ANALYSIS & TECHNICAL UPDATE TO THE

COLORADO WATER PLAN

VOLUME I

Analysis and Technical Update to the Colorado Water Plan

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This report was assembled by the Colorado Water Conservation Board (CWCB) staff and the contract team who supported the Analysis & Technical Update to the Colorado Water Plan. However, this effort was supported by numerous stakeholder interactions that helped drive the methodologies, review and presentation of this report. CWCB staff extends its appreciation to everyone who provided input throughout this process, including the Department of Natural Resources, the Division of Water Resources, senior leadership at the CWCB, the CWCB board, the Interbasin Compact Committee, members of the Technical Advisory Groups, members of the Implementation Working Group, each of the nine basin roundtables and many other subject matter experts, and engaged community members and colleagues whose efforts were invaluable to making this report as comprehensive and grass-roots driven as possible.

It is staff's sincere hope that this effort will continue to engage stakeholders and partners across the State of Colorado and will be used, refined and enhanced in future iterations of Basin Implementation Plan Updates and, ultimately, the Water Plan itself.

COLORADO

Colorado Water Conservation Board

Department of Natural Resources

[DISCLAIMER]

The Analysis and Technical Update to the Colorado Water Plan (Technical Update) provides technical data and information regarding Colorado's water resources. The technical data and information generated are intended to help inform decision making and planning regarding water resources at a statewide or basinwide planning level. The information made available is not intended to replace projections or analyses prepared by local entities for specific project or planning purposes.

The Colorado Water Conservation Board intends for the Technical Update to help promote and facilitate a better understanding of water supply and demand considerations within the State; however, the datasets provided are from a snapshot in time and cannot reflect actual or exact conditions in any given basin or the State at any given time. While this Technical Update strives to reflect the Colorado Water Conservation Board's best estimates of future water supply and demands under various scenarios, the reliability of these estimates is affected by the availability and reliability of data and the current capabilities of data evaluation. Moreover, the Technical Update cannot incorporate the varied and complex legal and policy considerations that may be relevant and applicable to any particular basin or project; therefore, nothing in the Technical Update or the associated Flow Tool or Costing Tool is intended for use in any administrative, judicial or other proceeding to evince or otherwise reflect the State of Colorado's or the CWCB's legal interpretations of state or federal law.

Furthermore, nothing in the Technical Update, Flow Tool, Costing Tool, or any subsequent reports generated from these datasets is intended to, nor should be construed so as to, interpret, diminish, or modify the rights, authorities, or obligations of the State of Colorado or the CWCB under state law, federal law, administrative rule, regulation, guideline or other administrative provision.

Prior to the 2015 Colorado Water Plan (Water Plan), past statewide water supply analyses included data analysis, project information and policy components. After the release of the Water Plan, these elements were split between the Water Plan (policy), Basin Implementation Plans (local projects) and statewide water supply initiatives (technical data analysis). To better recognize these delineations and make the connection to the Water Plan clear, the statewide water supply initiative (often referenced as SWSI) is now being referred to as the Analysis and Technical Update to the Water Plan (or Technical Update). The new name more accurately reflects the technical nature of the evaluations described in the report and better establishes how that data will be used to inform Water Plan updates. While the Technical Update is a statewide water supply initiative and continues that legacy, the SWSI acronym will be relegated to referencing earlier efforts that proceeded the Water Plan (e.g. SWSI 2010).

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The following are definitions for key terms used throughout the Technical Update report:

1051 Data – 1051 Data is the municipal water usage data reported to the CWCB by water providers pursuant to House Bill 2010-1051.

Active vs Passive Conservation – Active water conservation measures are water-saving strategies implemented or incentivized by water providers. Active water conservation includes watering restrictions, public education campaigns, or efficiency improvements. Passive water conservation are measures associated with the installation of new water-efficient fixtures and appliances without incentives from utilities, e.g., replacing an old toilet with a new low-flush toilet.

Adoption Rate – Portion of existing (2015) population that will have water use consistent with the future gallons per capita per day (gpcd) value for a given planning scenario by the year 2050 (i.e., retrofit population).

Agricultural Diversion Demand – The amount of water that needs to be diverted or pumped to meet the full crop irrigation water requirement. Note that SWSI 2010 (see definition below) defined agricultural demand as the amount of water consumed by crops at the field level and not the amount of water that needs to be diverted or pumped.

Agricultural Gap – The amount of additional water that would need to be diverted or pumped to meet crop irrigation shortages. The results of the calculations are also referred to as the "total agricultural gap". The "incremental agricultural gap" is a portion of the agricultural gap and is defined below. Note that Statewide Water Supply Initiative (SWSI) 2010 defined the agricultural gap as crop or field-based shortages, though it recognized river headgate diversions and pumping would need to be much larger to meet crop shortages.

