GROUP

1. **Concept Exploration – What will we tackle?**
- Expectations, SWSI Guidance and BIP Updates
2. **Sign Posts – Where should they be set?**
3. **SWSI Toolkit – What is it?**
-Data, Communications, etc?
4. **Standardizing BIP Updates – What are the critical elements?**
5. **IPP Database**
- Online Database of Identified Projects & Processes
6. **SWSI Guidance Chapter Review**
7. **Next Steps – Where to from here?**
-Informing the Statewide Basin Summit

THOUGHTS, COMMENTS OR
QUESTIONS?