Applied Water – Water that is diverted from the river, pumped from ground water, or released from reservoirs for irrigation purposes. It is also referred to as irrigation supplies. Applied water does not include or reflect precipitation consumed by crops.

Baseline M&I Demand – Reported and estimated demands representing average conditions for the Technical Update baseline year of 2015. Municipal demands are represented by the gpcd and on a volumetric basis, which is calculated from population and gpcd data.

Basin Implementation Plans (BIP) – Basin Implementation Plans provide critical input to the Colorado Water Plan. BIPs were developed by basin roundtables and demonstrate how each basin roundtable plans to meet its future municipal, industrial, agricultural, recreational, and environmental needs. The BIPs identify projects and methods to meet future water needs and develop goals and measurable outcomes, needs, and constraints and opportunities in each basin. Data and information from the Technical Update will be used by basin roundtables to update their BIPs.

Buy and Dry – The process of buying agricultural water rights and subsequently using the water rights for another purpose (typically for municipal or industrial use). The formerly irrigated agricultural lands are "dried up" and no longer irrigated by virtue of the water transfer.

Climate Change Projections – The climate change projections developed for the Colorado Water Plan and this Technical Update were built upon the foundational work of the multi-phase Colorado River Water Availability Study, Phase II (CRWAS-II). CRWAS-II identified a suite of future climate change projections intended to explore a range of water supply and demand conditions for Colorado in 2050. Three composite projections were used in the Colorado Water Plan and in the Technical Update—the "Current" (recent historical hydrology), "Hot and Dry", and "Between 20th Century Observed and Hot and Dry" (also, "Between" or "In-Between").

Colorado's Decision Support Systems (CDSS) – Colorado's Decisions Support Systems is a water management system developed by the Colorado Water Conservation Board (CWCB) and the Division of Water Resources for each of Colorado's major river basins. The CDSS includes water-focused data sets, models, geographic information system (GIS) layers and other tools, including StateMod, StateCU, Hydrobase and others, to assist with surface water and groundwater management in Colorado.

Crop Shortages – Crop shortages are the difference between the amount of water crops needed to meet full crop consumptive use (a.k.a., irrigation water requirement [IWR]) and the amount of applied water crops consumed when irrigation supplies are insufficient to meet the full demand (a.k.a., water supply limited [WSL] consumptive use.

Distributed Water – The volume of water entering the municipal distribution system, calculated as total water production from all sources minus water exported to another water provider.

Drivers – In many contexts in the Technical Update, "drivers" refer to the nine factors identified by the Interbasin Compact Committee (IBCC) that will shape the future of water supplies and demands by the year 2050.

E&R – In the context of the Technical update, E&R refers to attributes and data products related to "environment and recreation".

Evapotranspiration – The sum of water evaporated from the soil surface and transpired through vegetation.

Flow-ecology Relationships – Flow-ecology quantifies the relationship between specific flow statistics (such as average magnitude of peak flow or the ratio of flow in August and September to mean annual flow) and the risk status (low to very high) for environmental attributes under the flow scenario being analyzed.

Gaps – In the Technical Update, gaps were calculated using water allocation models and other analysis tools (in basins where models are not currently available) and were evaluated for both agricultural and municipal and industrial (M&I) uses. Gaps were calculated as the difference between the amount of water available to meet agricultural or M&I diversion demands and the full diversion demand. In other words, gaps reflect the amount by which agricultural or municipal demands could be shorted because of inadequate supplies.

Implementation Working Group – The Implementation Working Group refers to the basin roundtable, Interbasin Compact Committee and CWCB Board members who helped inform the Technical Update recommendations as well as the next steps for the updates to the BIPs.

Incremental Agricultural Gap – The incremental agricultural gap quantifies the degree to which the gap could increase beyond what agriculture has historically experienced under water shortage conditions.

Irrigation System Efficiency – The percent of diverted or pumped water consumed by crops or stored in soil moisture, which is calculated by dividing the sum of WSL (see definition below) and water stored in soil moisture by the total applied water from all sources. System efficiency reflects the losses to applied water due to canal seepage and on-farm application losses.

Irrigation Water Requirement (IWR) – The amount of water that must be applied to crops to meet the full crop consumptive use, also referred to as the crop demand or the consumptive irrigation requirement (CIR). IWR provides an estimate of the maximum amount of applied water the crops could consume if it was physically and legally available.

Metered Municipal Water Use – Water that reaches the end use, including billed/unbilled and authorized/unauthorized uses.

Model Year – The baseline water allocation models used in the Technical Update use time series of hydrology reflective of historical conditions from 1975 to the most recent year available. For planning analyses, the historical hydrology was adjusted to reflect climate change impacts in the applicable scenarios. Demands in the baseline models reflect current conditions; planning scenario models reflect future conditions. Water allocation modeling results are a time series of stream flows, diversions, and shortages that reflect historical variability but are affected by current or future demands. The term "model year" is used to describe model output that reflects historical variability, but is not intended to reflect actual historical conditions.

Municipal Demand – Portion of distributed water attributable to uses typical of municipal systems, including residential, commercial, light industrial, non-agricultural-related irrigation, firefighting, and non-revenue water. Demands for self-supplied households not connected to a public water supply are also included in the municipal demand category. Municipal demands represent diversion demands used in the water allocation models.

M&I Demands – This refers to municipal and industrial water demands inclusive of the self-supplied industrial (SSI) demands. In the Technical Update, this is sometimes also referred to as M&SSI demands or simply "industrial demands".

M&I Gap – The difference between the amount of water available to meet M&I demands and the full M&I diversion demand. Note that the M&I gap in SWSI 2010 was based on the difference between new M&I demands that will occur in the future and the yield of projects currently being pursued to provide future supplies.

Municipal Water Efficiency Plans (WEP) – The Water Conservation Act of 2004 (HB04-1365) requires all covered entities (i.e., retail water providers that sell 2,000 acre-feet or more on an annual basis) to have a state-approved water efficiency plan that contains certain required minimum plan elements.

Non-Revenue Water – The calculated difference between distributed water and authorized metered water use. Non-revenue water thus represents system water loss.

Nonconsumptive Needs and Datasets – In prior SWSIs, "nonconsumptive" referred to "environment and recreation" datasets and analyses. For the Technical Update, these two terms can be viewed as interchangeable; however, the phrase "environment and recreation" (or E&R) will be used moving forward.

Resiliency – The ability of water systems to adapt and continue providing adequate levels of service in the face of changing circumstances and drivers.

Scenario Planning – Scenario planning is a strategic planning process that acknowledges that the future is uncertain, identifies the drivers that affect water supplies and demands, and envisions alternative water futures that reflect the potential variability of drivers. Adaptive management plans can be developed to meet future needs identified in the scenarios.

Self-Supplied Industrial (SSI) Demands – Self-supplied industrial demands are defined as the water needs of large industrial water users that have their own water supplies or lease raw water from others. Industrial needs met by municipal water providers are incorporated into municipal water demands and are not part of SSI demands. Self-supplied industrial demands are also referenced simply as "industrial" demands in the Technical Update.

Statewide Water Supply Initiative (SWSI) 2010 – Refers to the Statewide Water Supply Initiative completed in 2010 (SWSI 2010). This effort built on the earlier SWSI I and SWSI II efforts. Since the 2015 launch of the Colorado Water Plan, SWSI is now referred to as the Analysis and Technical Update to the Colorado Water Plan (or simply "Technical Update").

Systemwide Municipal Demand – Systemwide municipal demand is equivalent to distributed water as defined by 1051 data or water supplied as defined in the American Water Works Association (AWWA) Water Loss Control audit methodology. This is equal to the sum of all municipal demand categories, including residential indoor, residential outdoor, non-residential indoor, non-residential outdoor and non-revenue water.

Targeted Water Provider Outreach (Targeted Outreach) – Targeted outreach that was facilitated by CWCB staff to gather municipal water usage data and information in select counties that had no 1051, Water Efficiency Plan, or BIP data.

Technical Advisory Groups (TAG) – The Technical Advisory Groups refer to the basin roundtable members and subject matter experts who helped inform the methodologies used in the Technical Update.

Technical Update – This refers to the analysis and technical update to the Colorado Water Plan. The Technical Update is similar to prior SWSI efforts but with important differences (see Section 3 for a comparison of SWSI to the Technical Update).

Water Conservation – Water conservation is the minimization of water loss or waste. The goal of water conservation is to use only the amount of water necessary to complete a task or meet a need. Water conservation can be achieved through policies, programs, and practices designed to encourage less water use.

Water Efficiency – Water efficiency refers to strategies or technologies that facilitate using less water to accomplish an activity. Low-flow toilets and showerheads are examples of technologies that increase water efficiency. Water efficiency improvements are typically accomplished via engineered products or solutions.

Water Efficiency Plans – See Municipal Water Efficiency Plans above.

Water Future – Colorado's "water future" refers broadly to future conditions with respect to water supplies and demands, social values, condition of environmental and recreational attributes, and the types of strategies and projects that will be implemented to meet future needs.

Water Plan – Abbreviated reference to the Colorado Water Plan (also referred to as the Colorado Water Plan).

Water Supply Limited (WSL) Consumptive Use – The amount of applied water consumed by crops, also referred to as actual crop consumptive use. WSL is the minimum of the IWR and the amount of applied water that reaches crops.